

## Human Amoebiasis: Distribution and Burden; and the Nigerian Environment

<sup>1</sup>C. M. AJERO; <sup>1</sup>B.E.B. NWOKO; <sup>2</sup>E.A. NWOKE AND <sup>1</sup>C.N. UKAGA

<sup>1</sup>Department of Animal & Environmental Biology, Faculty of Science, Imo State University Owerri, Nigeria

<sup>2</sup>Imo State School of Nursing, Owerri, Nigeria

**ABSTRACT:** Human amoebiasis is a disease caused by a Protozoan amoeba of the genera *Entamoeba*, of which *E. histolytica* is the most medically important. Infection occurs when man ingests foodstuffs, vegetables or drink water faecally contaminated by cysts of the parasite. Most of the infections are non-invasive and asymptomatic while symptomatic cases result from pathogenic invasion and hydrolysis of tissues of the intestinal lining, blood cells and other organs. Amoebiasis has a worldwide distribution. It causes death, impairs the physical, mental and intellectual development thereby exerting tremendous impact on productivity and hence the economy of the individual and the community. In Nigeria, there is a high prevalence and incidence of amoebiasis which is a reflection of the poor personal hygiene and unclean habits practiced by individuals compounded by public ignorance and illiteracy. This disease has continued to grow as the economic situation and availability of basic social amenities and infrastructures becomes increasingly unsatisfactory.

**KEYWORDS:** Human, Amoebiasis, Distribution, Burden, Nigeria, Environment

### INTRODUCTION

#### Definitions

Amoebiasis is a disease caused by a single-celled, protozoan organism, amoeba which belongs to the class Rhizopoda possessing organ of locomotion known as pseudopodia. Vast majority of amoebae are free-living in soil, water and decaying organic matter. A few are parasitic. In man, the parasitic species belong to four genera: *Entamoeba*, *Endolimax*, *Iodamoeba* and *Dientamoeba*. Of all these, only the genus *Entamoeba* contains species of medical importance which include *E.coli*, *E. gingivalis*, *E. polecki*, *E.hartmanni* and *E.histolytica* (Neal, 1966; Elsdon Dew, 1968; Symth, 1999).

*Entamoeba histolytica* is the most medically important species of amoeba of man. Infection of man by *E.histolytica* commonly results to amoebiasis. However, *E.histolytica* is not always pathogenic in man: Majority of individuals infected by *E.histolytica* show no symptoms of the disease, and is referred to as non-invasive infection caused by small "minuta" race of the parasite. When infection of *E.histolytica* results to results to clinical symptoms, the disease is referred to as invasive amoebiasis. The invasive amoebiasis is caused by the large "magna" race of the parasite which is pathogenic invading and hydrolysing the tissue of the intestinal lining, blood cells and other organs of the body, causing the disease known as human amoebiasis. The life cycle of this parasite is through faecal-oral route, simple and direct; and man is the only host. The clinicopathological complications of invasive amoebiasis is serious and are grouped into intestinal and extra-intestinal (which may involve the liver, lungs, spleen, brain and skin) human amoebiasis. Details of these have been highlighted by Neal (1966); Abioye and Edington (1972), Nnochiri (1975), Ukoli (1990) and Symth (1999). In this present, the disease distribution, the burden on infected persons and communities as well as the impact of Nigerian environment on the prevalence and intensity are brought to focus. It is written to create a better understanding of the disease epidemiology and its eventual control/eradication in the country.

#### Disease distribution and burden

Amoebiasis is widespread 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, the whole of South East Asia, Mexico and Western portion of South America, and the India subcontinent (Smyth, 1999). Poor environmental sanitation, personal hygiene and overcrowding as well as ignorance are some of the major factors that influence the high incidence and prevalence of *E.histolytica* in these regions. In Nigeria, amoebiasis is prevalent and widespread.

All races are susceptible to amoebiasis. Although the disease is often milder in European, this is probably related to sanitary standard, diet and freedom from debilitating disorders rather than a genuine racial factor (Ukoli, 1992). Infants under a year old are rarely infected with amoebiasis. The incidence gradually increases during childhood and usually reaches its highest incidence in young adults (Chandler and Read, 1961). Several results including Abioye & Edington (1972) and Rivera (1972) showed that any observed differences that have been reported in the incidence and prevalence of amoebiasis between sexes are probably related to exposure rather than a true sex susceptibility to infection.

In the tropical and other developing countries, amoebiasis cause some 450 million infections per annum, and about 50 million incidents and an estimated 100,000 deaths annually (Ruvdin, 1988). Sargeant (1987) and Mirelman (1988) noted that about 10% of the *E.histolytica* infection result in invasive amoebiasis; while the remaining 90% of infected persons remain asymptomatic carriers who pass cysts of *E.histolytica* in their stool.

The socio-economic burden of amoebiasis is enormous. It causes death, impairs the physical, mental and intellectual development of the infected individuals as well as affects the educational performance of infected school children. In his observation, Ukoli (1992) stated that obviously, any disease which causes death or results in acute illness (such as amoebiasis) must exert an impact on productivity and hence the economy of the individual and the community.

**Corresponding Author:** C.M.U. Ajero. Department of Animal & Environmental Biology, Imo State University, Owerri.

On the issue of productive capacity, amoebiasis exerts considerable impact on the health of infected persons, “thereby limiting their productive capacity and ultimately adversely affect the national economy” as well as community development.

In their study, Halloran et al (1989) noted that many studies have provided convincing data to show the existence of a direct link between parasitic diseases, such as amoebiasis and school performance. And they further said that the impact of parasitic diseases on educational performance can be measured either quantitatively in terms of absenteeism, under-enrollment, drop-out rates and repetition of class or qualitatively in terms of school performance, alertness and capacity to process information. In an African University community, Azikiwe (1984) pointed out that amoebiasis and other gastrointestinal protozoan infections are often times the culprits of most cases of retarded physical development of children and young adolescents between the ages of five and fifteen years. No wonder then Onubuogu (1978) working on intestinal parasites (including *E.histolytica*) of school children in urban and rural areas of Eastern Nigeria observed that many children come to school with various poor health condition such as general weakness, nausea, vomiting, anaemia, diarrhea, stomach upsets, distended abdomen, fever and headache. “This subscribes to the fact that such (infected) children are inattentive in the classroom and unable to participate actively in school activities; absenteeism becomes rampant in the school and consequently there is poor academic performance.”

#### Amoebiasis And The Nigerian Environment

Infection of *E.histolytica*, as pointed out earlier occurs when man ingests food stuffs, vegetables or drink water, milk, yoghurt etc faecally contaminated by cysts of the parasite. Amoebiasis has higher prevalence and incidence in the tropical and subtropical developing countries such as Nigeria. This is not because of the tropical high temperatures and humidities of these countries, for these factors are in fact known to destroy *E. histolytica* (Nnochiri, 1975). Rather the higher prevalence and incidence are a reflection of the poor environmental sanitation and very poor personal hygiene and unclean habits practiced by endemic villagers compounded by public ignorance and illiteracy. In addition, in Nigeria, surveys by Azikiwe (1984), Kogi et al (1991) and Asaolu et al (1992) among others (**Table 1**) indicated that intestinal parasitic infections such as amoebiasis are growing problem in the country as the economic situation and availability of basic social amenities and infrastructure become very unsatisfactory.

In Nigeria, there are multiple environmental sources of transmission of amoebiasis: contaminated water, cysts passed by food handlers (in homes, eating houses or on the street), flies and direct faecal hand-to-mouth contamination. (**Fig 1 and 2**) Other environmental factors which aid and abate the acquisition of *E.histolytica* and related parasites include occupation and standard of living within the population (Oyerinde, 1981). Spencer et al (1976) and Koopman (1978) observed a striking correlation between prevalence of intestinal parasites such as

*E.histolytica* and domestic water supply, toilet facilities, sewage and garbage disposal as well as environmental sanitation. In urban and semi-urban areas of Nigeria, Okpala (1961) further outlined the following factors as being responsible for high prevalence of *E.histolytica* and other parasitic infections:

- . poor personal hygiene
- . Poor housing and overcrowding
- . Poor environmental sanitation and inadequate methods of disposal of human faeces and public refuse (Fig. 3)

As regards water contamination in the transmission of amoebiasis, sewage-contaminate water supplies have been shown to be the source of infection in some community-wide outbreaks of amoebiasis (WHO, 1968). The major cause of this contamination is usually due to defects of plumbing and sanitation. It is a common occurrence in our cities to observe leakages of pipes of public water supplies due to normal bursting of old pipes and or destruction during road and house construction activities. These leakages result in low water pressure and consequent contamination of the chlorinated piped water. And because of the fact that cyst of *E.histolytica* survive for long period in unchlorinated waters, faecal contamination of springs and streams in our rural communities or in semi-urban settlements which rely on such waters can be a source of major outbreaks of amoebiasis.

The role of food-handlers and vendors in the spread of faeco-oral parasitic diseases such as amoebiasis is epidemiologically significant. In Nigeria as in many other developing countries, the selling of ready-cooked foods on the streets of towns and cities as well as in rural areas is now a common practice. It is important to point out here that cyst of *E.histolytica* remains viable for up to 5 minutes on the surface of the hand and for about 45 minutes under the fingernails (Beaver et al, 1984). Also, in liquid foods (e.g. yoghurt, milk etc.), the cysts may survive for as long as 15 days at 4°C (Nnochiri, 1975). The import of this is that the involvement of these numerous food-handlers and vendors, with poor personal hygiene and dirty habits all over the country in conveying viable cysts to ready-cooked foods, sandwiches and other foods consumed without further processing is very significant in introducing and disseminating amoebiasis. In fact, the habit of purchasing and consuming meals and snacks prepared outside the home is typical of the present life style of some homes in the country. FAO (1989) reported that “20%-30% of the household expenditure in developing countries (including Nigeria) now is on street foods.” And pathogenic microorganisms that are indicators of faecal contamination, such as *Entamoeba histolytica*, *Escherichia coli*, *Shigella*, *Staphylococcus aureus* and *Bacillus cereus* are frequently present, and street food may cause outbreaks of amoebiasis, cholera, typhoid and hepatitis A (Abdussalam and Kaferstein, 1993).

The habit of hand feeding (Fig 2), which is a common practice by most Nigerians, especially in the rural areas may play important role in the faecal oral transmission of *E. histolytica* and related parasites. This is epidemiologically more significant in the rural and semi-urban communities where the filthy environment is

Complexed by poverty, ignorance and low standard of living. The use of hand feeding of babies by housemaids and baby seaters (most of whom are brought from the rural villages), who themselves are riddled by ignorance and poor personal hygiene need not be over emphasized.



**Fig 1** How inefficient disposal of refuse, indiscriminate defaecation of human and animal excrement and street selling of ready cooked food by people with very low standards of personal and food hygiene in our cities and towns combine to aid house-flies and other filthy flies in the transmission of faecal-oral transmitted diseases such as Ameobiasis (Adopted from J. keiding, 1986; *The house-fly: Biology and control*.WHO/VBC/86.937).

Direct faecal contamination of the environment is another significant factor that predisposes our people to high incidence and prevalence of amoebiasis. Such direct contamination may occur when premises or homes are grossly contaminated by the habit of indiscriminate defaecation (Fig 3), especially in families who live in crowded conditions with poor sanitation. This type of environment is typical of what obtains in squatter/ urban periphery and refugee settlements. Furthermore, Nnochiri (1975) noted that "some practices in certain tropical countries, e.g. ablutions after defaecation, may increase the frequency, of faecal contamination of hands and water" and assist in the transmission of amoebiasis



**vnuagers in our communities play significant role in the faecal-oral transmission of *E.histolytica* and related parasites.**

House flies and other synanthropic flies come into contact both with substrata (such as faeces and other excreta, carcasses, garbage and other filthy matter) that may contain pathogens and then with human beings, their food and utensils. These flies pick up and carry many pathogens (viruses, bacteria, protozoa cysts, ova or larvae of helminths) both externally and internally (in their crop and intestinal tract). As a result these flies are potential and often important agents of transmission of several enteric parasitic diseases (Greenberg, 1971). In Nigeria, Dipeolu (1977) observed that such parasitic diseases that can be transmitted by these flies include ameobiasis and helminthic infections such as (*Hookworm, Ascaris, Enterobius, and Trichuris*). These flies breed in a variety of decaying, fermenting or rotting organic matter of both plant and animal origin; dung, garbage, and wastes from food processing, sewage, and organic manure other than dung.



**Fig. 3** In Nigeria, the habit of indiscriminate defaecation especially among the poor rural communities aid and abate the spread of *E.histolytica* and other faecal-oral transmitted parasites.

All these are seen in filthy unhygienic environment. In Nigeria protozoa dispersed mainly by cysts such as *E. histolytica* have peaks of infections which coincide with the beginning and end of rains (Obiamiwe, 1977). These peaks also coincide with "housefly season" which suggest contaminative transmission by the filthy flies as well as by contaminated water and food which such flies visit (Nnochiri, 1965; WHO, 1968). This is because during this fly season in the country, most parts of the urban and rural areas are littered with breeding grounds of the flies. On the other hand, during the non-fly season, these breeding sites are reduced, even with the littering of the environment. This because during this season most of the breeding sites are washed away be heavy storms (at the peak of rainy season). Also fly maggots (larvae) at this period are severely parasitized by micro-organisms in addition to being washed away and killed by the action of the run-offs. All of these reduce the relative abundance of the flies and their contaminative transmission at the peak of rainy season.

**Table 1 Prevalence rate(%) of some of the faeco-oral/soil transmitted parasitic protozoans in Nigeria**

Author(s)	Area of study	<i>E. Histolytica</i>	<i>E. coli</i>	<i>G. lamblia</i>	<i>E. nana</i>	<i>I. butschii</i>	<i>I. hominis</i>
Amali & Umeh (1997) Abst. Nig. J. Parasitol.21:27	Rural farming Population in Benue state.	0.40	-	-	-	-	-
Amadi et al (1999) Abst. Nig. J. Parasitol. 23:10	Aba, Abia State	10.6	-	-	-	-	-
Cowper & Woodward (1960) Gilles (1963) University Press. 1963:17-28	Moore Plantation, Ibadan Akufor near Ibadan, Oyo State	12.0 12.0	31.0 -	1.0 -	- -	5.0 -	- -
Caundiri & Okwuosa (2000) Abst. Nig. J. Parasitol. 24:15	Langtan LGA, Plateau state.	12.1	5.3	1.0	-	-	-
Caundiri et al (2001) Abst. Nig J.Parasitol. 25:14	School age Fulani Children in Guduso, Girei LGA, Adamawa State	7.2	4.3	-	-	-	-
Ikejian (1959)	Northern Nigeria Eastern Nigeria Western Nigeria	8.0 10.0 10.	- - -	- - -	- - -	- - -	- - -
Mba & Amadi (1991)	Aba, Abia State	13.3	-	-	-	-	-
Orient J. 1997 Mbanugo & Arazie (2001) Abst. Nig. J. Parasitol. 25:6	Pregnant and non-pregnant women in Nkpor, Idemili North LGA, Anambra State	13.64					
Nwoke & Ajayi (1981) Abst Sc. Assoc. Nig.22	Jos, Plateau State	27.4	28.4	5.7	-	-	-
Obiamiwe (1977) Ann.Trop. Med. Parasitol. 71:35-43	Specialist Hospital Benin city	1.9	14.1	1.2	1.8	0.9	3.9
Okpala (1961) Sa'Adiyya (1987) Abst. Nig J. Parasitol.21:30	Lagos School children in Samaru, Zaria. Kaduna State.	10.9 -	10.1 30.4	7.2 -	3.3 -	1.4 -	11.0 -



REFERENCES

- Abdussalam, M. & Kaferstein, F.K. (1993). Safety of street foods. *World Health Forum*. 14:191-194.
- Abioye, A. A. & Edington, G.M. (1972). Prevalence of amoebiasis at autopsy in Ibadan. *Trans. Roy. Soc. Trop. Med. Hyg.* 66 (5): 754-763.
- Asaolu, S.O.; Halland, V.C. & Jegede, J.O. (1992). The prevalence and intensity of soil transmitted helminthiasis in rural communities in Southern Nigeria. *Am. Trop. Med. Parasitol.* 86 (3): 279-287.
- Azikiwe, A.N. (1984). Prevalence and pattern of intestinal infestations in an African University Community. *Ann. Trop. Med. Parasitol.* 78:333-334.
- Beaver, P.C.; Jung, R.C. & Cupp, E.N. (1984). *Clinical Parasitology* 9th Ed. Lea and Febiger, Philadelphia.
- Dipeolu, O.O. (1977). Field and laboratory investigations into the role of *Musca* species in the transmission of intestinal parasite cysts and eggs in Nigeria. *J. Hyg. Epidemiol. Microbiol. Immunol.* 21: 209-214.
- Elsdon-Dew, R. (1968). The epidemiology of amoebiasis. *Advances in parasitol.* 6:1-62.
- FAO (1989). *Urban Food Consumption Pattern in Developing Countries*. FAO Rome.
- Greenberg, B. (1971). Flies and Diseases. In: *Ecology, Classification and Biotic Association*. Vol.1. Princeton University Press.
- Halloran, E.; Bundy, D.A. & Pollitt, E. (1989). Infectious diseases and the UNESCO basic education initiative. *Parasitol Today*.5
- Kogi, E.; Umoh, J.U. & Vajime, C.G. (1991). Intestinal parasites and gastroenteritis among patients attending the University Clinic, Samaru Zaria, Nigeria. *Nigeria J. Parasitol.* 12: 77-80.
- Koopman, J.C. (1978). Diarrhoea and school toilet hygiene in Cali, Columbia. *Ann. J. Epidemiol.* 107: 412- 420.
- Mirelman, D. (1988). Amoeba-bacterial relationships in amoebiasis. In. *Amoebiasis: Human Infection with Entamoeba histolytica*. (J. Ravdin Ed.) Pp. 351 369. John Wiley & Sons. New York.
- Neal, R.A. (1966). Experimental studies on *Entamoeba* with reference to speciation. *Advances in Parasitol.* 4:1-51.
- Nnochiri, E. (1965). Observations on childhood amoebiasis in urban family units in Nigeria. *J.Trop. Med. Hyg.* 68:231.
- Nnochiri, E. (1975). *Medical Parasitology in the Tropics*. Oxford University Press, London.
- Obiamiwe, B.E. (1977). The pattern of parasitic infection in human gut at the Specialist Hospital Benin City Nigeria. *Am. J. Trop. Med. Parasitol.* 71 (1): 35 43.
- Okpala, I. (1961). A survey of the incidence of intestinal parasites among government workers in Lagos, Nigeria. *West Afri. Med. J.* 10:148-157
- Onubuogu, U.V. (1978). Intestinal parasites of school children in urban and rural areas of Eastern Nigeria. *Zentralblatt Fur Bakteriologic and Hygien I: Abt Originate A.* 243:121-131.
- Oyerinde, J.P.O.; Adegbite Holliet, A.F. & Ogumbi, O.C. (1981). The prevalence of intestinal parasites of man in the metropolitan Lagos. *Nigeria J. Nat. Sc.* 3 (1 & 2): 147 155.
- Rivera, R.A. (1972). Fatal post partum amoebic colitis with trophozoites present in peritonea fluid. *Gastroenterology.* 62:314.
- Ravdin J. (Ed.) (1988). *Amoebiasis: Human Infection by Entamoeba histolytica*. John Wiley & Sons. New York.
- Sargeant, P.G. (1987). The reliability of *Entamoeba histolytica* zymodemes in clinical diagnosis. *Parasitology Today.* 3: 40-43.
- Smyth, J.D. (1999). *Animal Parasitology*. 3rd Ed. Cambridge University Press UK.
- Spencer, H.C.; Hermones, J.A.; Healy, G.R.; Melvin, D.M. & Shumes, E. (1976). Endemic amoebiasis in an Arkansas community. *Am. J. Epidemiol.* 104: 99-175.
- Ukoli, F.M.A. (1990). *Introduction to Parasitology in the Tropics*. Textflow Ltd, Ibadan, Nigeria.
- Ukoli, F.M.A. (1992). *Prevention and Control of parasitic Diseases in Tropical Africa. The Main Issues*. University Press, Ibadan, Nigeria.
- WHO (1968). Report of the Expert Committee on Amoebiasis. *WHO Tech. Rep. Series.* 421. WHO Geneva.