JASEM ISSN 1119-8362

Full-text Available Online at www.bioline.org.br/ja

J. Appl. Sci. Environ. Mgt. *June*, 2006
Vol. 10 (2) 67 - 73

Studies on the Epidemiology of Dracunculiasis in Ikwo Local Government Area of Ebonyi State, Nigeria

[1*]AMADI, ANC; [2]ANOSIKE, JC; [3]IWUALA, MOE

[1]Department of Biological Sciences, Michael OKpara University of Agriculture, Umudike, P.M.B 7267, Umuahia, Abia State, Nigeria E – MAIL: an-amadi@ yahoo.com.

[2]Department oF Animal and Environmental Biology, Imo State University Owerri

[3]Federal University of Technology, Owerri Imo State, Nigeria.

ABSTRACT: Between April 1999 and March 2000 an epidemiological survey was conducted for prevalence and distribution of dracunculiasis in fifteen communities in Ikwo Local government area of Ebonyi State, Nigeria. A total of 4568 persons were examined out of which 640 (14.0%), had active cases of guinea worm. The disease was higher in males (15.0%) than in females (12.0%). However infection rates varied significantly among different villages, age and occupational groups ($P<0.05$) with fever (45%) and severe pain (35%) as their predominant symptoms. Disability associated with guinea worm infections in the area include crippling effect, lowered sexual activity and poor maternal attention (in females). Infection in the area depends on the source of water supply. Pond water users recorded more infection than the bore-hole/well users. Over 57.7% of persons examined filtered their water before drinking, while 26.13% did not supply treatment of any kind. The prevalence rate showed seasonal variations with 105 cases in the month of March (16.4%) and 6 cases in the month of August (0.94%). Endemicity of dracunculiasis was encouraged by behavioural and cultural inclinations**.** @JASEM

Dracunculiasis is a parasitic infection acquired by drinking water from ponds contaminated by cyclopoid copepods infected with third stage larvae of the parasite *Dracunculus medinensis*. Worm emergence is through the skin after a year of entering the infected person and this is usually associated with secondary bacterial infection. It has been called a neglected disease of neglected people since it strikes remote farming populations who have been passed over by national development efforts (Anosike et al 2002). Dracunculiasis is endemic in areas where the population depends for its domestic water supply on surface water especially stagnant pools and water holes, shallow unprotected wells and slow flowing streams (Kale 1977). Infection is especially likely under circumstance in which the same water source is used for drinking and bathing and in which people have to wade into to fetch water (Nwoke 1992). Various works on the disease and its vectors (Cyclops) have been extensively recorded in Nigeria and these include: Onabamiro (1954, 1956), Nwosu et al (1982), Edungbola (1983; 1984), Osisanya et al (1986), Fabiyi (1991), Nwoke (1992), Anosike et al, (2000), Amadi (2002). Ebonyi State is known endemic area in Nigeria (Hopkins 1998). Efforts towards the disease eradication and control of the vectors as well as their complication still constitute a public health problem as many elsewhile communities that were thought to be free from the disease hitherto return endemic. The present investigation was designed to assess the status of the disease and possible strategies towards the final eradication and control.

MATERIALS AND METHODS

The study was carried out in fifteen communities of Ikwo Local Government Area located in Eastern Part of Ebonyi State Nigeria. The area consists of seasonal streams and ponds in which a larger portion of the population depends for water. Rainfall is seasonal, it runs between the months of May to September and measures about 200cm to 250cm, while the dry season is from October to April. A daily temperature of 30^0C is recorded. The inhabitants of the area are mainly farmers while others engage in petty trading, civil service work, fishing and palm wine tapping. Due to the swampy nature of the grassland majority of the farmers engage in the cultivation of rice. Other crops cultivated are yam, cassava groundnut etc.

The natural streams and ponds serve the inhabitants throughout the year and due to the drastic reduction in volume of these water bodies during the dry season, people inevitably wade into them to bath, fetch water for drinking and other domestic uses.

Data Collection: Between April 1999 to March 2000, a total of 4568 persons resident in Ikwo L.G.A. were examined physically for the emergency of guinea worm. House to house interview of patients and case search methods as in most guinea worm studies (Belcher 1975, Udonsi 1987a&b, Anosike et al 2000; Amadi 2002) were also adopted to determine among

**Corresponding author: E – mail: an-amadi@ yahoo.com.*

other things the number of people with active cases and those ever infected. The data was stratified by sex, age, occupation, source of drinking water, site of infection seasonality of outbreaks and disabilities associated with the diseases were identified.

RESULTS

Between April 1999 and March 2000, fifteen communities of Ikwo Local Government Area were studied for dracunculiasis. Of the 4568 persons examined, 640 (14%) had active cases. Infections with guinea worm showed a significant variation ($P<0.05$) between communities. Dracunculiasis was recorded in all the communities sampled with Ndufu Amagu (42.0%) having the highest and Echialike (4.1%) the least (Table 1). Of the 4568 persons examined, 2597 (56.9%) persons had ever been infected in the communities (Table 2). Of 4568 persons examined, 2093 were males while 2475 were females. In addition 231 (15.6%) and 319 (12.93%) were infected males and females respectively (Table 3).

Table 1 Prevalence of dracunculiasis in Ikwo area of Ebonyi State, Nigeria

Communities	No of Persons Examined	No of Persons Infected	% of Persons Infected
Ndiagu Amagu	967	121	12.5
Ndiagu Echara	328	57	17.4
Ndufu Alike	411	34	8.3
Ndufu Amagu	100	42	42.0
Ndufu Echara	175	58	33.1
Noyo	120	30	25.0
Amanyima	260	29	11.2
Echialike	363	15	41.0
Eka Awoke	174	27	15.5
Ekpa Omaka	101	10	9.9
Ekpelu	159	44	27.07
Enyibichiri	407	33	8.1
Ettam	280	25	8.8
Igbudu	396	49	12.4
Inyimagu	327	66	20.1
Total	4568	640	14.0

Table 2: Distribution of those with active cases and those ever infected in Ikwo area of Ebonyi State

Communities	Estimated Population	No of Persons Examined	No Ever Infected	No of Active Cases
Ndiagu Amagu	1277	967	130	121
Ndiagu Echara	2708	328	108	57
Ndufu Alike	3552	411	357	34
Ndufu Amagu	310	100	222	42
Ndufu Echara	4752	175	98	58
Noyo	820	120	84	30
Amanyima	2781	260	186	29
Echialike	3156	363	229	15
Eka Awoke	800	174	213	27
Ekpa Omaka	5533	101	68	10
Ekpelu	790	159	101	44
Enyibichiri	4113	407	321	33
Ettam	3992	280	124	24
Igbudu	3282	396	238	49
Inyimagu	6505	327	200	66
Total	44369	4568	2597	640

The distribution of dracunculiasis in relation to sex and disability in endemic area is shown in Table 4. Of the 4568 persons examined, 2767 (60.6%) were infected. This was based on both active and those ever infected in the area. Of these, 1417 (67.6%) males and 1350 (54.6%) females were infected. However, 213 (15.3%) and 109 (7.2%) of males had crippling effect and lower sexual activity respectively. Infection is significantly higher in the 0-40 years of age ($P< 0.05$) than in other age groups (Table 5). Fever was the most common symptom suffered by patients in the area. This is usually prior to the emergence of the worm. Both fever and severe pain were recorded in all the age groups.

Table 3: Prevalence of dracunculiasis in relation to sexes in the area

Communities	MALES		FEMALES		BOTH SEXES	
	No of Person Examined	No (%) of Persons infected	No of Persons Examined	No (%) of Persons infected	No of Persons Examined	No (%) of Persons infected
Ndiagu Amagu	500	60(12.0)	467	61(13.1)	967	121(12.5)
Ndiagu Echara	163	23(14.1)	165	34(20.6)	328	57(17.4)
Ndufu Alike	211	25(11.8)	200	9(4.5)	411	34(8.3)
Ndufu Amagu	44	16((36.4)	56	26(46.4)	100	42(42.0)
Ndufu Echara	50	36(72.0)	125	22(17^)	175	56(33.1)
Noyo	73	11(15.1)	47	19(40.46)	120	30(25.8)
Amanyima	132	14(10.6)	128	15(11.7)	260	29(11.2)
Echialike	101	6(3.7)	202	9(4.3)	363	15(4.1)
Eka Awoke	124	12(9.7)	50	15(30.0)	174	27(15.5)
Ekpa Omaka	21	7(33.3)	80	3(3.8)	101	10(9.9)
Ekpelu	67	17(25.9)	92	27(2.9)	159	44(27.7)
Enyibichiri	164	20(12.2)	243	13(5.3)	407	33(8.1)
Ettam	130	15(11.5)	150	10(6.7)	280	25(8.9)
Igbudu	131	19(14.5)	265	30(11.3)	396	49(12.4)
Inyimagu	122	40(32.8)	205	26(12.9)	327	66(20.1)
Total	2093	321(15.3)	2475	319(12.9)	4568	640(140)

In all the age groups, there exist persons with active cases as well as those ever infected. The prevalence of dracunculiasis in persons within the 0 – 40 years age group are significantly higher than in those of 41 years and above. The pattern of infection in relation to worm emergency showed that adult worms of *D. medinensis* could emerge from any part of the body. Higher number of worms emerged from the foot (172) followed by the ankle (680) and the knee (62). Some worms emerged from the breast (0.9%) and buttocks (1.6%) (Table 6). Table 7 illustrated the prevalence of guinea worm infected regarding source of water supply/use in the area. These people depend mainly on streams, stagnant pond and seasonal stream. About 8.8% and 5.0% of well and borehole users respectively were infected. Observation in the field showed that due to ignorance and people's belief, most of the villagers do mix borehole and well water together with pond water. To them they believe that pond water is natural. This could explain why some people who claim that they depend on well or borehole water have guinea worm infection.

Table 4: Distribution of Dracunculiasis in Relation to sexes and Disability in fifteen endemic Communities in Ikwo, Ebonyi State

Sex	Number Examined	No. (%)* Infected	No. (%) with crippling effect	Poor Maternal attention	Lowered Sexual activity
Male	2093	1417(67.7)	213(15.3)	0	109(7.7)
Female	2475	1350(54.6)	201(149)	99(7.3)	114(8.4)
Total	4568	2767(60.6)	414(15.0)	99(3.6)	223(8.1)

*Based on both active and ever infected persons.

Table 5: Prevalence and Symptoms of Guinea worm infection in the various age-groups sampled

Age Group	No of Persons Exam.	No (%) of Persons Infected	Number With Symptoms						
			Fever	Nausea	Loss of Appetite	Vomiting	Diarrhoea	Severe Pain	Wounds
0-10	726	143	62	32	7	4	4	1	0
11-20	1580	203	60	14	20	7	3	50	40
21-30	856	203	34	8	55	11	2	45	28
31-40	652	124	56	3	16	0	0	40	26
41-50	306	67	35	2	9	3	2	43	15
51-60	241	42	16	12	13	21	15	14	12
61-70	160	39	14	50	6	7	5	12	8
71+	47	13 9	10	0	0	0	0	10	14
Total	4560	460	287	76	126	31	31	216	143

Of the 4568 persons examined, 2643 (57.9%) agreed to have filtered their water before drinking. Also 615 (13.4%) and 116 (2.5%) of persons who treated their water boiled or sedimented theirs respectively (Table 8). In addition, 1194 (26.13%) claimed that they did not treat their drinking water. 81.1% of persons who could not treat their water were mainly farmers and students/pupils. They believed that water treatment before drinking is a mere waste of time and energy. About 70.2% of the infected persons are farmers and students/pupils (Table 9). A chi-square analysis revealed that the prevalence of dracunculiasis and occupation are related. The monthly and seasonal variation pattern of prevalence showed that March had the highest number of active cases with 105 (16.0%). During the dry season there was a gradual increase in the number of guinea worm active cases starting from 48 (7.5%) recorded by September to 105 (16.4%) recorded in March. By the month of April 40 (6.2%) active cases were recorded. There was a gradual decrease in the number of active cases running through May down to August when the least number of cases 6 (0.9%) were recorded (Table 10).

Table 6: Prevalence of dracunculiasis in relation to predilection sites

Location	Number of Cases	Percentage Infected
Foot	721	26.9
Knee	62	9 7
Ankle	68	10.6
Shin	54	8.4
Calf	49	7.7
Thigh	30	4.7
Toe	40	6.3
Wrist	35	5.5
Sole	25	3.9
Upper	21	3.3
arm	13	2.0
Groin	27	4.2
Palm	15	2.3
Umbilicus	10	1.6
Buttocks	6	0.9
Breasts	9	1.4
Scrotum	4	0.7
Back		
Total	640	1 4.0

DISCUSSION

Ebonyi State had hitherto been known as the most endemic state for dracunculiasis in Nigeria (Hopkins 1998). The endemicity in the area could be related to the topography as well as the existence of several large ponds in the area which are not found in other local Government areas. Associated with these large water bodies is the problem of abate treatment. Unlike in other areas where smaller ponds exist, abate treatment is feasible and the water bodies are technically not easy to treat than large water bodies which are not treatable. Consequently, such large water bodies have continued to be breeding sites for Cyclops vectors in the area. The field officers working in the area could only treat the contact points in the water bodies where the people fetch water. However, this is not very effective as the entire volume of water is not well covered. This also shows that pond treatment with the chemical (abate) is a major intervention strategy in the eradication of dracunculiasis. Similar observations have been made by (Nwosu et al 1982; Nwobi et al 1996).

Table 7: Prevalence of dracunculiasis in relation to source of water supply

Source of Water	No of Person Examined	No. (%) of Pers Infected
Streams	427	43(10.1)
Ponds	2538	450(17.7)
Wells	340	30(8.8)
Stagnant	1061	107(10.0)
ponds	202	10(5.0)
Borehole		
Total	4568	640(14.0)

There was significant variation in the various communities. These may be attributed to two major factors. Firstly Ndufu Amagu and Ndufu Echara where highest prevalences were recorded had intercommunity clashes in the last three years. This clash disrupted all the guinea worm eradication efforts in the area. Furthermore, due to the intercommunity problems, the Village Based Health Worker (VBHWs) in the area either stopped intervention activities or backed out of the programme and this consequently led to high prevalence rates in these areas. For any meaningful attempt at control/eradication of dracunculiasis in such communities therefore, there must be Village Based Health Worker covering these communities in terms of case detection, disease management through case containment as well as systematic pond treatment every 28 days. This would eventually aid in the final fight against dracunculiasis eradication in Ebonyi State as it has been the case in other endemic areas (Udonsi, 1987 a, b; Nwoke 1992). Secondly, differences observed in the various communities could as well be related to variations and degree of exposure to the infested source of water supply. This is in line with the reports of Anosike et al (2000). They noted that in communities where the inhabitants are fully exposed to guinea worm infection due to lack of good sources of water and systematic pond treatment that endemicity levels are usually high. Kappus et al (1991) and Nwoke (1992) also subscribed to these observations.

Table 8: Methods of water treatment in relation to various occupational groups in the communities studied

Occupation	Boiling	Sedimentation	Filtration	No Treatment
Student/Pupils	221	15	602	18
Teachers	346	22	976	99
Civil Servants	26	36	850	109
Traders	17	30	101	228
Farmers	5	13	114	740
Total	615	116	2643	1194
% of Water Treatment	13.4%	2.50%	(57.9%)	(26.13%)

The disease pattern in the study area showed that it is a long standing infection since over 58% of the population sampled in Ikwo L.G.A had ever been infected at one point or the other. Similar observations have been made in other endemic areas in Nigeria (Onabamiro 1956; Edungbola 1983; 1984; Onwuliri et al 1988-90a & b; Nwoke 1992, Okoye et al 1995). Strikingly, most people in these communities sampled initially do not associate dracunculiasis with water (Anosike 2000). Sequel to this, effective health education talks were organized by the Nigeria guinea worm eradication programme (NIGEP) field managers in Ebonyi State to the endemic rural people, it is interesting to note that presently, most communities in the endemic areas of Ebonyi State are fully aware that dracunculiasis is caused by drinking water from infested ponds (Amadi 2002). Therefore, the provision of safe drinking water and mass mobilization of communities and the adoption of simple health education measures may be necessary to break dracunculiasis, thus eliminating its morbidity and socio-economic consequences (Suleiman and Abdullahi 1988-90 and Udonsi 1987). More males than females were affected because of hired laborers from other communities. The disabilities found to be common amongst guinea worm infected persons are crippling effects which were very high in both female and male patients, while poor maternal attention was only found among the females. Disability arising from guinea worm infection is due to swelling effect of the legs as well as painful ulcers due to re-infection and emergence of new worms several months after the first worm emergence. Dracunculiasis has serious economic implications in any guinea worm endemic area since the persons mostly affected are those young adults that belong to the productive age group. This is in agreement with those of Nwosu et al (1982), Edungbola (1983; 1984) Onwuliri et al (1998-90a & b) Anosike et al (2000). Majority of the infected persons had fever especially prior to the blisters. This is usually followed by severe pain, more so when such worm is nearer to the ankle or joints. However, several mild clinical symptoms such as fever, nausea, loss of appetite, vomiting, diarrhoea, severe pain and wounds are of epidemiological importance.

Sources of water supply and use in Ikwo L.G.A include seasonal streams, wells, seasonal stagnant ponds and few peremial ponds as well as some borehole which could not serve the whole communities. All the people depending on these several types of water supply had guinea worm infections. A few subjects that depend on boreholes had infections. Actually, these people did not contact such infections from the boreholes but rather confirmed that they drank from untreated pond water the previous year before the boreholes were installed. A greater proportion of persons who depended on pond water had infections. This observation is expected. Infected Cyclopes are found in the ponds and when taken without filtering or boiling results in guinea worm infection. A few others who depended on streams were also infected. During the dry season months, such seasonal streams stop flowing thereby creating stagnant ponds along the water courses. Communities around such areas depend on these water bodies for drinking, washing and other domestic chores. This could explain why 14% of the persons who depend on these water sources were infected.

Table 9: Occupation – related prevalence of dracunculiasis in Ikwo area

Source of Water	No of Person Examined	No of Persons Infected	Percentage infected
Student/Pupils	2091	363	17.4
Teachers	1270	206	16.2
Civil Servants	500	33	6.6
Traders	407	11	2.5
Farmers	300	27	9.0
Total	4568	640	14.0

Boreholes and wells had no infected Cyclops while ponds harbour infected Cyclops. Conversely, observations in the field showed that due to mixing of borehole water and well water together with the untreated pond water mainly to have pond water taste. They believe that pond water is cool and thick in the mouth. To some others, they still depend on pond water regardless of the presence of boreholes in their communities. This could explain why those who claim to depend on boreholes/wells water still have guinea worm disease. This therefore, calls for constant health education of these rural population to wipe out this belief and ignorance. Currently, the staff of Nigeria Guinea worm Eradication Programme (NIGEP), have mounted a campaign towards erasing these local beliefs as was done in parts of Western Nigeria (Brieger et al 1991; Nwoke 1992). Therefore, the prevalence of guinea worm infection in relation to source of drinking water supply showed that the disease in the study area depends on the sources of water supply. This actually agrees with the earlier report by Bourne (1986) that guinea worm is the only disease exclusively transmitted by drinking contaminated water therefore can be eradicated simply by providing safe water sources. Different methods of water treatment exist in the rural communities of Ebonyi State and these were related to various occupations of the endemic communities. They are aware that the only way to prevent guinea worm infection is by water treatment. Therefore, they boil, sediment or filter their water. However, there are still some others who find it very difficult to use any of these method to treat their water. They generally believe that treatment of water by boiling for example is waste of time, energy and financial resources. In this study, 26.1% of the total sampled population agreed that they did not treat their water before drinking. These were mainly farmers and traders. The farmers after farming drink untreated pond water due to thirst while traders who move from one market to another buying and selling food stuff rarely treat their drinking water. They buy pond water sold in the market places and drink them without proper treatment. Infection is more on people who find it very difficult to treat their water before use even when filters are given free of charge courtesy of Global 2000, Carter Center and NIGEP staff working in the area. However, with proper health education talks, there could be behavioural change by the people. Nwoke (1992) has proposed the use of consistent and persistent health education to solve this cultural and behavioural inclinations.

Table 10: Monthly and Seasonal Variation patterns of Guinea worm cases in Ikwo LGA

Months of the Year 1999-2000	Number of Cases	% of Cases
April 1999	40	6.25
May	35	5.47
June	28	4.38
July	15	2.43
August	6	0.94
September	48	7.50
October	59	9.22
November	66	10.31
December	75	11.72
January 2000	78	12.19
February	83	12.97
March	105	16.40
Total	640	14.0

There is seasonal variation in the prevalence of dracunculiasis in the area. The transmission period in that area was found to be the months of dry season. During the dry season periods the volume of water in the ponds is reduced and the Cyclops density in the water bodies are more. Consequently, the villagers depend more on the ponds for domestic water use. Furthermore, this period is farming season in the area and farmers depend on pond water while working in their farms. For eradication purposes, intervention activities must be instituted in the area before the beginning of dry season. This would help in forecasting the period when materials should be taken to the field.

Finally, guinea worm disease is endemic in Ikwo area of Ebonyi State Nigeria and the goal of control and final eradication of the disease in the entire state is especially important now the almost all West African countries and the entire world at large are calling for the complete eradication of the disease. The Federal, state and local government authorities in collaboration with other NGOs have launched a final war against the neglected and ancient disease. There is a greater urgency to identify those communities that need filters and abate for the control of infected Cyclops and break in

transmission. Provision of clean water in addition to health education will aid in the complete and final eradication of the disease in Ebonyi State Nigeria.

REFERENCES

Amadi, ANC (2002). Studies on Dracunculiacsis, its various and the impact of Environmental factors on the diseases in Ebonyi state Nigeria. Ph.D. Thesis Federal University of Technology, (FUTO), Owerri Nigeria.

Anosike, JC; Njoku A J; Nwoke BEB; Ukaga, CN; Okoro, OU; Amadi, ANC (2000). The status of dracunculiasis in parts of Isieke community in Ebonyi Local Government Area of Ebonyi State, Nigeria. Trop Ecol 41: 183-193.

Anosike, JC; Azoro, VA; Nwoke B E B; Keke, I R; Okere AN; Oku, EE; Ogbulie, JN; Tony-Njoku, F; Okoro, OU; Nwosu, DC (2002). Dracunculiasis in the North Eastern Border of Ebonyi State, South Eastern Nigeria. Int. J. Hgy. Environ. Hlth. 205: 1-7.

Belcher, DW; Wurapa, FK; Ward WB; (1975). Failure of thiabendazole and metroniazole in the treatment and suppression of guinea worm disease. Am. J. Trop. Med. Hyg. 24: 444-446.

Bourne, PG; (1986). Water and Sanitation for all. Srch. J. Emory. Univ. Sch. Med. 1:41

Edungbola, LD (1984). Dracunculiasis in Igbon Oyo State, Nigeria. J. Trop. Med. Hyg. 87: 153-158.

Edungbola LD (1983). Babana Parasitic disease projects 11 prevalence And impact of Dracunculiasis in Babana district Kwara State, Nigeria. Trans. Roy. Soc. Trop. Med. Hyg. 77:310-315.

Fabiyi, JP (1991). Geographical distribution of dracontiasis in Bauchi State, Nigeria. Discov. Innov. 3: 72-76.

Hopkins, DR (1998). Perspective from the dracunculiasis eradication Programme: Public Health Strategies. Bulletin of World Health Organization. Orlando, F L Academic Press.

Kale, OO (1977). The Clinico-epidemiological profile of guinea worm in Ibadan district of Nigeria. Am. J. Trop. Med. Hgy. 26: 208-214.

Nwobi, BC; Onwuliri, COE; Okoli CJ Njoku, OM; Oguma, CEO (1996). Infection rate of Cyclops vector populations in guinea worm endemic villages of Awe, Plateau State, Nigeria. Nig. J. Parasit. 17:83-88.

Nwoke, BEB; (1992). Behavioural aspects and their possible uses in the control of Dracontiasis (guinea worm) in Igwun river basin area of Imo State, Nigeria. Angew. Parasitol. 33:205-210.

Nwosu, ABC; Ifezulike, EO; Anya, AO; (1982). Endemic dracontiasis in Anambra State of Nigeria: Geographical distribution, clinical features, epidemiology and socio-economic impact of the disease. Ann. Trop. Med. Hyg. 76: 187-200.

Okoye, SN Onwuliri COE; Anosike JC; (1995). A survey of predilection sites and Degree of disability associated with guinea worm (*Dracunculus medinensis*). Int. J. Parasitol 25: 1127-129.

Onabamiro, SD (1954). The diurnal migra of Cyclops infected with the larvae of *Dracunculus medinensis* (Linnaeus) with some observations on the development of the larvae worms. West. Afri. Med. J. 3:180-190.

Onabamiro, SD (1956). The effects of hetrazan (Banocide:diethyl carbamazine) larval form of *Dracunculus medinensis*. West Afri. Med. J. 5:64.

Onwuliri, COE; Braide EI; Anosike JC; (1988-90a). Dracunculiasis in Bauchi State, Nigeria. Nig. J. Parasit. 9-11:21-26.

Onwuliri, COE; Adeiyongo, CM; Anosike JC (1988-90b). Guinea worm infections in Oju and Okpokwu Local Government areas of Benue State, Nigeria. Nig. J. Parasit. 9-11:27-31.

Osisanya, JOS., Eluzie EI; Okoro FI; (1986). Dracontiasis: pattern of morbidity in a North western village in Sokoto State, Nigeria. Trans. Roy. Soc. Trop. Med. Hyg. 80:293-294.

Suleiman, MM; Abdulahi G (1988-90). Guinea worm infection in Kiri-Manai village, Sokoto, Nigeria. Nig. J. Parasit. 9-11:17-20.

Udonsi JK; (1987a). Control of endemic dracontiasis by provision of water supply in rural Communities of Imo State, Nigeria. Pub. Hlth. 100: 63-70.

Udonsi, JK; (1987b). Dracontiasis in Igwum River Basin, Nigeria: its distribution, Epidemiology and transmission dynamics. Trop. Med. Hyg. 38: 304-308