International Journal of Clinical Medicine Research
2014; 1(4): 146-150
Published online October 30, 2014 (http://www.aascit.org/journal/ijcmr)


**Keywords**
*Entamoeba histolytica*,
*Giardia lamblia*,
*Balantidium coli*,
*Entamoeba coli*,
Protozoan Parasites

Received: September 15, 2014
Revised: October 11, 2014
Accepted: October 12, 2014

# Studies on protozoan parasites in Angwan Rogo, Jos-North Local Government of Plateau State, Nigeria

**Emmanuel Teryila Tyokumbur[1, *], Jeremiah Ajayi[2]**

[1]Department of Zoology, University of Ibadan, Ibadan, Nigeria
[2]Department of Zoology, University of Jos, Jos, Nigeria

## Email address
e.tyokumbur@mail.ui.edu.ng (E. T. Tyokumbur)

## Citation
Emmanuel Teryila Tyokumbur, Jeremiah Ajayi. Studies on Protozoan Parasites in Angwan Rogo, Jos-North Local Government of Plateau State, Nigeria. *International Journal of Clinical Medicine Research.* Vol. 1, No. 4, 2014, pp. 146-150.

## Abstract
A study was carried out on the incidence and spread of intestinal protozoan infections in the residents of Angwan Rogo Village in Jos-North Local Government Area of Plateau State, Nigeria. Faecal samples were collected from 686 residents and examined using direct smear and concentration techniques. Residents examined were between the ages of below 15 years and above and were drawn from five divided units of the study area. Results of the study showed generally low infection rates of 22.30%, 2.33%, 4.96%, and 2.77% for *Entamoeba histolytica, Giardia lamblia, Balantidium coli* and *Entamoeba coli* respectively. Infection rates for residents of different age groups showed little variation in the different parts of Angwan Rogo.There were cases of mixed infections with *Entamoeba histolytica* in most cases .Socio-economic factors such as types of toilets used and the personal hygiene appeared to have limited effects on the observed parasitic infection rates. Preventive measures to enhance control of the infections are discussed.

## 1. Introduction

Parasites continue to be of great importance due to their adverse effects on the health, growth and development of infected individuals. Factors of climate, environment, occupation, age, sex, food, water supply and socio-economic disposition contribute to the prevalence of these parasitic infections in a community (Nnochiri, 1968; Rajan, 2008).

Many important species of parasites have a world-wide distribution although tropical countries where optimal conditions of temperature and humidity prevail are most favorable for the survival, development and transmission of the parasites (Brown, 1975; Bogitsh *et al*, 2005). Purely as matter of convenience, the protozoan parasites of man may be divided into two general groups, according to the organs and tissues in which they are found. These are those that inhabit the blood and tissue and those that are found in the alimentary canal and related cavities and passages (Hegner and Stiles, 1951; Smyth and Wakelin, 1994; Muller *et al*, 2007).

Alimentary canal protozoan parasites in particular are often associated with poor sanitation, domestic and personal hygiene as well as general ignorance of the disease which enhances the problem. The prevalence of these parasitic infections shows correlation with the methods of faecal disposal and the personal hygiene of the affected people (Cheng, 1973; Crewe, 1977; Nelson and Williams, 2007). The World Health Organization has reported world-wide prevalence of these parasitic infections and noted

that the incidence varies with the state of development of different people. The highest incidences were among the developing nations in Africa, Asia and South America (Chandler and Read, 1961; Noble and Noble, 1983; Lautenbach *et al*, 2010).The protozoan parasites of the alimentary canal include the following in the table below:

***Table 1.*** *Alimentary protozoan parasites of man*

| *Organism/parasite* | *Predilection site of infection* |
|---|---|
| *Entamoeba gingivalis* | Mouth |
| *Entamoeba histolytica* | Intestine,lung,brain,liver |
| *Dientamoeba fragilis* | Intestine |
| *Giardia lamblia* | Intestine |
| *Balantidium coli* | Colon, ileum |
| *Sarcocystis hominis* | Intestine |

(After Chandler and Read, 1961; Jones, 1967; Markell and Marietta, 1976; Crewe, 1977 Noble and Noble, 1983; Bogitsh *et al*, 2005; Stark *et al*, 2005)

Hegner and Stiles (1951) asserted that *Entamoeba gingivalis* infects over 50% of the population and thrives well in all mouth conditions particularly in tooth decay.*Dientamoeba fragilis* is numerous in the intestine when present, though more frequently encountered in patients with *Enterobius* infections (Jones,1967).*Entamoeba histolytica* cysts can be recovered from the faeces of 10-25% of populations in temperate zones and up to 100% of certain populations of the tropics, with most been carriers (Gelfand,1957;Jones,1967; Nelson and Williams, 2007). In a study carried out on 4,759 students in Lagos for the prevalence of intestinal parasites among school children,Okpala (1956) showed that 10.85% (516) were infected with *E.histolytica* and 8.1% (385) *E.coli* which is closely associated with the former parasite. In a similar study among students and kitchen personnel of the University of Nigeria, Nsukka, out of 529 persons examined, 13.2% (70) were infected with *E.coli* and 12.85% (68) with *E.histolytica* (Okpala, 1971).The incidence of *Giardia lamblia* in temperate zones is about 2% while adolescents and preadolescent shows about 25% giardiasis (Jones, 1967; Meyer, 1994; Welch, 2000; Ford, 2005).

The incidence of other protozoans parasitic in the alimentary canal depends mostly on personal hygiene and faecal disposal of man and animals (Levine, 1973; Chandler and Read, 1981; Lautenbach *et al*, 2010). The aims and objectives of this study are to determine the species of alimentary protozoan parasites in faecal samples of Angwan Rogo residents of Jos North Local Government Area of Plateau State and to ascertain what extent age and sex predispose the residents to infection by these parasites.

## 2. Materials and Methods

The study was carried out among the residents of Angwan Rogo village which is situated behind the University of Jos Main Campus, Bauchi Road in the Jos-North Local Government of Plateau State. The sampling area was demarcated into five areas or units namely; directly behind University of Jos, areas bordering Katako, areas bordering Angwan Rimi, areas bordering Alikazaure and around Bauchi Park to Bridge.

Collection of stool samples was done fortnightly from mid-March to Mid-June. A total of 686 residents of the two sexes and different age groups of below 15 years and above 15 years were examined during the period of the study. Samples collected from patients came from Angwan Rogo Primary School children and some generous donors.

Stool sample donors were provided with clean plain sheets of paper to pass faeces on, so as to avoid contamination by some contaminant microorganisms in the soil. Improvised stool sample picks were provided for transferring the faeces into the clean specimen bottles that had been thoroughly washed in detergent water and rinsed .The specimen bottles were labeled with each donor's age and sex with date of donation.

The samples were brought to the laboratory and fixed in 70% ethanol or 10% formalin and left at room temperature for examination.

### 2.1. Preparation of Slides

Direct wet smear: A drop of saline solution was placed on a clean slide with the aid of toothpick, little quantity of faeces was emulsified, tilting the slide a little, large particles were removed and the smear was covered with a coverslip .A drop of Lugol's iodine was added to the edge of the coverslip, so as to enable gradual diffusion into the saline solution mount. The slide was examined under the microscope.

Concentration by Ridley and Hawgoods Formol-ether method: A gramme of faeces was emulsified in 10ml of normal saline and filtered into a centrifuge tube through a sieve. The filtrate was centrifuged for a minute, the supernatant was poured out and sediments resuspended in fresh saline solution. This was repeated until the supernatant became clear.10ml of formalin (10% concentration) was added to the sediments, allowed to stand for 5 minutes and 3ml ether or sodium chloride grammes was added and shaken vigorously. The mixture was centrifuged for 11/2 minutes, the ''fatty plug'' between the ether and formalin layers was loosened .The supernatant was decanted and transferred to a clean slide ,stained with a drop of Lugol's iodine ,covered with a slip and examined.

### 2.2. Identification of Parasites

The parasites observed were identified using the identification chart outlined by Ukoli (1991) that shows the morphological features of different protozoan trophozoite and cysts, as well as the text by Neva and Brown (1994) and Marr *et al*,(2002). For example, the cysts of *Entamoeba histolytica* shows 1-4 nuclei and 1-2 chromatoid bodies in the cytoplasm whereas those of *Giardia lamblia* has 4 nuclei and many fibrillar remnants of trophozoite organellar,and that of *Entamoeba coli* has 8 nuclei. Also *E.histolytica* unlike *G.lamblia* has no flagella.

## 3. Results

The results obtained from the study are set out in tables 2 and 3.A total of 686 residents were examined during the three month period of study. Of this number, 330 were males and 356 females .The general prevalence rates for the different age groups and sexes are shown in Table 3 while table 2 shows the prevalence rate for different study areas. There were few cases of double and triple infections in an individual.

Out of the 686 residents examined, 246 were positive for parasites giving an overall infection rate of 35.9%.Out of the number examined, 153 were infected with *Entamoeba histolytica* (22.30%), 16(2.34%) by *Giardia lamblia*, 33 (4.81%) by *Balantidium coli*, 19(2.76%) by *Entamoeba coli*, 9 (1.31%) by *E.histolytica* and *G.lamblia*, 6(0.87%) by *E.histolytica* and *E.coli* and 3(0.44%) by *E.histolytica*, *G.lamblia* and *E.coli*.

Sixty-five (9.62%) with *E.histolytica* infection were males and 90(13.12%) were females. Thus the infection rate with *E.histolytica* was slightly higher in the females than in the males. Males were infected more than females with *Balantidium coli* i.e. 19(2.77%) by males and females 14(2.04%).

The different age groups, below 15 years and 15 years and above showed general prevalence rates of 17.64% and 18.22% respectively. Out of the 373 residents in the age group of <15years examined, 80(11.66%) had *E.histolytica*, *12*(1.75%) had *G.lamblia*, 18(2.62%) *Balantidium coli*, 7(1.02%) *E.coli*.

***Table 2.*** *Prevalence of protozoan infections in different parts of Angwan Rogo Village in Jos, Nigeria.*

| Area | Number examined | | | Number/percent infected | | | | | | Single infection | | | | Double infection | | | Triple infection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | Total | M | % | F | % | Total | % | Eh | Gl | Bc | Ec | Eh/Gl | Eh/Bc | Eh/Ec | Eh/Gl/Ec |
| DBUJ | 74 | 70 | 144 | 12 | 16.8 | 18 | 25.7 | 30 | 20.8 | 17 | 4 | 3 | 6 | 0 | 1 | 0 | 0 |
| BK | 64 | 76 | 140 | 26 | 40.6 | 32 | 42.1 | 58 | 41.4 | 42 | 3 | 5 | 3 | 1 | 3 | 1 | 0 |
| BAR | 69 | 73 | 142 | 23 | 33.3 | 25 | 34.2 | 48 | 33.8 | 33 | 2 | 10 | 1 | 0 | 0 | 2 | 0 |
| BAZ | 76 | 64 | 140 | 41 | 53.9 | 26 | 40.6 | 67 | 47.9 | 34 | 4 | 9 | 7 | 7 | 3 | 1 | 2 |
| ABPB | 47 | 73 | 120 | 17 | 36.2 | 26 | 35.6 | 43 | 35.8 | 27 | 3 | 7 | 2 | 1 | 0 | 2 | 1 |

***Table 3.*** *Prevalence rate for different age groups and sexes*

| Area | Age group | Number examined | | | Number/percent infected | | | | | Single infection | | | | Double infection | | | Triple infection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M | F | Total | M | % | F | % | Total | Eh | Gl | Bc | Ec | Eh/Gl | Eh/Bc | Eh/Ec | Eh/Gl/Ec |
| DBUJ | B-15 | 59 | 51 | 110 | 8 | 14 | 12 | 24 | 20 | 11 | 2 | 2 | 3 | 0 | 0 | 0 | 0 |
| | A-15 | 15 | 19 | 34 | 4 | 27 | 6 | 32 | 10 | 6 | 2 | 0 | 3 | 0 | 1 | 0 | 0 |
| BK | B-15 | 32 | 40 | 72 | 14 | 44 | 13 | 33 | 27 | 28 | 3 | 1 | 3 | 1 | 2 | 0 | 0 |
| | A-15 | 33 | 35 | 68 | 12 | 36 | 19 | 54 | 31 | 14 | 0 | 4 | 0 | 0 | 1 | 0 | 0 |
| BAR | B-15 | 34 | 35 | 69 | 13 | 38 | 16 | 46 | 29 | 22 | 1 | 8 | 1 | 1 | 0 | 1 | 0 |
| | A-15 | 35 | 38 | 73 | 10 | 29 | 9 | 24 | 19 | 11 | 1 | 2 | 0 | 0 | 0 | 1 | 0 |
| BAZ | B-15 | 32 | 34 | 66 | 13 | 41 | 13 | 38 | 26 | 16 | 3 | 3 | 0 | 4 | 2 | 0 | 1 |
| | A-15 | 44 | 30 | 74 | 28 | 64 | 13 | 43 | 41 | 15 | 1 | 6 | 5 | 2 | 1 | 1 | 2 |
| ABPB | B-15 | 19 | 37 | 56 | 8 | 42 | 11 | 30 | 19 | 11 | 3 | 4 | 0 | 0 | 0 | 2 | 1 |
| | A-15 | 29 | 35 | 64 | 9 | 31 | 15 | 43 | 24 | 16 | 0 | 3 | 3 | 1 | 0 | 0 | 1 |

Key to Tables 2 and 3: DBUJ=Directly Behind University of Jos, BK=Bordering Katako, BAR=Bordering Angwan Rimi, BAZ=Bordering Alika Zaure, ABPB=Around Bauchi Park to Bridge.
Eh=*Entamoeba histolytica*, Gl=*Giardia lamblia*, Bc=*Balantidium coli*, Ec=*Entamoeba coli*, M=Male=Female, %=percent, B-15= Below 15 years, 15-A= Above 15 years

Double infection occurred in 14(2.04%) residents comprising mostly of the 15-year old, while of the single infection in 15 years above displayed this result: Out of 313 residents ,62(9.04%) had *E.histolytica* ,4(0.58%) had *G.lamblia*,11(1.60%) had *E.coli*,15(2.19%) had *B.coli*. Double infection occurred in 8 residents (1.16%).

The highest mean parasite infection was recorded for *E.histolytica* (22.30%), *Giardia lamblia* (2.33%), *B.coli* (4.81%) and *E.coli* (2.77%).

The result also indicated a slightly higher infection rate of 18.22% in age range above 15years than 17.6% in <15 years.

The data in Table 2 and 3 were subjected to statistical analysis using the chi-square ($X^2$) and analysis of variance (ANOVA) respectively to test for the influence of sampling units and treatments (fortnightly results due to season),on the infection rates due to various types of protozoan parasites. ANOVA was used because at each fortnightly sampling, 35 samples were collected from units and examined.

The results obtained showed that the interaction of sex and age was not significantly different since the calculated value was less than the tabulated .A comparison among the infection types in a given sampling unit and given set of ages revealed that *Entamoeba histolytica* occurred more frequently. The ANOVA collected indicated that there was no significant difference between the sampling areas/units and fortnightly infections indicating acceptance of the null hypothesis.

Comparison between the two ages, <15years and >15years in a given sampling area for a given parasite indicated that residents between <15years in areas bordering Katako and Angwan Rimi had more *Entamoeba histolytica*, while the reverse was true of Bauch Park-Bridge and directly behind University of Jos.As for *Giardia lamblia* and *Balantidium coli* ,there was no difference between ages at any area/unit. The *E.coli* showed not much difference in ages of the residents but for <15years around Bauchi park to Bridge and Alikazaure borderers.

In this connection, the results indicated that residents of <15years exhibited an almost strikingly same percentage infection in all sampling areas. The highest case of double infection was recorded among <15years old at areas of Angwan Rogo bordering Alikazaure.

The data also indicated that the females showed more *Entamoeba histolytica* infection than males but there was no difference between the sexes regarding the other types of infection. The prevalence rate for different age groups and sexes in table 3 indicated that *Entamoeba histolytica* occurred at higher rates in both male and female than other infection type.

Generally, it was observed that *Entamoeba histolytica* (cysts and trophozoites) occurred more than other infection types in all the demarcated sampling areas, within age ranges and sexes.

## 4. Discussion and Recommendation

Results of this investigation indicate a rather limited incidence of protozoan parasites among residents of Angwan Rogo Village, with the most prevalent parasite being *Entamoeba histolytica*, followed by *Balantidium coli* and *Entamoeba coli*.

The parasite rate of 62.2% was recorded for *Entamoeba coli*. However, Okpala (1971) in his survey of the incidence of the blood, urinary and intestinal parasites among students and kitchen personnel of the University of Nigeria Nsukka, recorded a higher prevalence of 13.2% for *Entamoeba coli* and a lower rate of infection which was 12.85% for *Entamoeba histolytica*. There are few cases of double infection with *Entamoeba* associated in each case.

The frequent occurrence of *Entamoeba histolytica* can be attributed to unsanitary conditions of the toilet system in many living quarters and careless handling of faeces. The cysts are passed in the faeces which get to the soil where they are washed into drinking streams and also picked in soil by flies to human food (Chandler and Read, 1981; John *et al*, 2006; Nelson and Williams, 2007) .The following was observed in the study area as coined by Ukoli (1991) citing Okpala (1961):

i.Unsanitary and inadequate methods of disposal of human excreta and public refuse in general. Most earth pit and dry pail are not well protected and usually situated within the flight range of houseflies, thereby making contamination from toilet to food, water and kitchen utensils possible.

ii.Poor personal hygiene

iii.Overcrowding and poor housing observed in Angwan Rogo due to the high cost of living and ever-rising house rents.

iv.Low standard of education and lack of adequate health education particularly the main residents unlike the tenant students of University of Jos and other schools, some of whom are aware.

Nnochiri (1968, 1975) and Heelan (2004) asserted that the factors of environment (ecological factors), occupation and the socio-economic disposition contribute to the prevalence of parasitic infections in a community or village. Most protozoan parasitic infections occur and spread due to ignorance and may be reduced by educating the public on importance of personal hygiene, danger of water and food contamination and proper disposal of sewage and refuse. This can be done through lectures in the sampling units, churches and mosques, at health and community centers with full stimulating incentives such as showing films, advertisements and awards to attract people to such to such enlightenment campaigns. Emphasis should be placed on water sanitation through simple boiling of drinking water, which compensates for deficient quality, proper disposal of human faeces and more so, Angwan Rogo village has a very poor supply of portable drinking water. Septic tank systems are recommended for home use in Angwan Rogo since it is inaccessible to flies (Pacey, 1978).

Residents should also be advised to avoid indiscriminate defaecation around their surroundings since this was a common sight observed during the study especially areas behind the University of Jos and the hills bordering Katako along the stream. The surroundings around homes need to be kept clean through proper refuse disposal in order to limit the breeding sites of flies. Finally, symptomatic and asymptomatic cases should always be reported to the nearest health center for treatment (Blessmann and Tannich, 2002).

## 5. Conclusion

This study shows a rather limited incidence of protozoan parasites among residents of Angwan Rogo Village, with the most prevalent parasite being *Entamoeba histolytica*, (62%) followed by *Balantidium coli* and *Entamoeba coli*. It is recommended that environmental health factors such as types of toilets used and the personal hygiene appeared that have effects on the observed parasitic infection rates should be improved. Preventive measures to avoid infections are urged in the inhabitants of Angwan Rogo in Jos North Local Government Area of Plateau State, Nigeria.

## Acknowledgement

The supervisory role of late Professor Ajayi in this BSc Project remains highly appreciated. Equipment support and laboratory space provided by Department of Zoology, University of Jos, Jos, Nigeria is hereby acknowledged. The financial assistance of Mr Joseph Ityokumbul for the typing of the project is worthy of mention.

## References


[1] Blessmann, J and Tannich, E. (2002). Treatment of asymptomatic intestinal *Entamoeba histolytica* infection. N. Engl. J. Med, 347 (17), 1384

[2] Bogitsh, B.J, Carter, C.E. and Oeltmann, T.N. (2005).Human parasitology. Academic Press.459pp

[3] Brown, H.W. (1975).Basic clinical parasitology.4th Edition. Appleton-century crafts. New York.335pp

[4] Chandler, A.C. and Read, C.P. (1961).Introduction to parasitology.10th edition. John Wiley and Sons Inc.New York, London.pp.277-455

[5] Cheng, T.C. (1973). General Parasitology. Academic Press, New York

[6] Crewe, W. (1977).A guide to human parasitology.10th edition.H.K.Lewis and Co.Ltd pp.167-179

[7] Ford, B.J. (2005). The discovery of *Giardia*. The Microscope, 53 (4), 148–153

[8] Gelfand, M. (1957).The Sick African: A clinical study. Juta and Coy Ltd, Netherlands.

[9] Heelan, J.S. (2004).Cases in Human Parasitology.ASM Press.243pp

[10] Hegner, N and Stiles, N.R. (1951).College Zoology. Macmillan Company.6th Edition.

[11] John, D.T., Petri, W.A., Markell, E.K. and Voge, M. (2006). Markell and Voge's Medical Parasitology. Elsevier Health Sciences.463pp

[12] Jones, A.W. (1967).Introduction to Parasitology. Addison-Wesley Publishing Company, Inc, Phillipines.pp.74-84

[13] Lautenbach, E., Woeltje, K.F. and Malani, P.N. (2010).Practical Healthcare Epidemiology. University of Chicago Press.484pp.

[14] Levine, N.D. (1973).Parasites of domestic animals and man. Burgess, Minneapolis, U.S.A

[15] Markell, E.K and Marietta, V. (1976).Medical Parasitology.4th edition. W.B.Saunders Company.pp.355

[16] Marr, J.J., Nilsen, T.W. and Komuniecki, R (2002).Molecular medical parasitology. Academic press.488pp

[17] Meyer, E. (1984). *Giardia* and Giardiasis. Plenum Press, New York.

[18] Muller, R., Rolinson, D.and Hay, S.I. (2007).Advances in parasitology. Academic Press.358pp

[19] Nelson, K.E. and Williams, C.M. (2007).Infectious disease epidemiology: Theory and Practice. Jones and Bartlett learning.1207pp

[20] Neva, F.A. and Brown, H.W. (1994).Basic clinical parasitology. Appleton and Lange.356pp

[21] Nnochiri, E. (1968).Parasitic diseases and urbanization in a developing community. Oxford University Press.pp.56-90

[22] Nnochiri, E. (1975).Medical parasitology in the tropics. Oxford University Press. Ely House, London

[23] Noble, E.R. and Noble, G.A. (1983). Parasitology: The biology of animal parasites.5th edition. Lea and Febiger, Philadelphia

[24] Okpala, I. (1956).The incidence of intestinal parasites among school children in Lagos, Nigeria. West African Medical Journal, l(4),167-170

[25] Okpala, I. (1971).A survey of the incidence of blood, urinary and intestinal parasites among students and kitchen personnel of the University of Nigeria, Nsukka. West African Medical Journal, 20,260-262

[26] Pacey, A. (1978).Sanitation in developing countries. John Wiley International.pp.238-240

[27] Rajan, T.V. (2008).Textbook of Medical Parasitology. BI Publications Pvt Ltd, India.200pp

[28] Smyth, J.D. and Wakelin, D. (1994).Introduction to Animal Parasitology. Cambridge University Press.549pp

[29] Stark, D., Beebe, N., Marriott, D., Ellis, J. and Harkness, J. (2005). Prospective study of the prevalence, genotyping, and clinical relevance of *Dientamoeba fragilis* infections in an Australian population. J. Clin. Microbiol. 43 (6), 2718–23

[30] Ukoli, F.M.A. (1991).Introduction to Parasitology in Tropical Africa. Textflow Ltd, Ibadan, Nigeria.pp.349-395

[31] Welch, T.P. (2000). Risk of giardiasis from consumption of wilderness water in North America: a systematic review of epidemiologic data. *International Journal of Infectious Diseases*, 4 (2), 100–103. DOI:10.1016/S1201-9712(00)90102-4.