

Prevalence and Predictors of *Entamoeba histolytica* Infection Among School-Age Children In Wamakko Local Government Area, Sokoto State Nigeria.

ABSTRACT

Entamoeba histolytica is an important protozoan of man, it is the third most common and widespread parasitic cause of death world-wide,

Aims: the study was aimed at determining the prevalence and predictors of *Entamoeba histolytica* among primary school children in Wamakko Local Government area of Sokoto state.

Study Design: This was a cross-sectional, descriptive study

Place and Duration of Study: This study was conducted among school aged children, in Wamakko Local Government Area, Sokoto State, between May, 2016 to November, 2017.

Methodology Faecal samples were collected from three hundred and seventy one (371) pupils and analysed using direct wet smear and Formol Ether Concentration Technique.

Results The overall prevalence was found to be 211 (56.9%). Although more males pupils are infected with 50.5% while female with 49.6%, but the difference was not statistically significant (p -value = 0.330). But the higher prevalence infection obtained from males pupils might be attributed to male children are more engaged in extracurricular activities such as recreational activities and games. Based on five age group used in the study, 29 pupils within age group of 14-15 years, 19 (65.5%) were found to be infected with *E.histolytica* and has the highest prevalence of infection, this was attributed to fact that being older they engaged in activities such as assisting their parent in farming activities like irrigation, taking manure to farm etc. **Conclusion** Great success toward the control of the infection can be achieve through integration of complementary strategies by government agencies and non-governmental organizations such as disease surveillance, mass chemotherapy, health education, construction and use of toilets in all primary schools, religious centres, markets and the general public sanitation in the study area.

Key Words: Prevalence, Predictors, *Entamoeba histolytica*, School Children, Wamakko, Sokoto State, Nigeria.

1.0 INTRODUCTION

Entamoeba histolytica is an intestinal protozoa of humans. Several species of the genus *Entamoeba* infect humans. These include: *Entamoeba histolytica*, *Entamoeba dispar*, *Entamoeba coli*, *Entamoeba hartmani*, *Entamoeba polecki*, and *Entamoeba gingivalis* [1]. Among these, only *E. histolytica* is considered pathogenic and the disease it causes is called amoebiasis or amoebic dysentery [2]. *Entamoeba histolytica* is an enteric parasite that colonizes the human intestinal lumen

and has the capacity to invade the epithelium. Amoebic dysentery occurs when *E. histolytica* trophozoites invade the walls of large intestines and multiply in the mucosa, forming ulcers. Most frequent manifestations of infection are dysentery, colitis, flatulent stomach, weight loss, fatigue and abdominal pain. A common outcome of invasion of the amoeba into tissues is liver abscesses which can be fatal. The pathogen secretes histolysin [3], which digest the gut of the infected individual hence the Latin name, histo (tissue) lytica (destruction) [4].

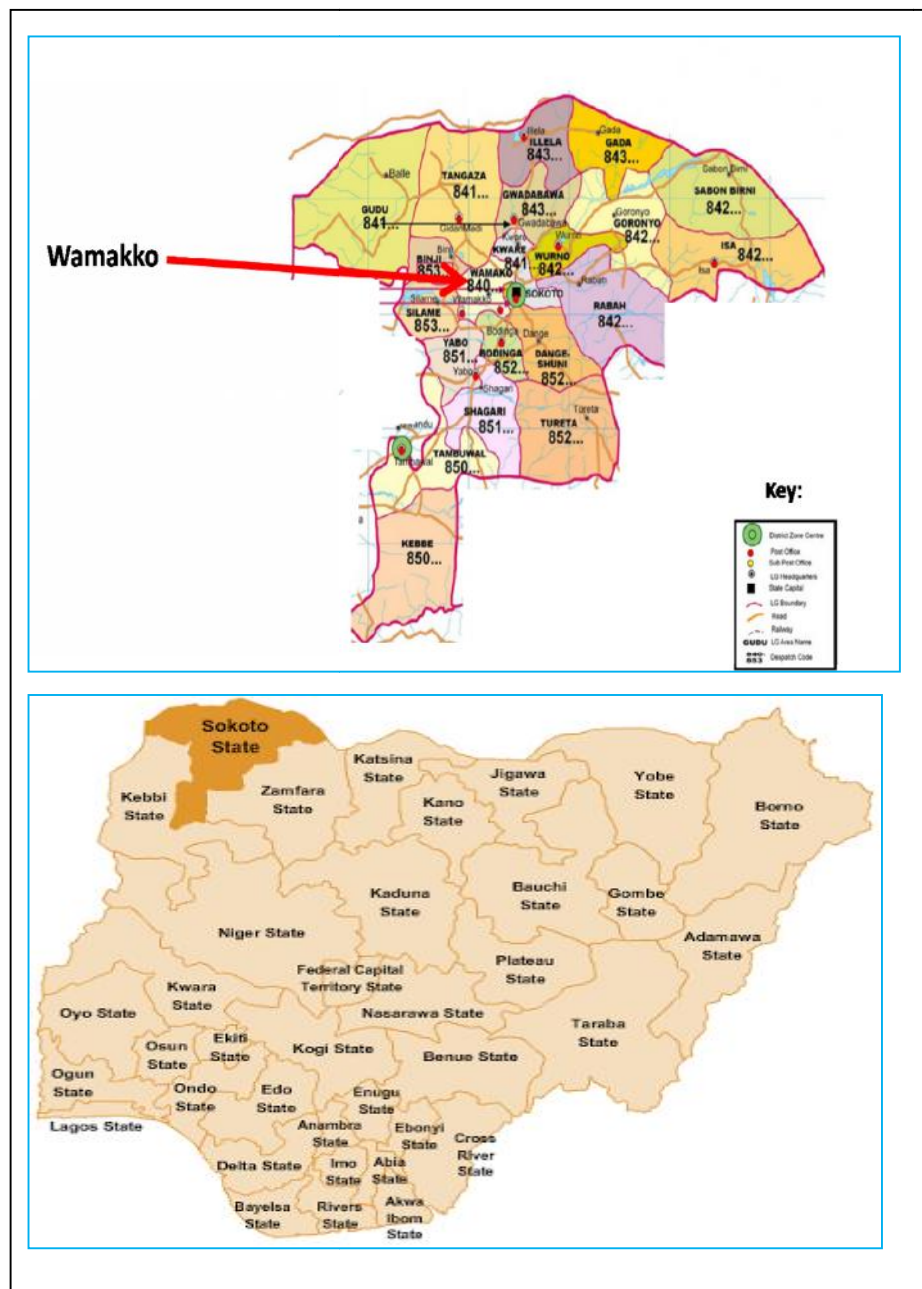
Amoebiasis is a condition due to the infection by *Entamoeba histolytica* and is known to cause about 450 million infections per annum in developing countries, with an incidence of about 50 million and 100,000 deaths [5]. Intestinal Amoebiasis is said to be the world greatest cause of death attributed to parasitic infection after malaria and schistosomiasis [6]. The infection is acquired through the faecal-oral route by consumption of food, water or drinks contaminated with cysts of the parasite. Licking or sucking of faecal contaminated hands have been documented to introduce the infection to humans [7]. *E. histolytica* is an aerobic parasitic protozoan belonging to Genus *Entamoeba* and an etiology agent of Amoebiasis. *E. histolytica* is pathogenic in the caecum and colon of human being. The term 'histolytica' literally means "Tissue dissolving" referring to the carnivorous habit of the organism. *E. histolytica* is the most unique among the amoebas because of its ability to hydrolyse host tissue. It can become a highly virulent and invasive organism causing diarrhoea. Acute infection of Amoebiasis may be presented with other infection apart from bloody diarrhoea such as ulceration of the colonic mucosa, abdominal pain and a palpable mass in corresponding areas of the abdomen. Amoebiasis may give rise to amoebic liver abscess and intestinal pathologies [7]. Amoebiasis is widely spread in its distribution, occurring in all parts of the world. The invasive amoebiasis is more prevalent in certain areas of the world including West and South-East Africa, China, Mexico and Western portions of South America, and the India subcontinent [8].

Ingestion of contaminated food or water containing infectious cysts leads to excystation in the intestine. Each cyst produces eight motile trophozoites which colonize the host's colon. In those cases where the infection is not self-limiting, amoebic dysentery and liver abscesses formation can occur. Ninety percent of infections with *E. histolytica* are asymptomatic and self-limiting. [1] reported that an estimated 50 million cases of invasive infection occur twice annually. According to [9], amoebiasis is ranked the third most important parasitic disease and that 100,000 deaths occur annually due to the disease. Intestinal parasites infections (IPIs) are globally endemic and have been described as constituting the greatest single worldwide causes of illness and diseases [10].

2.0 MATERIALS AND METHODS

2.1 STUDY AREA

Wamakko is a Local Government Area in Sokoto State, North Western Nigeria. Its headquarters is in the town of Wamakko. It has both urban and rural settlement. It lies between latitude 13°2' 16" N longitude 5°5' 37" E with annual average temperature of 28.3°C (82.9 °F). It has an area of 697 km² and a population of 179,619 at the 2006 census [11]. The concentration of wealth, prestige, the political power and religious learning centres in Wamakko attracted large numbers of rural-urban migrants, both from the neighbouring state and from distance regions. Demographics: Wamakko Local government is mainly populated by Hausa-Fulani people.



Map of Nigeria and Sokoto State indicating Wamakko Local Government

Source: <https://www.maps-streetview.com>

2.2 STUDY POPULATION

The study population consists of 371 school aged children, Sokoto, North-Western, Nigeria.

2.3 STUDY DESIGN

This is an observational cross sectional study aimed at determining the prevalence and predictors of *Entamoeba histolytica* among primary school children in the study area. The research was conducted during the raining season from May, 2016- November, 2017. The procedure was explained to all participants and were each given the consent forms to sign. Questionnaires were distributed to generate information on their bio-data

2.4 INCLUSION AND EXCLUSION CRETERIA

2.4.1 INCLUSION CRITERIA

1. Pupils within the age range between 6 to 15 years of age were included in the research. These are the ages most at the risk of infection with intestinal parasites [12].
2. Pupils who gave their consent to participate in the study
3. Pupils who were present during the initial day of the study.

2.4.2 EXCLUSION CRETERIA

1. Pupils that do not fulfil the above age range were excluded in the research.
2. Pupils who refused to give consent in the study.
3. Pupils who were absent during the initial day of the study will be excluded.

3.5 SAMPLE SIZE DETERMINATION AND SAMPLING TECHNIQUES

3.5.1 SAMPLE SIZE DETERMINATION

The sample size was calculated using the prevalence rate of *E. histolytica* in Akure, Ondo State, Nigeria (prevalence = 67.6%, $67.6 / 100 = 0.676$). [13]. A standard epidemiological formula is used to calculate the sample size as follows;

$$n = \frac{z^2 pq}{d^2}$$

Where;

n = Sample size,

z = standard normal distribution at 95% (1.96) confidence interval p = prevalence rate 67.6% (0.676), [13]

q = 1-p,

1 = is the maximum value of probability,

d = allowable error taken as 5% (0.05)

$$n = \frac{(1.96)^2 \times 0.676 \times (1-0.676)}{(0.05)^2}$$

$$= 336.6 \approx 337 \text{ subjects}$$

Drop out 10%. Therefore, $337 + (0.1 \times 337)$

Actual sample size = 371 subjects

3.5.2 SAMPLING TECHNIQUES

Wamakko Local Government area has a total of 92 primary schools. A cluster random sampling was used to sample the schools. The schools were clustered into two (2) zones (Wamakko South and Wamakko North) and then two schools were picked randomly from each zone. The selected schools are; Dundaye model primary School, Bakin Gulfi primary school, Kalambaina primary school and Wajeke primary school. 93 pupils were selected randomly from each of the three sampled schools (279 pupils) and 92 pupils from one sampled school to fulfil the sample size (371).

3.6 SAMPLE COLLECTION

A total of 371 pupils aged between 6 to 15 years were enrolled in the study. Clean, labelled wide mouth faecal plastic specimen container were given to the pupils and they were instructed on how to introduce sample (stool) into the sample containers. Applicator sticks and tissue papers were given to them as apparatus for sample collection. Two days were allocated to each school for the sample collection. Stool samples were collected and transported to the School of Medical Laboratory Science UDUS, Department of Medical Microbiology for parasitological examination.

3.7 LABORATORY TECHNIQUES

3.7.1 Macroscopy

The collected stool specimens were first observed physically for consistency, presence of blood stains, mucous and any macroscopic parasites. [15].

3.7.2 Microscopy (*Preparation of faecal smears and identification of parasite*)

3.7.2.1 Wet Preparation (*Saline and Iodine*)

- i. Drop of lugol iodine was place at a centre of a clean microscope glass slide.
- ii. Small portion of stool specimen was emulsified on the iodine using an applicator stick, and was covered with a cover slip.
- iii. It was examine under microscope for cysts and eggs of the parasites systematically using 10X and 40X objectives lens.
- iv. The same procedure was used to examine for the Trophozoite, but normal saline was used in place of Lugol's iodine.

This method was used because iodine stains the nucleus of *E. histolytica* properly for easy identification [15].

179 **3.7.2.2 Formol-Ether Concentration Technique**

180 Concentration technique was also employed in analysing the faecal samples.

181 **Procedure:**

- 182 i. Using an applicator stick, about 1 g (pea-size) of faeces was emulsified in about 4 ml of 10%
183 formol saline contained in a screw-cap bottle or tube.
- 184 ii. A further 3ml of 10% v/v formol saline was added and the bottle capped, then it mixed well
185 by shaking.
- 186 iii. The emulsified faeces was sieved and the sieved suspension was collected in a beaker.
- 187 iv. The suspension was transferred to a conical (centrifuge) tube made of strong glass followed
188 by addition of 3–4 ml of diethyl ether.
- 189 v. The tube was stoppered and mixed for 1 minute. And with a tissue or piece of cloth wrapped
190 around the top of the tube, the stopper was loosen.
- 191 vi. The tube was centrifuged immediately at 3000 rpm for 1 minute.
- 192 vii. Using a stick, the layer of faecal debris was loosen from the side of the tube and the tube
193 *inverted* to discard the ether, faecal debris, and formol water. The sediment remained.
- 194 viii. The tube was returned to its upright position and the fluid from the side of the tube was
195 allowed to drain to the bottom. The bottom of the tube was tapped to re-suspend and mix the
196 sediment.
- 197 ix. The sediment was then transferred to a slide, and covered with a cover glass.
- 198 x. The preparation was examined microscopically using the 10X objective with the condenser
199 iris *closed sufficiently* to give good contrast. Using the 40X objective to examine small cysts
200 and eggs [15].

201 **3.8 RESEARCH TOOLS**

202 **3.8.1 QUESTIONNAIRE**

203 Questionnaire were used in this study to obtain data on both Socio- Demographical characteristic and
204 risk factor. Socio-Demographic characteristic include age and sex while risk factor include; source of
205 drinking water, type of toilet used, personnel hygiene etc.

206 **3.8.2 Validation of the Questionnaire**

207 The questionnaire was made valid by passing it through research experts.

208 **3.8.3 Domain of the questionnaire**

209 The questionnaire has three domains. This includes;

210 **Section A:** this consists of the socio demographic data such as age, sex, gender, etc.

211 **Section B:** this consists of the Risk factors associated to the subject matter (*Entamoeba*
212 *histolytica*) source of drinking water, type of toilet used .etc.

213 **Section C:** Laboratory diagnosis result for *Entamoeba histolytica*.

3.9 STATISTICAL ANALYSIS

Data collected was analysed using the Statistical Package for Social Science (SPSS) Version 21.0. Chi-square test was used to determine the association between variables. Simple and multiple logistic regression analysis were used to determine the associated risk factors of the infections. Values were considered statistically significant at $P < 0.05$.

3.10 ETHICAL APPROVAL

Permission to conduct the research was obtained from the Ethics and Research Committee of the Ministry of health Sokoto State and Local Education Authority of Wamakko Local Government Area of Sokoto State. Participation of the pupils was voluntary. All respondents were asked to give an informed consent through their parents or legal guardians.

4.0 RESULT

The result of our findings shows that three hundred and seventy one (371) pupils were examined for *E.histolytica* infection aged 6-15 years, out of which two hundred and eleven (211) pupils (56.9%) were found to be infected with *E.histolytica*.

i. Table 1 and Table 2 Socio-Demographic Characteristic of the Respondents

Result from table 1 shows that out of the three hundred and seventy one (371) pupils enrolled and participated in this study, 50.3% were male pupils and 49.6% were females pupils .Within the five age groups used in the study 26.3% were aged 6-7 years, 25.8% were aged 8-9 years, 19.4% were aged 10-11 years, 20.4 were aged 12-13 years and 7.8% were aged 14-15 years. Out three hundred and seventy one (371) pupils responded water sources 45.7%consume borehole/ tap water 37.9% consume well water and 16.1% consume river/stream water out of three hundred and seventy one pupils (371) respond to presence latrine 60.4% have latrine at home while 53.1% do not have latrine at home.

Result from table 1 also shows that out of three hundred and seventy one (371) pupils respond open field defecation toilet system 51.6% respond to yes while 48.1% respond to No. out of the Out of three hundred and seventy one (371) pupils respond to washing of hands before and after eating 49.7% respond to Yes while 50.0% respond to No. out of three hundred and seventy one (371) pupils responds to washing of hands before and after defecation 47.3% responds Yes while 52.4% responds to No. out of three hundred and seventy one pupils responds to how the dispose refuse at home, 7.8% dispose their refuse in garbage pit, 64.5% dispose their refuse outside their compounds and 27.4% dispose their refuse in dust-bin. Out of three hundred and seventy one pupils respond to level of income of parents/guardians, 9.4% are from the parents/guardians of high level incomes, 53.5% are from the parents/guardians of low level incomes and 36.8% are from the parents/guardians of medium level incomes. Out of three hundred and seventy one (371) pupils respond to treating drinking water at home, 36.1 % responds to Yes while 63.9% responds to No (Table 2).

ii Table 3 and table 4 prevalence of *E. Histolytica* Infection

Prevalence and distribution of intestinal amoebiasis with regard to age group, gender, sources of water, presence of latrine, open defecation, washing hands before and after eating. In table 3, the result based on five age group show that out 29 pupils aged 14-15 years, 19 (65.5%) pupils were found to be infected with *E.histolytica* and has the highest prevalence infection among the age groups, out 98 pupils age 6-7 year 59 (60.2%) pupils were found to be infected with *E.histolytica*, out of 72 pupils aged 10-11 years, 38 (52.8%) pupils were found to be infected with *E.histolytica*, out

of 76 pupils aged 12-13 years 19 (56.6%) pupils were found to be infected with *E.histolytica*. (P-value =0.716). The result based on gender show that out of one hundred and eighty seven (187) male pupils, one hundred and eleven (59.4%) were found to be infected with *E.histolytica*, out of one hundred and eighty four (184) female pupils, one hundred (54.3%) were found to be infected with *E.histolytica*, that was shown female has the lower prevalence infection compared to male pupils, (P-value =0.330). The result based on water source shown those that consume river/stream water has the highest prevalence rate of 71.7% followed by those that consume well water with prevalence rate of 62.2% and those that consume borehole /tap water has the least prevalence rate of 47.1% (p-value=0.001) . The result based on the presence of latrine shown those that have latrine at home has the lower prevalence infection of 55.3% while those that do not have latrine at home have the higher prevalence rate of 58.6% (P-value=0.523). Result based on the defecation in an open source show that out of 192 pupils that defecate in an open source 116 (60.4%) pupils were found to be infected with *E.histolytica*, while out of 129 pupils that do not defecate in an open sources, 95 (53.1%) pupils were found to be infected with *E.histolytica*, and it shows the lower prevalence infection (P-value=0.154). Result based on the washing hands before and after eating shows that out of 185 pupils that washes their hands before and after eating 91 (49.2%) pupils were found to be infected with *E.histolytica*, while out of 186 pupils that do not washes their hands before and after eating 120 (64.5%) were found to be infected with *E.histolytica*, and show the higher prevalence infection (P-value=0.003).

Result from table 4 shows that, the prevalence and distribution of intestinal amoebiasis with respect to washing of hands before and after defecation, refuse disposal, level of income of parents /guardians. Result based on washing hands before and defecation shows that out of 176 pupils that washes their hands before and after defecation 90 (51.1%) pupils were found to infected with *E.histolytica*, while out of 195 pupils that do not washes their hands before and after defecation 121 (62.1%) pupils were found to be infected with *E.histolytica*, and shows the higher prevalence infection (P-value=0.034). Result based how refuse is dispose at home show that out 240 pupils that dispose of refuse outside their compounds 147 (61.2%) were found to be infected with *E.histolytica* and shows the highest prevalence infection, out of 29 pupils that dispose refuse in garbage pit 16 (55.5%) pupils were found to be infected with *E.histolytica*, out of 102 pupils that dispose refuse through dust-bin 48 (47.1%) were found to be infected with *E.histolytica*, and show the least prevalence infection (P-value=0.052). Result based on level of income of parents /guardians show that out of 199 pupils with parents/guardian of low level incomes 136 (68.3%) pupils were found to be infected with *E.histolytica*, and show the highest prevalence infection, out of 137 pupils with parents/guardians of medium level incomes 64 (46.7%) pupils were found to be infected with *E.histolytica*, out of 35 pupils with parents /guardians of high level incomes 11 (31.4%) pupils were found to be infected with *E.histolytica*, and shows the least prevalence infection (P-value=0.001). Result based on treating drinking water at home show that out of 134 pupils that treat drinking at home before consuming 80(59.7%) were found to be infected with *E.histolytica*, while out 237 pupils that do not treat drinking water 131 (55.3%) were found to be infected with *E.histolytica*, and shows the lower prevalence infection (P-value=0.034).

iii Table 5 and Table 6 Simple and Multiple Logistic Regression Analysis

The result from table 5 shows that there is a strong association between washing of hands before and after eating and *E.histolytica* infection. However, those that do not washes their hands before and after eating are at high risk of infection 1.87 times (OR; 95% CI, 1.24, 2.84, P- value <0.003) compared those that washes hands before and after eating, and *statistically* significant different was observed $p < 0.05$. the strong association recorded in the study might linked to the hands can act as conduits to transfer cysts from surface in or outside the home, currency, food and animals (pets of wild). Also the result shows that there is a strong association between washes hands before and after defecation and *E.histolytica* infection. However, those that do not washes their hands before and after defecation are at high risk of infection 0.45 times (OR; 95%CI, 1.03, 2.36 P-value

<0.034) compared to those that washes their hands and a statistically significant difference in the variable observed $P < 0.05$.

The result from table 6 shows that there is strong association between source of water and *E. histolytica* infection. However, those that consume river/stream water are at high risk of infection 2.897 times (OR 95% CI 1.493, 5.622 P -value < 0.002) compared to those that consume borehole/tap water and statistically significant difference in the variable observed $P < 0.05$. This might be attributed to the fact that human and domestic /wild animals use these (River/stream) a situation that could lead to contamination with faeces and subsequent infection of exposed individuals. Also result shows that there is strong association between level of income of parents/guardians and *E. histolytica* infection. However those pupils with parents/guardians of low level income are at high risk of infection 4.317 times (OR 95% CI 1.493, 5.622, P -value < 0.001) compared to those pupils with parents/guardians of high level incomes and statistically significant difference in the variable observed $P < 0.05$.

Table 1: Socio-demographic characteristic with respect to age group, gender, sources of water, presence latrine, open defecation, washing of hand before and after eating.

Variables	Frequency (F)	Percentage (%)
Age group (years)		
6-7	98	26.3
8-9	96	25.8
10-11	72	19.4
12-13	76	20.4
14-15	29	7.8
Gender		
Female	184	49.5
Male	187	50.3
Sources of water		
Bore hole/tap water	170	45.7
Well water	141	37.9
River/stream	60	16.1
Presence of latrine		
Yes	179	48.1
No	192	51.6
Open defecation		
Yes	192	51.6
No	179	48.1
Washing of hand before and after eating		
Yes	185	49.7
No	186	50.0

Source: Field data.

Table 2: Socio-demographic characteristics with respect to washing of hands before and after defecation, refuse disposal, level of income of parent/guardian and treating drinking water at home.

Variables	Frequency (F)	Percentage (%)
Washing of hand before and after defecation		
Yes	176	47.3
No	195	52.4
Refuse disposal		
Garbage pit	29	7.8
Outside compound	240	64.5
Dust bin	102	27.4
Level of income of Parent/guardians		
High	35	9.4
Low	199	53.5
Medium	137	36.8
Treating drinking water at home		
Yes	134	36.1
No	237	63.9

source: Field data

Table 3: Prevalence and Distribution of intestinal amoebiasis among study population with respects to age group, gender, sources of water, presence latrine, open defecation, washing of hands before and after eating.

Variable(s)	Entamoeba histolytica		Total N (%)	p-value ^a
	Infection N (%)	No Infection N (%)		
Age group (years)				
6-7	59 (60.2)	39(39.8)	98(100.0)	0.716
8-9	52(54.2)	44 (45.8)	96 (100.0)	
10-11	38 (52.8)	34 (47.2)	72 (100.0)	
12-13	43 (56.6)	33 (43.4)	76 (100.0)	
14-15	19 (65.5)	10 (34.5)	29 (100.0)	
Gender				
Female	100 (54.3)	84 (45.7)	184 (100.0)	0.330
Male	111 (59.4)	76 (40.6)	187 (100.0)	
Sources of water				
Bore hole/tap water	80 (47.1)	90 (52.9)	170 (100.0)	0.001
Well water	88 (62.2)	53 (37.6)	141 (100.0)	
River/stream	43 (71.7)	17 (28.3)	60 (100.0)	

Presence of latrine					
Yes	109 (55.3)	88 (44.7)	197 (100.0)	0.523	
No	102 (58.6)	72 (41.4)	174 (100.0)		
Open defecation					
Yes	116 (60.4)	76 (39.6)	192 (100.0)	0.154	
No	95 (53.1)	84 (46.9)	129 (100.0)		
Washing of hands before and after eating					
Yes	91(49.2)	94(50.8)	185(100.0)	0.003	
No	120 (64.5)	66 (35.5)	186 (100.0)		

337 KEY:

338 a = Pearson chi-square test

339 source: Field data.

340

341 **Table 4 : Prevalence and distribution of intestinal amoebiasis among study population**
 342 **with respects to washing of hands before and after defecation; refuse disposal and level of**
 343 **income of parent/guardian**

344

Variable(s)	Entamoeba histolytica		Total	p-value ^a
	Infection	No	n (%)	
	n (%)	infection		
	n (%)	n (%)		
Washing of hands before and after defecation				
Yes	90 (51.1)	86(48.9)	176(100.0)	0.034
No	121(62.1)	74(37.9)	195(100.0)	
Refuse disposal				
Garbage pit	16(55.5)	13(44.8)	29(100.0)	0.052
Outside compound	147(61.2)	93(38.8)	240(100.0)	
Dust bin	48(47.1)	54(52.9)	102(100.0)	
Level of income of parent/guardian				
High	11(31.4)	24 (68.6)	35 (100.0)	0.001
Low	136(68.3)	63 (37.1)	199 (100.0)	
Medium	64(46.7)	73(53.3)	137 (100.0)	
Treating drinking water				
Yes	80(59.7)	54 (40.3)	134 (100.0)	0.034
No	131 (55.3)	106 (44.7)	237 (100.0)	

345

346

Table 5: Shows simple logistic regression analysis with respect to intestinal amoebiasis in relation to Sources of water, washing of hand before and after eating, washing of hand before and after defecation, level of incomes of parents/guardians and treating drinking water at home.

Variables	* b	** Exp (B) OR (95% CI)	Wald statistic	p- value
Sources of water				
Bore hole/tap water	0	1.00		
Well water	0.625	1.86 (1.18, 2.94)	7.25	0.007
River/stream	1.046	2.84 (1.50, 5.38)	10.34	0.001
Washing of hands before and after eating				
Yes	0	1.00		
No	0.63	1.87 (1.24, 2.84)	8.81	0.003
Washing of hand before and after defecation				
Yes	0	1.00		
No	0.45	1.56 (1.03, 2.36)	4.47	0.034
Level of income of parents/guardians				
High	0	1.00		
Low	1.550	0.47 (2.17, 10.2)	15.4	0.001
Medium	0.649	1.91 (0.86, 4.20)	2.59	0.107
Treating drinking water				
Yes	0	1.00		
No	-0.181	0.83 (0.53, 1.28)		0.408

Table 6: Shows multiple logistic regression analysis with respect to intestinal amoebiasis in relation to Sources of water, level of incomes of parents/guardians

Variables	* b	** Exp (B) OR (95% CI)	Wald statistic	p- value
Sources of water				
Bore hole/tap water	0	1.00		
Well water	0.532	1.702(1.055,2.745)	4.759	0.029
River/stream	1.064	2.897(1.493,5.622)	9.885	0.002
Level of income of parent/guardians				
High	0	1.00		
Low	1.483	4.317(1.497,9.575)	12.955	0.001
Medium	0.623	1.855(0.828,4.17)	2.266	0.132

Key:

*Regression co-efficient

** Crude odds ratio

5.DISCUSSION

The result of this study showed that the overall prevalence of intestinal amoebiasis among primary school children in Wamakko Local Government Area of Sokoto State was 56.9%. This high prevalence infection was attributed to poor water source. The finding is line with finding by [16]. With 56.8% in Lere Kaduna State, North Western Nigeria. The high prevalence could also be linked to poor sanitary condition within both urban and rural settlements of the study area. The prevalence obtained in this study was higher compared to study carried out by [17]. With 54.2%. [18]. With 46% in Bosso town Niger State North central Nigeria, [19] With 30.8% [20] With 42.1% the high finding might be attributed to resistant cyst of *E.histolytica* in the study area which can withstand adverse condition [17]. The prevalence obtained in this study was lower compared to study carried out by [21] with 72% in Abeokuta Ogun State South western Nigeria, [22] with 80.9% in konduga Borno State North eastern Nigeria, [23] with 64.1% in Akonkwo Imo State South Eastern Nigeria, [13] with 67.6% among primary school children in Akure Ondo State South Western Nigeria.

Base on our finding in this study prevalence of *E.histolytica*. in relation to age, pupils of 14-15 years has the highest prevalence infection of 65.5%, this was attributed to the fact being older they engaged in activities such as assisting their parent in farming activities such irrigation, taking manure to farms. This agreed with the research carried out by [24] among primary school children in Kyuso Zone, Kyuso district of Kenya, which recorded highest prevalence in older pupils then the younger ones. However this finding is not in line with the prevalence infection of research carried out by [13] which recorded highest prevalence infection among children aged 4-6 years, also [25] reported that children below 14 years has high prevalence infection.

Based on our finding in this study males pupils were more infected (111 infected) with *E.histolytica*. than female pupils (100 infected) with *E.histolytica*. 59.4% and 54.3% respectively higher prevalence obtained from male pupils might be due to fact that males are more engaged in extracurricular activities such as recreational activities and games. The lower prevalence in females may be due to cultural practices which require females to be indoors most of the time while males take part in many outdoor activities also the higher prevalence in male might due to males mostly engaged in water

contact activities like summing and bathing, fishing farming and watering cattle could lead to higher exposure among males.[26] and [27] made similar observation in south Eastern Nigeria.

Based on our finding in this study prevalence infection *E.histolytica*. in relation to sources of water shows that there is significance differences, those that consume river/stream water has the highest prevalence infection of 71.7% this might be because human and domestic /wild animals use these (River/ stream) as source of drinking water especially during dry season in local Communities. A situation that could lead to contamination with faeces and subsequent infection of exposed individuals, then followed by the those that consume well water with 62.2% this may be due to some well in the community are dug close to pit latrine and poor sanitation around the well enhances the transmission of the infection and those that consume borehole /tap water has the least prevalence infection. This agreed with the research carried out by [13]on intestinal amoebiasis among primary school children in Akure, ondo State South Western Nigeria, were they recorded highest prevalence infection among those pupils that consume stream water 94.3% followed by those that consume well water with 74.4% and those that consume tap water has the least prevalence infection. Also our finding is in line with the research on intestinal amoebiasis carried out by [28] were they reported significance infection rate for laser of surface water and unprotected well water, while they recorded low prevalence infection for tap water and protected borehole water. However the finding of this study is not in line with report of [29] and [30] reported the prevalence *E.histolytica* was not associated with type of water supply but was seemingly influenced by storage of household supplies.

Based on our finding in this study, the prevalence of *E.histolytica* in relation to use of latrine indicated that those pupils that do not have latrine at home has a higher prevalence infection of 58.6% and those that have latrine at home has lower prevalence infection with slight differences (table 3), this could be due poor sanitation which may encourage flies and cockroaches to spread the cysts of *E.histolytica* [31]. Also must of the people that do not have latrine at home involved in open defecation which can lead to washing away of the faeces contaminants into community water source during raining season, this practice could also enhances the transmission of cysts [32]

Based on our finding in this study the prevalence of *E.histolytica* in relation to open field defecation toilet system shows that those pupils that pupils that practices open field defecation toilet system has the higher prevalence infection (table) while those that do not practice open field

defecation toilet system has the lower prevalence infection, similar observation were made among those that use open field defecation toilet system by [26]. This could be due to poor sanitation which might encourage flies and cockroaches to spreads the cysts of *E. histolytica* [31].

Based on our finding in this study prevalence of *E.histolytica* in relation to washing of hands before and after eating shown that those pupils practice washing of hands before and after eating has a least prevalence infection compared to those pupils that do not practices, the high prevalence infection obtained by those pupil that do not practices washing of hands before and after eating might linked to hands can act as conduits to transfer cysts from surfaces in or outside the home, currency food and animals (pets or wild). The finding is in line with the research finding carried out [33] which reported high prevalence on people that do not practices washes hands before and after eating has the higher prevalence infection.

Based on our finding in this study, prevalence of *E.histolytica* in relation to washing hands before and after defecation shows that those pupils that do not washes their hands before and after defecation has the higher prevalence infection, this might attributed to the fact that most children used their hands to eat which easily transmit the resistance cysts [34]. This study also agreed with research carried out by [35] where identified lack of washing hands as being significant to high prevalence infection.

Based on our finding in this study, prevalence of *E.histolytica* in relation to this refuses disposal shows that those pupils that dispose refuse outside their compounds has the highest prevalence infection, this might attributed to the fact that erosion may wash away the faeces contaminants in to the community or home water source during raining season [24].

Based on our finding in this study, prevalence of *E.histolytica* in relation to level of incomes of parents/guardian shows that those pupils with parents /guardians of low level incomes has the highest prevalence infection followed by pupils with parents/ guardians of medium level incomes and pupils with parents/guardians of high level income has the least prevalence infection. This finding is in line with the finding in the research carried out by Al-[36]which reported that rate of infection is higher in poor community. Also another research carried by [37], [38] linked the high prevalence infection obtained with poverty.

Based on our finding in this study, prevalence of *E. histolytica* infection in relation to treating drinking water at home showed higher prevalence for those that treat drinking water at home. This outcome may be due to improper treatment of drinking water. Apart from improper treatment, most of the pupils that respond to 'Yes' they use chlorine for the treatment of drinking water and they are ignorant that chlorine does not completely kill the cyst of *E. histolytica*. This finding is in line with the research finding carried out by [31] where they recorded high prevalence infection among people that treat drinking water and they link the high prevalence obtained with improper water treatment.

The finding of this study showed that infection with *E. histolytica* among primary school children in Wamakko Local Government Area are found to be high. This also showed that personal hygiene, environmental sanitation and poor access to safe water contributes to transmission of *E. histolytica* in the study area; therefore the null hypothesis is rejected and alternative hypothesis is accepted.

6.CONCLUSIONS

The result of this study are indication that intestinal amoebiasis is a public health concern in a study area. It also reveals that the control measures in the study area are not effective and this could be among the difficulties to encounter for the control of amoebiasis in the study area.

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