EPIDEMIOLOGY OF GUINEA WORM IN FOUR VILLAGES IN MALUMFASHI LOCAL GOVERNMENT AREA, KATSINA STATE.

BY

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FACULTY OF VETERINARY MEDICINE,
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1995

DECLARATION

I, Kilo Prudence K, hereby declare that this thesis entitled, The Epidemiology of Guineaworm in Four Villages in Malumfashi Local Government Area, Katsina State, submitted to the Post Graduate School, A.B.U. Zaria, in partial fulfilment for the award of a master of Science degree, is the result of my own research except, where reference is made to published Literature and duly acknowledged.

Kilo

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CERTIFICATION

This thesis entitled, The Epidemiology of Guineaworm in Malumfashi L.G.A., Katsina State, by Kilo Prudence K. meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge.

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DEDICATION

To my beloved Late father, Kilo Sylvester Kindzeka, who died on 25/April/1977. "Daddy may your soul rest in peace" Amen.

My dearest mother whose love qnd understanding, an invaluable source of impetus unbending, propelled my quest for academic proliferation. (I do express my infinite appreciation with all my heart and love).

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I fondly remember Marie Komtangi, Rose Ndasi, Atesang Samuel, Kukah B, Dogara M.M., Cleopatra E., Lucky Nwosu and family, Dr. Ajogi, Umaru Y., Felix Oresajo, Yinka Davis and Jim I.B. for their advice, social and moral support throughout my stay in Nigeria.

At last! Father Lord, thank you for going before me, for filling the valleys before me, breaking the gates of bronze and the bars of iron before me, for leveling this mountain and hills before me, as well as for supplying all my needs according to your riches in glory by Chirst Jesus, Amen.

ABSTRACT

In order to determine the prevalence, distribution and socio economic impact of dracunculiasis and to assess health education program for it's control in Malumfashi Local Government Area of Katsina state, information was obtained by interviewing 2,701 in habitants in 216 house hold of four villages (YanDoka, Kalgo, Lamuntanni and Gangara) using a structured questionnaire. The sources of drinking water for the villages were examined for the presence of (1) Thermocyclops sp (2) Eucyclops sp and Halicyclops sp, vector of Dracunculus medinensis.

The study, which was carried out by house to house survey, between October 1992 and September 1993, revealed that 665 inhabitant were infected (24.62). YanDoka village had the highest prevalence of 33.6%, followed by Kalgo (30.12). The highest rate of infection was in Gidan /Tambaya hamlet in Kalgo village. Males were 1.6 times more likely to be affected than females; however the difference was not statistically significant. Interestingly, the 0-10 age group was the age group at the greatest risk of infection. It was 2.6 times more likely to be affected than all other age groups combined. This pattern differs from other studies. It was noted that (35.3%) of the in habitants of the four villages were children. When the prevalence was related to occupation, it was observed that school pupils (32.3%), the jobless (28.8%) and the farmers (23.6%) had high risk of infection. The disease is more frequent, during the rainy

season.

Dayi dam was used by a large proportion (1814) of the respondents and 28.6% of them had dracunculiasis. Dayi dam users were 2.1 times more likely to be affected than users of other water sources combined. Both Dayi and the pond at Lamuntanni were found to harbour cyclops: Thermocyclops and Eucyclops (Dayi) and Theremocyclops (pond at lamuntanni). The density of cyclops was highest in Dayi dam, followed by the pond at Lamuntanni but no cyclops were seen in the stream at Fari and Gangara dam the other two sources of water for the area. The number of cases of the disease was lower among the villages who use the later two sources.

Lower limbs were the main site of emergence of the worms involving 81.8% of the 665 affected persons. 210 of 257 person*? who were incapacitated for 1-3 weeks had worm emergence from their lower limbs. The survey indicated that 91.6% of the 216 household, studied were-aware that guineaworm would be contracted by drinking contaminated water. Only 55 (25.5%) out of the 216 households use monofilamentous filters, 56 (25.9%) used cloth and 105 (48.6%) did not use any filter. People who use cloth filter were 1.8 times more likely to be infected than those who used monofilamentous filter. Those who did not use any filter at all were 2.7 times more likely to be infected than those who use. Health education program were available to the village but a significant proportion of those who attend health education talks did not practice what they were told.

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FACULTY OF VETERINARY MEDICINE

(Office of the Dean)

Date: 29/11/96

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The Dean,
Post Graduate School,
Ahmadu Bello University,
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Dear Sir,

Submission of Copy of Thesis

Please find enclosed 5 copies of an M.Sc./Ph.D thesis titled The Epidemiology of guinea worm in four villages in malumfashi Local Government Area, Katsina State

by Kilo, Prudence Vinila from this Faculty for your collection by regulation. We also include 5 copies of the abstract. Please acknowledge.

Yours sincerely,

DR. I. AJOGI
Assistant Dean, Post-graduate & Research Affairs.

3/12/96

Based on this study, treatment of Dayi dam and pond at Lamuntanni to reduce cyclops density, increased accessibility of the villagers to filamentous filters and proper health education to encourage community participation in the control program are recommended towards elimination of guinea worm in the study.

TABLE OF CONTENTS **PAGE**

DECLARATION	... ...	i
CERTIFICATION	... ...	ii
DEDICATION	... ...	iii
AKNOWLEDGEMENT	... ...	iv
ABSTRACT	... ...	v
TABLE OF CONTENTS	... ...	viii
LIST OF TABLES	... ...	ix
LIST OF FIGURES	... ...	x
CHAPTER I		1
INTRODUCTION		1
CHAPTER 2		
2.0	LITERATURE REVIEW	6
2.1	STRUCTURE AND LIFE CYCLE	6
2.2	VECTORS OF GUINEAWORM IN NIGERIA	8
2.3	EPIDEMIOLOGY	9
2.3.1	TRANSMISSION	9
2.3.2	PATHOGENESIS	10
2.3.3	COMPLICATIONS	12
2.3.4	SOCIO-ECONOMIC IMPACT OF DRACUNCULIASIS	13
2.3.5	DISTRIBUTION	15
2.4	DIAGNOSIS OF DRACUNCULIASIS/CLINICAL SIGNS	19
2.5	TREATMENT	21
2.6	ACTIVITIES OF NIGERIAN GUINEAWORM ERADICATION PROGRAM (NIGEP)	22
CHAPTER 3		
3.0	MATERIALS AND METHODS	27
3.1	EXAMINATION OF WATER SOURCES USED FOR DRINKING FOR THE PRESENCE OF CYCLOPS	30
3.2	CRITERIA FOR CYCLOPS IDENTIFICATION AND DATA ANALYSIS	31
3.3	DATA ANALYSIS	32
CHAPTER 4		
4.0	RESUSLTS	34
4.1	DISEASE AND USE OF WATER	35
4.2	HEALTH EDUCATION AND THE INCIDENCE OF DRACUNCULIASIS	37
CHAPTER 5		
5.0	DISCUSSION	40
5.1	CONCLUSION AND RECOMMENDATIONS	46
REFERENCES		

LIST OF TABLES

TABLES		PAGE
1.	Distribution of Guineaworm Cases According to Villags/Hamlets 1992 - 1993	52
2.	Distribution of Guineaworm Cases in Four Villages in Malumfashi L.G.A. According to Sex ...	53
3.	Distribution of Guineaworm Cases According to Age Group	54
4.	Distribution of Guineaworm Cases According to Marital Status	55
5.	Distribution of Guineaworm Cases According to Occupation	56
6.	Distribution of Guineaworm Cases According to Source used for Drinking	57
7.	Distribution of Guineaworm Cases According to Site of Emerging worm and The period of Incapacitation 1992 - 1993	58
8.	Distribution of Guineaworm Cases According to Age Group and period of Incapacitation	59
9.	Distribution of Guineaworm Cases According to Various Age Groups and Site of Emergence of the Worm.	60
10.	Distribution of Guineaworm Cases According to the Season of the year. 1992 - 1993	61
11.	Distribution of Guineaworm Cases and the Impact of the Disease on the Villagers	62
12.	Distribution of Guineaworm Cases According to Households in Malumfashi LGA, 1992 - 1993 ...	63
13a.	Association of water sources used by the Four Villages with Guineaworm infection in Malumfashi L.G.A. 1992 - 1993	64
13b.	Cyclopoid copepods collected from water sources in the four Villages of Malumfashi L.G.A., 1992-1993 ...	65
14.	Health Education and the Case of water in 216 Households in Malumfashi (L.G.A.), 1992 - 1993 ...	66
15.	Health Education Talks on Dracunculiasis and the Household Response regarding the Water Treatment Practice.	67
16.	The Effect of the Type of filters used in The Households and Guineaworm Disease in Malumfashi L. G. A., 1992 - 1993	68
17.	Effect of the frequency of use of monofilamentous filter in the Households in relation to Guineaworm disease in the four villages of Malumfashi L.G.A. ...	69
18.	Yearly Distribution of Guineaworm Case According to States and Based on Endemicity	70

LIST OF FIGURES

FIGURE 1: Halicyclops sp. 49

FIGURE 3: Thermocyclops sp. 50

FIGURE 4: Eucyclops sp. 51

CHAPTER 1

Introduction:

Dracunculus medinensis, (the guineaworm) is a parasitic disease of man in rural communities in India, Pakistan, the Middle East and Africa (Muller, 1976). Dracunculiasis is transmitted solely by drinking water contaminated with larvae of Dracunculus medinensis. Its eradication has been adopted as a goal for the International Drinking Water Decade by agencies such as United Nations Development Program (UNDP), United Nations Children's Fund (UNICEF), World Health Organisation (WHO) and The Bank of Credit and Commerce International (BCCI) (Muller, 1985).

The disease constitutes a major public health problem in Africa, with an estimate of 15 million people infected (Kale, 1977). It is endemic in 19 African countries with Burkinafaso, Ghana and Nigeria being the most severely affected. In these three countries, the disease is nationwide (Anon, 1989). Edungbola (1986) reported that the disease is endemic in all parts of Nigeria.

The disease is acquired by drinking water containing infected cyclops. All stages of a suitable predatory species of cyclops from hatching to adult can ingest guineaworm larvae, and by the time the larvae have developed to the third stage the cyclops are likely to be adults (Muller, 1985). In the cyclops, the larva moults twice and develop to the third stage, (infective stage) in a minimum period of 14 days (Muller, 1985). Once man ingests these infected cyclops in water, a year later, the main symptom to the

disease which is a blister usually appears on the leg from which the female worm 40-50cm long gradually emerges. Many sufferers are incapacitated for one to two months due to the painful lesion. The control of dracunculiasis is the reduction of the disease to a point where it is no longer a public health problem, while eradication is when the disease is eliminated from that country. This requires an intervention which is relatively and technically simple and greatly enhanced by changes in human behaviour (Hopkins, 1983).

Since the adoption of the resolution by National Council on Health in mid 1988 to make guineaworm a notifiable disease, a national task force was set up with the sole objective of spearheading the guineaworm eradication program in Nigeria (Nwobi, 1989). The Nigerian guineaworm eradication program has adopted an action plan that calls for monthly disease surveillance and reporting in all States of the Federation (Kale, 1991). Surveillance will become critical in certifying the elimination of guineaworm from Nigeria (Hopkins, 1991).

Health education is the pivot around which all Nigerian Guinea Worm Eradication (NIGEP) activities oscillate. It aims at encouraging the villagers to use guineaworm free drinking water by protecting their water source from contamination and by undertaking personal protection from infection through boiling and filtering water before drinking (Kale, 1991). It also focuses on the mode of transmission of the disease, by educating the villagers to prevent individuals with guineaworm ulcers from immersing the

ulcers in drinking water bodies (Braide, 1991).

The chemical treatment of water and provision and maintenance of safe water supply are the best long term solution for water borne disease. At the second national conference on Dracunculiasis held at Sheraton Hotels, Lagos on March 20, 1989 the Federal Government announced that the Directorate of Food, Roads and Rural Infrastructure (DFRRI) would make villages with guineaworm a priority for its water projects (Ransome Kuti, 1991).

The Directorate of Food, Roads and Rural Infrastructure (DFRRI) has provided over 5,000 water points in 20 States in its phase 1 program and more 10,000 water points were given in the phase 2 of the project. UNDP provided water points in one local government each in Plateau, Bauchi, Borno, Benue State and Abuja (FCT). Japanese International Cooperation Agency (JICA) provided 150 boreholes in Anambra and Niger States. UNICEF provided water in eight states under its water and sanitation program. The Canadian government committed a large sum of money for the provision of water points in Ondo State (Ransome Kuti, 1991). However, not all the 6,000 endemic villages in Nigeria have been provided with water points.

Lack of portable water sources in communities could result in many water contact and water borne diseases. Dracunculiasis is characterised by a period of misery, poverty and disablement on villagers who have no safe source of drinking water and who are ignorant of the mode of transmission of the disease and its prevention (Adeniyi, et al, 1991). This infection is rarely fatal,

but causes severe disabilities and has adverse socio-economic effects (Edungbola, 1986). Ordinarily, rural farmers depend on family labour for farm work. Farmers hire non-family labour, when family labour supply becomes constrained by guineaworm infection (Nwosu, 1977). This disease has been associated with low agricultural productivity (Nwosu, 1988), absenteeism and low academic performance among school children (Edungbola, 1983), susceptibility to tetanus through guineaworm ulcers (Muller, 1971), and habitual abortion in pregnant women (George, 1975). In endemic areas, the disease has been incriminated in deformity of the limbs and frustration (Onabamiro, 1951).

Katsina State, in the North-West Guineaworm Zone had hoped to eradicate the disease from the State in 1993. The State had 182 endemic villages in 6 Local Government Areas (LGAs) with 12,018 cases in the state in 1988, 24,716 cases in 1989 and 20,757 in 1990.

The 1990-91 case search revealed a decrease to 12,641. The state ranks seventh in terms of endemicity and third among the hyperendemic states (Fourth National Case Search, 1990-91).

One wonders why guineaworm disease continues to persist in most endemic villages in Nigeria, despite the efforts put in by Global 2000, UNICEF, UNDP, WHO, and the Nigerian Government towards its control and eradication. It's persistence could be as a result of (1). Lack of health workers in all endemic villages to aid in educating the villagers. (2) Shortage of resources such as the monofilamentous filters, hand pumps,

boreholes and temphos for water treatment. (3) Complete negligence on the part of the villagers to adhere to health education talk on water treatment practice and the use of monofilamentous filters, and (4) Poor surveillance and reporting methods.

Considering Malumfashi L.G.A of Katsina State the following questions should be asked;

1. What is the prevalence, the distribution, and the socio-economic impact of the disease in the area ?
2. What are the genera of cyclops, responsible for the transmission of guineaworm disease, in the various water sources used for drinking ?
3. How are the inhabitants responding to various intervention measures put in place for eradication of the disease and what has been the effect of the use of monofilamentous filters in the control of dracunculiasis?

Thus, the objective of this study are:

(1) To determine the prevalence, the distribution, the socio-economic impact of the disease in Malumfashi Local Government Area.

(2) To identify cyclops responsible for the transmission of guineaworm disease in the various water sources used in drinking in Malumfashi Local Government Area.

(3) To assess the acceptability of the use of filters and health education lectures as the intervention measures in the eradication of the disease in this LGA.

(4) To evaluate the efficacy of monofilamentous filters in the control of dracunculiasis.

CHAPTER 2

LITERATURE REVIEW

2.1 Structure and Life Cycle:

Guinea worm is caused by a thread-like worm called *Dracunculus medinensis.* According to Moorthy and Sweet (1938), parasites from experimentally infected animals are often smaller. Females removed from dogs measured (280mm x 1.0mm), while those from patients in Pakistan measured (690mm x 2.0mm).
Muller (1971) described the female with a triangular opening surrounded by a quadrangular cuticularized plate. It has four double external and internal papillae. The dorsal and ventral papillae are also doubled. The pharynx measured 100-400mm. The vulva opens about half way down the body, that is 70mm from the anterior end of a specimen 135mm long (Muller, 1971).

The ovarian tubules, the oviducts and uteri are paired; the vagina unpaired and often seen as a partly exposed worm through the ulcer which appears on the skin (Fedchenko, 1971).
The uterus, at 8-9 months, is filled with developing eggs and later fertilized by the spermatozoids from male worm. The male worm dies shortly after. Cleavage and cell division occurs and by ten months mature embryos break free from the egg-shell into water. Turkhud (191) estimated 3 million embryos from the female worm. Muller (1971) estimated 189,000 to 143,600 embryos from female worm in a rhesus monkey. These embryos are the first stage

larvae. They have a fully formed gut with mouth and anus but they do not feed. They can remain in water for 5-7 days (Moorthyand Sweet, 1938). Muller (1971) detected a fall in percentage infection rate of the cyclops after three days. Active larvae in water may be swallowed by cyclops, tiny crustaceans which are the intermediate hosts.

The entry of the larvae into the cyclops was at first said to be by active penetration through cuticle (Fedchenko et al., 1871) while Leiper (1907) thought the idea was improbable. Muller et al. (1971) firmly believed that the embryo have to be ingested. Once in the stomach of the cyclops, the embryo penetrates through the gut wall into the haemocoel in 60-240 minutes depending on the temperature (Moorthy, 1938). The larvae moults twice and the time depends on the temperature and species of cyclops (Manson, 1985).

The third stage larvae is reached in 12-14 days at about 25°C -30°C. Muller (1971) measured a 15 day old larvae from Cyclops nigerianus in Nigeria and it measured 353Um x 13.4Um. These larvae differ from Camallanid larvae which uses cyclops as their intermediate host also. The Camallanid larvae are shorter, broader and have a large buccal capsule with a trifid tail (Muller, 1971).

When infected cyclops sink to the bottom of ponds, dams and wells. When these infected cyclops are consumed with water, the gastric juice kills the cyclops and liberates the larvae (Adeniyi, 1991). The larvae penetrate walls of digestive tracts

quickly to reach the abdominal or thoracic cavity where they mature into males and females.

Mating occurs at three months of age (Edungbola, 1983). The males dies and become encapsulated and the females live in connective tissues before migrating to the lower limbs and other sites of emergence (Edungbola, 1985). The adult female worm secretes a toxic substance that provokes a painful blister and subsequently an ulcer. At this point the symptoms of dracunculiasis are manifested and the adult female could be seen partly protruding through the ulcerated body. When in contact with water, the uterus ruptures to release thousands of embryos into water and the whole sequence is repeated (Edungbola, 1985).

2.2 VECTORS OF GUINEA WORM IN NIGERIA

Dracunculus medinensis exhibits a high level of host specificity and only a few cyclop species act as vectors in nature (Johnson et al., 1988). D. medinensis is vectored in Nigeria and other West African countries by seven species of fresh water cyclops: Thermocyclops crassus, Thermocyclops inopinus, Thermocyclops incisus, Thermocyclops oblongatus nigerianus, Mesocyclops aequatorialis, Mesocyclops kieferi and Mesocyclops margaretae (Braide et al., 1988). Of the several species of cyclops identified in Mkpani village in Cross River State, only two species were naturally infected with the guineaworm larvae. These are Mesocyclops aequatorialis smills and Thermocyclops oblongatus nigerianus (Johnson et al., 1988).

The larvae of guinea worm have been found to be very

sensitive to acid conditions when compared with other nematode larvae which penetrate through the gut wall such as the larvae of Trichinella spiralis (Muller, 1971). Burgis, (1970) reported that high temperatures of above 32.5°C caused retardation of embryonic development and at 35°C the embryo hatch but dies immediately. Moorthy (1935) noted that cyclops were killed by human bile in about 20 minutes and the contained larvae escaped about 60 minutes later. Roa (1936) confirmed that bile was quickly lethal to cyclops but he did not think that this was of any practical significance as all cyclops die two minutes after ingestion

2.3 EPIDEMIOLOGY

2.3.1 Transmission:

The transmission of dracunculiasis could be described as a biological vector transmission. This is because the first stage larvae, when swallowed by the cyclops moults twice into a third stage larvae at optimal temperatures of 25-30 °C. This time needed for these moults for the agent to become infective is the extrinsic incubation period which is about two weeks. Hence the ingestion of an infective cyclops in water is the only means of transmission to the definitive host, (man).

Active guineaworm transmission occurs in every state although the level of endemicity varies (Anon 1989). The prevalence of dracunculiasis shows marked variation with the season and this is closely bound to its mode of transmission (Adeniyi, 1991). Transmission is not only dependent on the levels of infective

cyclops but also on their behaviour. Cyclops which contain infective dracunculus larvae invariably sink to the bottom of ponds. Thus it is believed that surface water of ponds, at least one metre deep, is safe (Onabamiro, 1954).

Transmission periods vary with geographical regions Watts, 1987). Onwuliri et al., (1988) reported transmission during May - October in Bauchi State which coincide with planting period. Ramsay (1935), Muller (1971) noted that in the Sahel savannah. areas of Africa where annual rainfall is less than 75cm per year guineaworm infection is confined to the rainy season until the ponds dry up. Contrary to this view, it has been reported that in the forest and guinea savannah region of West Africa, transmission is during the dry season. (Udonsi, 1987a) These differences in the period of transmission are of importance in any intervention strategies.

2.3.2 **PATHOGENESIS**

Most worms emerge normally from the lower limbs although occassionally worms may be found almost anywhere in the body (Muller, 1971; Onwuliri, et al, 1990). Kale (1971) associated this feature to a geotactic response that ensures the survival and perpetuation of Dracunculus medinensis. Usually one to three worms emerge at one time, although several larvae may have been ingested (Onabamiro, 1951). Occassionally there may be multiple infection with up to forty worms in one season (Blacklock and O'Farrell et al., 1919).

There are three ways in which infection with guineaworm may first become apparent, these are: by the recognition of a palpable sometimes moving worm; by allergic symptoms or by the formation of a bleb (Muller, 1971). Reddy (1969) found that only 37% of patients were aware of the infection before a blister appeared, while other workers reported that a generalized urticaria is the first sign in 30-80% of their patients (Fairley, 1924a). Dracunculiasis is sometimes accompanied by fever, gastro - intestinal symptoms and dyspnoea (Duke, 1895; Fairley and Liston 1924b; Caryon and Camain 1961). Occasionally chronic infection with non emergent worm may cause an allergic pruritis (Hodgson and Barrett, 1964).

Local blister is the first sign in 61% of the patients (Fairley & Liston,, 1924). Microscopic examination of the skin lesion in man showed that the blister formed just below the germinal layer of fibrin, containing leukocytes and juveniles dividing the blister into two parts. The base is composed of granulation tissue which contains neutrophils, mononuclear cells and uncommonly large number of eosinophils and fibroblasts which are continuous with similar tissues forming a fibrous membrane, surrounding the tract occupied by the living adult worm (Fairley and Liston, 1924b).

A portion of the worm is extruded through the ulcer, which is formed by bursting of the blister. After a few days, the anterior end of the worm protrudes and with immersion in water, the embryos become expelled.

Secondary bacteria infections occur resulting in various complications such as acute abscess, cellulitis, arthritis, synovitis, fibrous ankylosis of joints and contraction of tendons (Fairley and Liston, 1924b). The most common organisms cultured from lesions were Staphylococcus aureus, Escherichia coli and Streptococci spp (Muller, 1971). A study at University College Hospital Ibadan revealed that guineaworm ulcer was the third most important source of tetanus infection (Lauckner et al., 1961).

In some cases, the worms fail to reach the surface; they become calcified and are only detectable by x-ray (Muller, 1971). In most of the radiographs, several worms were seen in varying stages of calcification. The patients were monitored for one year but showed no symptom of the disease (Muller, 1971). Scotts (1960) suggested excessive gastric activity as an important factor in resistance. A single person may ingest in one season an average of 75 infected cyclop each containing one to three larvae, but only one of three worms finally emerge. The rest die and become calcified (Scotts, 1960). Reddy et al., (1968) found that older patients have higher percentage of calcified worms than young people and it is likely that these older persons are the more resistant to guineaworm invasion (Nwosu et al., 1982)

The presence of guineaworm at unusual anatomical locations is the major cause of complications (Kale and Edungbola, 1985). Primary complications may arise due to formation of an abscess round a dying or dead non-emergent worm. This may lead to

pressure symptoms especially when the site is around a vital internal organ such as the spinal cord (Fairley and Liston, 1924b.

A non-emergent worm around a joint can lead to arthritis (Reddy et al., 1969). Greenwood (1968) reported cases of aseptic arthritis in knee joints, ankle, waist and elbows of some guineaworm patients in Western Nigeria. Kinare et al. (1962) found a gravid female worm in an abscess cavity in the pericardium of a 5 year old Hindu man with constrictive pericarditis.

Donaldson and Angelo (1961) reported a case of quadriplegia due to guineaworm abscess in the spinal canal with recovery after laminectomy and removal of the worm. Verma (1969) removed a guineaworm from the subconjunctival space of the right eye of a 12 year old girl in India. Two cases of extradural abscess caused by guineaworm were reported (Reddy and Valli, 1967).

Secondary bacteria infection due to negligence, ignorance and poor sanitary methods of local management practice of the ulcer are major causes of death in complicated dracunculiasis. A study in Upper Volta revealed that 7.0% of these villagers who died of tetanus were previously infected with guinea worm (Pirame and Becquet, 1963).

2.3.3 Socio-economic Impact of Dracunculiasis:

Loss of agricultural productivity is one of the readily

assessable impact of guinea worm infection. A study on 399 guineaworm cases in six villages, showing age distribution unveiled that 90% fell between age groups of 25-44 years. This group represents the most productive age group in any country (Hopkins, 1973). In Idere village in Nigeria, Adeniyi et al. (1991) noted that of 40 women interviewed, 80% abandoned their occupation at some point due to guinea worm infection.

Impact on other socio-economic conditions of affected communities such as school attendance, malnutrition among children and general household duties have been documented (Edungbola, 1985). Brieger et al, (1989) reported lack of ability of women to carry out home duties due to dracunculiasis. From 42 women studied, only 2 could continue home duties normally. Ten were confined to home based chores only, while 30 needed help with all chores, and even bathing proved difficult to some. Among women or mothers still breast feeding, only 15 reported their children fed normally and 27 reported malnutrition, where mothers could not feed their children regularly due to guineaworm infection on the breast.

Ifezulik and Anay (1982) documented the level of absenteeism from school in Anambra State of Nigeria, which increased to 60% from normal 18% at the later part of the term due to guineaworm attacks. Two schools were closed down during this time. Studies have shown that when guineaworm is controlled, school attendance increases, absenteeism decreases

and school enrollment is enhanced with its resultant educational benefits (Brew-Graves, 1991). Various models have indicated that especially in the rice growing countries, where the paddies are the source of infection, massive revenue can be lost as a result of the reduction in labour, and decrease in acreage. Income and agricultural consumption are also adversely affected. It thus follows that during the seasons of major guineaworm outbreaks, malnutrition could be a direct or indirect consequences. Cost of treatment for those affected becomes an additional burden which can aggravate mental and other social problems in an already impoverished family or community (Brew Graves, 1991).

2.3.4 **DISTRIBUTION:**

Guineaworm is endemic in four Asian countries and also in Africa. The main Asian foci are Pakistan and India (WHO, 1989).
In Africa, ninteen countries have been affected in a belt extending right across the northern part of the continent and in East Africa extending almost to the equator. In Africa, the annual prevalence was estimated to be about 3.32 million and pupulation at risk about 120 million (Watts, 1987).
By 1986, the most seriously affected countries in Africa were Benin, Mali, Burkina Faso, Ghana, Niger, Cote d'Ivoire, Mauritania, Nigeria, Togo Southern Sudan, Ethiopia, Northern and Eastern Uganda and Northwest Kenya (Watts, 1987).

In Nigeria, the disease was reported from 303 local

government areas and the Federal capital territory of Abuja (WHO, 1986). Nigeria with a total population of 88 million had an estimated 75% of the annual African cases. Thirty million Nigerians were said to be at risk of the infection (WHO, 1986). Guinea worm disease is a recurrent public health problem in Nigeria, particularly in the rural villages of Anambra, Bauchi, Borno, Imo, Kwara, Ogun, Oyo and Sokoto states (Ilegbodu et al., 1987). It is found in all ecological zones from the forest through the Savanna to the sahel and to the desert. In Africa, cases recorded in the desert may originate elsewhere. Transmission in desert areas is not documented in Africa (Watts, 1987) although it is known in Pakistan.

It was also noted that savanna vegetation dominated by grasses, scattered trees and shrubs, and associated with a tropical wet and dry climate prodominates where dracunculiasis is present. Here seasonal variation in the availability and sources of drinking water are a feature of many rural communities and are often associated with seasonal changes in dracunculiasis transmission (Watts, 1987).

Dracunculiasis has been found to occur in rural communities that depend for their drinking water on surface water especially ponds, water holes, shallow unprotected wells and seasonal streams that become discrete ponds during the dry season (Onabamiro, 1951). Transmission varies with geographical location and season. Ugwu and Nwaorgu (1990) noted that the

prevalence of guinea worm in Anambra State was at its peak during the dry season. This report is in line with those of (Nwosu, 1987; Onabamiro, 1952; Udonsi, 1987 and Scott, 1960) who documented that guinea worm transmission occurs mainly during the dry season in the forest and guinea savanna regions.
This pattern was contrary to that of (Braide et al., 1990) who reported that transmission occurs during the rainy season, as well as that of Ramsay, 1935; Muller, 1971 who documented that in the sahel savanna areas of Africa where the annual rainfall is less than 75cm per year, guinea worm infection is confined to the rainy season. These difference in the pattern of transmission were important in conducting country-wide epidemiological surveys and in planning a control program. Infection has been found in all age groups, but highest prevalence occurred in the adult age groups. Onwuliri (1990) observed highest infection in the age group (20-29 years) for males and 30-39 years) for females, with more males infected. While (Ilegbodu et al., 1987) noted higher infection in males over 19 years of age than in adult females. The peak infection rate in females was at 35-44 years and for males at 45-54 years. Ilegbodu et al. (1987) also found higher infection rate in girls than in boys less than 15 years of age but in the 15-19 year age group higher prevalence was noted among males than females.

The lower prevalence of infection in (infants < 1 year) is expected because of the usually long period of breast feeding (Ilegbodu et al., 1987). Boiled water usually is used in

preparing food for the very young ones. The long prepatent period of infection results in children less than one year of age not showing any signs (Edungbola, 1983).

Infection has been shown to be highest among farmers, students and traders (Onwuliri et al., 1990; Adeiyongo 1990). Kale (1985) supported that farmers predominate in rural communities compared to the rest of occupations. Onwuliri et al (1990) attributed this high rate to out door activities and hard nature of men's work such as cattle rearing, fishing and hunting. The high frequency is a factor of increased exposure to infection (Kale, 1985; Edungbola, 1985). However, there has not been any satisfactory explanation as to why some individuals in guineaworm endemic community appear to escape infection most of the time while some are affected virtually every year (Kale, 1985). Various studies have shown that some individuals may become infected year after year and Braide et al (1990) reported a total of 151 cases of reinfection in Bauchi State suggesting that there is no protective immunity against dracunculiasis. Cairncross and Tayeh. (1988) reported the prevalence according to various water sources used by villagers. He noted the highest prevalence among open reservoir users, then follows in decreasing order, divert run-offs, shallow waterholes, dug wells and hand pump users. Their findings that hand pumps were a relatively safe source of drinking water agrees with the fact that infection is not associated with deep narrow draw wells (Muller, 1979). The larvae of cyclops develop best between 25°C

and 30°C and will not develop at temperature below 19°C. Infection is therefore limited to tropical and subtropical regions (Muller, 1971). Of the species of cyclops recovered by Onabamiro, (1952) only those which could live in water with a PH of between 6 and 6.8 played an important role in the transmission of guineaworm. Kirshner et al, (1938) noted that larvae collected from the ulcer in sterile tap water died in about 6 hours. In order to keep them alive it was necessary to transfer them immediately to pond water.

2.3.5 Diagnosis of Dracunculiasis/Clinical Signs:

Local itching, urticaria and a burning pain at the site of a small blister are usually the first clear symptoms of dracunculiasis (Muller, 1971); Nwosu et at., 1982). Eosinophilia is typical of helminth disease and has been recorded many times in Dracunculus infection when worms are emerging. Usually, the relative figure is between 13 and 18% (Billet, 1896; Dudgeon and Child, 1903; Fairley, 1924a; Jain and Gupta, 1966).

Once the first mature female worm has provoked the formation of a blister at the site of emergence, infection can be confirmed parasitologically. This is done by adding cold water on the ulcer or spraying ethylchloride near to it to facilitate the bursting of the blister in about four days, at this stage embryos can often be obtained and viewed under a low power microscope (Muller, 1971). However, a deep seated abscess formed by bursting of a worm in the tissues can sometimes be diagnosed by needle

aspiration. When the pus is examined microscopically it may show numerous embryos actively moving under low power (Muller, 1971).

Various immunological test, have been described for patients with patent infections, but have very little practical application at present (Muller, 1985). The indirect flourescent antibody test is effective with sera from patients with patent infections. In experimentally infected rhesus monkeys, one could detect antibodies produced in response to the guineaworm antigen, four months before emergence, which vanish 2-9 months after patency. If similar result could be obtained in man, then the flourescent antibody test (FAT) may be very useful in early diagnosis (Muller, 1970).

Intradermal test (Ramsay, 1935) and complement fixation test (Stetanopoulo and Dariaud, 1940) were some possible diagnostic tests, but some workers have shown that these test arenon and ineffective. Results of heamagglutination and immunodiffusion techniques used to estimate serum levels of antibody specific for Dracunculus medinensis suggested little role for agglutinating and precipitating antibodies in the response to the parasite. Serum levels of IgG and IgE were found to elevate significantly in infected patients. IgM level raised just slightly but there was an overlap between infected and control group. IgE present in low levels in normal serum was found to be raised markedly in a majority of infected patients. The significance of IgE response was confirmed by the high incidence of(87%) immediate hypersensitivity reactions on skin testing in infected subjects.

IgE being homocytotropic would initiate allergic reactions.

Cell mediated immunity is doubtful as all of eight infected patients examined failed to show a delayed hypersensitivity response to antigen. However, no method has actually proved sufficiently sensitive and specific for use as a diagnostic test. The haemagglutination test provides a fairly sensitive technique for estimation of agglutinating antibody particularly IgM (Alyedun, 1985 Garate et al. (1990) used the haaemagglutination test and hard an (80%) reliability and (100%) sensitivity when a conjugate directed against antibody of the IgG4 subclass was used. Garate et al. (1990) thought this could be used as a possible way of rapid assesment of pre and post seroprevalence infections especially where the prevalence of filariasis is very low.

2.3.6 TREATMENT:

Until recently the only treatment for dracunculiasis was the time honoured one of laboriously rolling out each emerging worm around a small stick. This is usually accompanied by antibiotics to prevent secondary infections and drugs to hasten and ease eruption of the worm. Pardani (1977) reported a symptomatic relief of pain and pruritis, and ease of emerging adult female worm in patients who underwent metrinidazole trial in India. This drug did not kill the worm nor its larvae. Local treatment with hydrocortisone cream which contain antibiotics had more effective results. Surgical removal of Dracunculus after local anesthetic is widely used in India and Pakistan (Muller, 1971).

This is easy when the outline of the worm can be seen or palpated, then it can be completely removed by a single small incision.

Reddy and Sivaramappa (1968) recommended the surgical removal of worms found in the synovial cavity but Greenwood (1968) followed up some few cases and found that, provided that there was no bacterial infection the condition eventually regressed without operation. In most parts of Nigeria, guineaworm patients often apply oily substances like palm oil to skin lesions. They believe this facilitates the worm's expulsion and produce a soothing relief (Kale, 1985). Rousset (1952) noted that the antifilarial drug diethylcarbamazine is a potent chemoprophylactic and acts on the developing stages only.

2.3.7 Activities of Nigerian Guineaworm Eradication Program (NIGEP)

The adoption of the resolution by the National Council on Health in mid 1988 to make guineaworm a notifiable disease, a National Task Force was set up with the sole objective of spear-heading the guineaworm eradication program in Nigeria (Nwobi, 1989). A multisectorial approach was to be adopted to adequately tackle this problem, this was reflected in the composition of the National Task Force which held its inaugural meeting on 5th May, 1988, aimed at defining the major strategies for the eradication efforts and monitoring national progress toward elimination of this desease (Ransome Kuti, 1991). Between October

and February, 1988, the first ever guineaworm case search in the country was carried out. During this search, the distribution and magnitude of the disease was identified. Almost every village in Nigeria was visited and over 650,000 cases were found in about 6,000 villages. A national plan of action for the eradication of guineaworm from Nigeria by December, 1995 was developed in 1987. A memorandum of agreement between the Federal Government and Global 2000/BCCI was signed in 1988 (Report on Final Meeting in Brazzaville, 1991). By November, 1989 the second nationwide active case search was initiated and during the third National Conference on Dracunculiasis held in March, 1990, provisional results showed that there were over 640,000 cases. The 20th March being the national guineaworm day. By 1990, nylon filters were donated by Dupont and Precision Fabrics and Nigeria's allocation was 119,000sq yards, valued at over $700,000. By March, 1991 these filters were distributed. During the fourth National Conference provisional results of the third active case search in 1989/90 indicated 394,082 cases. Already the reduction of over 200,000 cases between 1989 - 1990 had restored 18.2 million person days to production, school attendance (Anon, 1991) Strategies incorporated in guineaworm eradication includes:

1. Surveillance: This is needed to properly plan and monitor the program as it is implemented (Hopkins, 1991). Nigeria has adopted an action plan that calls for monthly disease surveillance and reporting in all states of the federation (Kale, 1991). National case searches to determine the true extent of

guineaworm have produced surprises in Pakistan, Ghana, Cameroon and Nigeria. In Ghana and Nigeria improved surveillance is now documenting dramatic reduction in prevalence. Surveillance will become critical in certifying the elimination of guineaworm from Nigeria (Hopkins, 1991).

2. Health Education: It aims at encouraging the villagers to use guineaworm free drinking water by protecting their water source from contamination and by undertaking personal protection from infestion through boiling and filtering water before drinking (Kale, 1991). Health education lectures also focus on the mode of transmission of the disease and individuals with guineaworm ulcers should not immerse the ulcers in water bodies (Braide, 1991). NIGEP's health education strategies incorporate standard methods adopted to the guineaworm situation. These strategies include: (a) The mobilization of communities towards self help in the construction of sanitory wells;

(b) Filtration of drinking water with monofilamentous filters;

(c) Destruction of the intermediate host, the cyclops with the relatively safe organo-phosphorous chemical agent, temphos.

3) Chemical treatment of unsafe drinking water sources: Many compounds were found to be effective. Chlorinated hydrocarbons and some of the organophosphorous compounds were outstanding.

The timing of application must be carefully done taking into consideration local pattern of transmission. In an area with a short transmission period, two applications of a chemical with no residual action such as (bleaching powder) could be effective.

The first application is given four weeks, after the ponds refill, and the second four weeks later if necessary (Muller, 1971). This timing is based on the assumption that it will be at least 2 weeks after the ponds have refilled before there are enough cyclops present for transmission to occur, and the larvae take a minimum of 12-14 days to reach infective stage (Muller, 1970). In areas with long transmission period, a compound with residual action would be of great advantage particularly where there are numerous scattered water sources.

Biological methods of control have also been advocated, Moorthy and Sweet (1936a) found that the addition of small fishes (Gambusia and Barbus spp.) to step wells in two villages in India, after treatment with perchloron or copper sulphate, markedly reduced the infection rate in the villages the following year. Gideon (1942) recommended the addition of the fish (Rashbora donicomus) to the wells.

4. Provision and Maintenance of safe water supply: Provision of safe drinking water reduces the prevalence of the disease.

A notable example is the 50% reduction of cases in the known hyperendemic areas of Ondo state, the towns of Fiditi and Igbo Ora in Western Nigeria each with a population of 30,000. The prevalence was over 20% among secondary school children in Fiditi and over 60% in the general population of Igbo Ora prior to the completion of pipe water in 1963 and 1965. After the completion of pipe water, no cases were reported two years later in the area, although the disease remains endemic in surrounding areas

(Muller, 1971).

Borewells and tubewells can also provide a constant supply of pure water. When full and if used with an elevated tank, can provide the convenience of a piped water supply with taps (Muller, 1971).

Due to the construction of 2 wells in some villages in Togo by the community, guinea worm was reduced from 928 cases in 1981 to 7 cases in '1985 (Kodio, 1986). In villages of Akufo in Western Nigeria the annual incidence of guineaworm infection is nearly 26% even though a properly designed well was built a few years ago. Pond water is apparently still used because of the extra efforts involved in drawing well water (Ball & Gilles, 1964).

CHAPTER THREE

MATERIALS AND METHODS

Study Area:

Malumfashi Local Government Area in Katsina State belongs to the North-West Guineaworm zone. According to the 1991 census, the estimate of the population of the area was 312,940. Out of this, females were 157,497 and males were 155,443.

The 51 villages under this LGA have been categorised under three main groups based on population size as follows:

Small about 500 people

Medium about 500-3000 people

Large above 3000 people

(Statistical summary of Third National Case Search, 1989).

Four villages were selected using the stratified random sampling method. These villages are YanDoka, medium; Kalgo, large; Lamuntanni, small and Gangara, small.

The main occupation of the people is farming, but they also engage in animal rearing, trading, sewing and hunting. The types of animals common in the LGA include cattle, goats, donkeys, horses and guinea fowls. The main cash crop is cotton while food crops include groundnut, guineacorn and millet. The LGA has a health centre in Malumfashi town and two dispensaries at Dagi and Lamuntanni.

There are six wells in the four villages. A dam in Dayi used by inhabitants in Kalgo and Yan Doka, while those in Gangara use the

Gangara dam. There is also a pond at Lamuntanni utilised by the Lamuntanni villagers for domestic purposes and drinking, Furi, a part of Lamuntanni, use stream water for drinking and other domestic activities.

There are two distinct seasons. The dry season which starts from October to April and the wet season from May to September.

Sample Size:

Katsina State is among the hyperendemic guineaworm zones. The prevalence of guineaworm was 30% (Kankia, 1987). To be 95% sure that the prevalence of guineaworm in my study lies within 2% of the true prevalence, the sample size required would be as follows: $S.E^2 = \frac{P(100-P)}{n}$

$$S.E^2 n = P(100-P)$$

$$n = \frac{P(100-P)}{S.E^2}$$

IF P is 95% confidence of being within 2% of the true prevalence, $n = \frac{P(100-P)}{(2/1.96)^2}$

$$= \frac{1.0412}{2100}$$

$$= \frac{1.0412}{2016}$$

Data Collection:

For this survey, questionnaires were designed to cover information on the extent of spread of health education on guineaworm infection in these villages, the drinking water sources used by households type of water treatment practised, whether the households were given and are using monofilamentous filters and by whom. Their opinion on the acceptibility of the use of filters compared with other control measures were sought as well as their belief in the final control and eradication of guineaworm, family size, number infected per household, their age and sex, the number of worms that emerged and the location, extent of incapacitation if any and treatment sought. The period of incapacitation was based on the number of days an individual could not do his/her normal activity such as farming, house duties, regular market activities as a result of guineaworm infection. Disablement was considered as a condition where a person becomes deformed due to guineaworm.

With the help of local health officials, the questionnaires were distributed to all members of each household in the four villages. The health officials helped with interviewing the respondants in Hausa after which the questionnaires were

immediately collected to reduce the risk of losing them, and external influence in answering the questions

2701 questionnaires were completed in the four villages from October, 1992 to September, 1993. A case of dracunculiasis was defined as the emergence of one female worm as well as the typical guineaworm ulcers on any part of the body or the presence of pre-emergent adult worm palpated on the subject and reliable history of the clinical features of guineaworm by the patient or any grown up in the household if the patient was a minor.

Examination of Water sources used for drinking for the presence of cyclops.

Plankton net-ring with monofilamentous filter attached to the ring and 50ml bottle tied to its end was used for the collection of water sample. A sieve of 1000 mesh size per inch was placed at the circular opening to filter off large floating particles, allowing water with smaller suspended particles to pass through the monofilamentous filter into the bottle. For the open water bodies, a distance of about 1m vertically was estimated for the plankton net to be dragged as described in (WHO, 1963; APHA, 1980).

The net was washed with normal tap water after each drag. Freshly collected samples were labelled immediately and brought to the laboratory in the Department of Biological Sciences Ahmadu Bello University, Zaria, for bioassey. Copepod isolation was done by centrifuging the water sample at 1000rpm for 5 minutes. Supernatant was passed through the monofilamentous filter (about

100 mesh size per inch). capable of retaining all stages of the cyclop and its content was washed into petri dishes. The petri dishes were placed in a refrigerator overnight; removed the following morning and left for 15 minutes to assume room temperature. Cyclops were seen by active movement of larva inside their guts (Onabamiro, 1950). Isolated copepods were later preserved in 5% formalin and identified using a variety of keys (Harding and Smith, 1974; Dussart, 1974; Van de Velde, 1984; and Jeje, 1987). Slides were prepared using gylcerine as a mounting agent and stained with iodine dye

Criteria for Cyclops Identification:

Identification of the cyclops was based on anatomical details of the appendages. The body is clearly segmented, more or less elongated, cylindrical, and divided into head, thorax and abdomen. The metasome is much wider than urosome; basal segment of fifth legs without inner expansion; first antennae with 6-18 segments. The fifth legs and caudal rami are similar in both males and female cyclops. However the sixth legs are not present in females, but are present in the males. Both of the first antennae are geniculate in the male, neither in the female. Finally matured females often carry egg sacs.

Immature (copepodid) cyclopoids are difficult to identify, even to the genus level. In plankton population, however, they may often be identified by association with adults. In copepodid stages the last body segment is about twice as long as the preceding segments; in adults the last body segment is shorter

than the preceding segment.

Identification was based on the following:

(1) The number of segments in the first antenna,

(2) Inner margin of caudal ramus hairy, length of caudal ramus more than 5 times as wide; 2.5 to 5.0mm long.

(1) First antenna six-segmented; last segment of fifth leg with four or five setae and or spines, Halicyclops sp. (Fig. 1)

(2) Fifth leg with 2 setae inserted distally or subdistally on free segment, Thermocyclops sp. (Fig. 2)

(3) Thermocyclops sp. copepodid stage (Fig. 3)

(4) First antenna occasionally 9-segmented usually 11-segmented, or 10 segmented.

The fifth leg is rudimentary and not distinct from the body in the female in the form of a plate with three stout setae on the body at the base of the plate; about 0.7 to 1.3mm long.

Eucyclops sp. (Fig. 4)

(5) A female cyclops sp. (Fig. 5)

First antenna occasionally about 25-segments. The female often carry egg sacs if matured. The sixth leg is usually absent in the female cyclops (Harding et al, 1974; Dussart et al, 1985; Jeje, 1988).

Data Analysis:

The data from the questionnaire were coded and analysed by using percentage specific rates for the various factors. Chisquare was used to compare two or more different groups. While odds ratio was employed to determine the number of times a

factor was associated with the disease.

Analyses were done with a computer, using the (spss) statistical package for social sciences

CHAPTER FOUR

4.0 RESULTS:

The overall prevalence for guineaworm in the four villages of Malumfashi Local Government Area was 24.6% (665) of 2701 in the study population (Table 1).

YanDoka had the highest prevalence of 33.6%, followed by Kalgo 30.1%, Lamuntanni 23.6% and Gangaza had the lowest 4.5%. The prevalence of guineaworm by hamlets showed that Gidan Tanbaya in Kalgo about 100 meters from Dagi Dam had the highest, 52.2% while Gatari had the lowest .9%. Comparatively the hamlets in Gangaza had low prevalence of 3.4% to 4.8% (Table 1). All the 2701 inhabitants of the four villages interviewed had been living in Malumfashi Local Government Area for at least two years at the time of the survey.

The distribution of guineaworm infection by sex of those examined revealed that, of 1324 males 28.8% (382) were infected and 20.5% (283) of the 1377 females examined had the disease. An odds ratio of 1.6 for males indicate that males were 1.6 times more likely to be infected by guineaworm disease than females (Table 2).

The pattern of infection by age of inhabitants as shown in (Table 3) indicates that the 0-10 age group had the highest rate of infection (45.5%) followed by the 11-20 age group (34.3%); the 21-30 age group had 32.2% and the lowest percentage infection was in the 71-80 age group. The difference between infection in the various age groups was statistically significant at ($P<.05$).

When compared to all ages combined, the 0 - 10, 11 - 20, and 21 - 30 age groups were 2.6, 1.6, and 1.5 times more likely to be infected (Table 3). The distribution of dracunculiasis according to marital status as shown in Table 4, revealed a (29.5%) infection among single subjects and 21.4% among married couple. The single subjects were 1.5 times more likely to be infected by guineaworm disease than married couples.

Based on occupation, pupils were most affected, with infection rate of 32.3% jobless subjects with 28.8%; farmers, with 23.6%; housewives with 21.7%; traders with 18.8%; livestock farmers with 13.6% while none of the tailors were infected. There was a statistically significant difference in the frequency of the disease between the various occupation groups (Table 5).

Dayi dam water served as the most important source for dracunculiasis infection with a 28.6% of 1814 people using it being infected. The pond at Lamuntanni was next with 26.6%. Gangara dam with 6-3% and the stream water produced 3.1% infection. Dayi dam users were 2.1 times more likely to become affected than all water sources combined (Table 6).

On the site of emergence of the worms, 81.8% (544) of 665 affected persons had worms emerging from the lower limbs. Only 6.4% had worms emerged from the abdomen. 1.8% from their genital organ, 0.9% from chest/breast while 2.7% from more than one part of the body (Table 7 and 9). 81.7% (210) of the 257 persons incapacitated for 1-3 weeks had worms emerging from the lower limbs (Table 7). It was observed that the 0-10 age group

had the highest frequency of incapacitation, for 1-3 weeks followed by the 11-20 age group, and 21-30 age group. In the 4-6 weeks of incapacitation category, the 21-30 age group were most affected. Chi-square analysis showed a significant difference in period of incapacitation among the different age groups ($P<0.05$). Results of the survey revealed that 91.1% of guineaworm cases occurred during the rainy season (between May and September), while 8.1% of cases were during the dry season (October to April), (Table 10). The season specific rates were 2.2% for dry season and 22.4% of wet season (Table 10). An analysis of the impact of guineaworm infection on the villagers revealed that 31.7% of the 665 infected persons said that the infection did not interfere with their normal day to day activities; 31.4% could not continue with their farm activities, 14.3% could not move around, 3.0% were absent from School during the course of infection, 19.7% could not do their home duties (Table 11).

About 59.3% of the 216 households (i.e 128) had at least one case of guineaworm. YanDoka had the highest household specific rate of 86.9%, Kalgo 81.1%, Lamuntanni 70.5% and Gangara 24.3% (Table 12). Association of the various water sources used in the four villages with guineaworm infection showed that 28.6% (519) of the 1813 individuals who used the Dagi dam had infection. There was statistically significant diffrence in the rate of infection between the users and non-users of the Dayi dam at ($P< 0.05$).

About 6.1% of Gangara dam users had dracunculiasis, 26.3% of Lamuntanni pond users and 3.1% of those who use stream water at Lamuntanni had infection. Among the four main water sources used in drinking, i.e Dayi dam, pond at lamuntanni, stream, at Fari, Lamuntanni and Gangara dam, Dayi dam had the hightest population of cyclops. Three genera of cyclops were isolated, Thermocyclops sp, Eucyclops sp, and Halicyclop sp. Among these only the Thermocyclops sp and Eucyclops sp were infected by the larvae of guineaworm. Only two genera namely the Thermocyclops sp and and Eucyclop sp were seen in the pond water source. Infected ones were of the genus Thermocyclops sp.

No cyclops was isolated from the Gangara dam and the streem water source (Table 136).

Lectures on the control of guineaworm by filtering and boiling water as well as preventing infected persons from contaminating drinking water sources were given by the public health workers and health officials in each district. The results of this field survey revealed that 46.2% of the 216 households interviewed confirmed that the health education officers demonstrated the use of filters in guineaworm control. 30% reported the message was heard from the radio and 23.8% had no idea of health education for control of guineaworm. Using the chi-squared test at ($P< 0.05$) there was a significant difference in infection rate between those who heard the health education lectures and those who did not. 91.6% of households were aware of contacting guineaworm disease from contaminated drinking

water, 5.7% were not aware and 2.7% gave no response (Table 14).

The household response on water treatment practice was based on those who heard health lectures and those who did not. Seven out of the 116 household who did not attend the lectures but heard health education programme over the radio, boil and filter their drinking water. 58 of the 104 households who filter their drinking water heard talk by the public health officials, 42 of the 105 households heard talk and did nothing about it (Table 15).

Analysis of the type of filters used in the households showed that 55 out of 216 households used monofilamentous filters, while 56 used any cloth and 105 did not filter water. About 89.2% of households who use any cloth in filtering water still suffered from dracunculiasis, 54.5% who use monofilamentous filters had the disease and 92.4% who did not filter had guineaworm. An analysis of responses between filter types used showed that monofilamentous filters could reduce the prevalence of the disease. People who used cloth to filter water were 1.8 times more likely to be infected by guineaworm disease than those who use monofilamentous filter. However, the results showed an odds ratio of 2.7 for those who did not filter water.
Household response on how frequent the monofilamentous filters were used showed that 28 households used their filters always; 83 did so sometimes, and 105 had never used monofilamen- tous filters. Out of the 28 households who use the monofilamentous filters always, only 8 households had at least one case of

ginueaworm disease i.e 28.60%)

About 83 households used the filters sometimes, there was 86% infection among those who never used the monofilanentous filters, only 48 households had at least one case each, there was 45.7% infection. (Table 17).

CHAPTER FIVE

DISCUSSION

The results from the four villages sampled revealed an overall prevalence of 24.6%. It has been reported that the disease is hyperendemic in neighbouring States of the North-West Guineaworm Zone (Ramsay, 1965; Thompson, 1956; Beko, 1986 and Suleman, 1990). Among the four villages, YanDoka had the highest infection rate, while Gangara recorded the lowest. This may be attributed to the high cyclop content in the Dayi dam. Three different genus of cyclops: Thermocyclops sp, Eucyclops sp and Halicyclops sp were identified in Dayi dam. Of the three only the Genus Thermocyclops and Eucylops were found infected with larvae of guineaworm. No cyclops was found in Gangara dam. The Dayi dam used by the inhabitants of YanDoka for drinking was also polluted by animal faeces. The livestock in this village drink water and defaecate in this dam giving rise to growth and maturation of cyclops. Braide et al (1988) noted that the Thermocyclops sp. was a natural intermediate host for guineaworm larvae. It was reported that high organic content in water favours the growth of cyclops as well as high temperatures of 20-30°C and a pH of between 6 and 6.8 (Onabamiro, 1952; Muller, 1971).

Varying pattern of infection between sex has been reported in other coutries. In Ghana, more females were infected than males (Muller, 1979). This study revealed a higher infection rate among males than females. Similar pattern had also reported

by Ilegbodu et al.1987; and Ngwu and Nwuorgu, 1990. It was suggested that in most communities women aged 20-40 years may be involved in activities which bring them in constant contact with water. Most males were farmers and livestock owners. Such an occupation has close link with water sources. During the hot season the high thirst for water makes them drink water from the dam etc without filtering and this result in high infection rate among males. In addition males have greater freedom of movement than females and hence have higher risk of exposures than famales.

The pattern of age distribution of cases in this study differs from that of earlier workers. Ilegbodu et al (1987) noted highest infection in the 20-29 years age group for males and 30-39 for females. The age structure of the population surveyed is an important factor. In the four villages many of the inhabitants (35.3%) were children. Children do not abide by health education lectures, and were always found around water sources.

There was 29.5% infection rate among single subjects and 21.4% among married persons. The infection rate was higher in single subject and could be age related since the single subjects were below 20 years of age. They tend to play around water sources used in the villages and may not abide by health education lectures as compared to adults.

Occupation related infection rate decreased, in the following order: pupils, the jobless, farmers, housewives,

traders, livestock farmers, and tailors. The frequency of infection has been shown to be highest among farmers, students, traders (Kale, 1985; Onwuliri, et al, 1990; Adeiyongo, et al 1990). Kale and Edungbola (1985) attributed high infections among farmers to be due to out door activities. However, any high frequency noted was due to increased exposure to infected water. The high infection rate among house wives in this study could be as a result of negligence in the use of monofilamentous filters at home, or lack of the filters, and not boiling drinking water.

The distribution of infection according to water source used by the people of the study area for drinking showed that the Dayi dam was responsible for the highest frequency of infection as compared to stream, pond and Gangara dam. The risk due to water source decreased in the following order Dayi dam, pond at Lamuntanni, Gangara dam and stream water. Dayi dam had the highest population of cyclops.

The genus Thermocyclops was common in both Dayi dam and the pond at Lamuntanni. The pond water source had next highest cyclops content. The stream at Fari and Gangara dam did not habour any cyclops. Among the cyclop species recovered only the genus Thermocyclops and Eucyclops were infected with larvae hence were probably for guineaworm disease in the study area.
The pattern of emergence of worms mostly from the lower limbs was similar to the obsavation by Muller, 1971; Onwuliri, et al 1990 and Kale 1977. They associated this feature with a

geotactic response that ensures the survival and perpetuation of Dracunculus medinensis. Feet and ankles are most intimately and constantly in contact with pond and dam water, This ensures that embryos are expelled into the water habitat of the next host - the cyclops. However, no part of the body is spared (Kale, 1977). The site of emergence in relation to period of incapacitation showed a high frequency for the 1-3 weeks, 4-6 weeks, 7 weeks and above corresponding to infection on the lower limbs. Location of the lesion is one of the factors which affect the degree of disability. Lesions located on the ankles and soles of the feet, between toes as well as the knee result in locomotor disability. Lesions on the hands and near the elbows similarly incapacitates the patient with regards to the use of his hands.

More cases of guinea worm disease occurred during the rainy season than the dry season in the area. Data on total monthly cases for Katsina State for 1992, depicted highest percentage infection in June, through July to September.
For the whole nation (country) high percentages were between April to July - (Fifth National Case Search, 1991-92).

Braide et al. (1988) noted seasonal pattern in Bauchi State, similar to the one in this study. Ramsay (1935) and Muller (1971) reported that in the sahel savanna areas of Africa where rainfall is less than 75cm per year, guineaworm infection is confined to the rainy season. It is expected that transmission in Yan Doka, Kalgo and Lamuntanni should occur

throughout the year since their main water source, the Dayi dam and Gangara dam do not dry up during the dry season. The pattern observed could be due to high temperatures during the months of April to October, i.e. the rainy season. This favours the development of larvae in cyclops which shall produce infection same period the following year.

On the impact of the disease on the villagers, 31.7% of the infected persons were not prevented from their normal duties. However 31.4% were prevented from farm activities. Many villagers had been suffering from this disease since their youth and have now learnt to live with it. While those incapacitated had to hire non-family labour, when family labour supply becomes constrain by guineaworm. Nwosu (1988) reported that over 73% of labour employed on the family farm is supplied by the family; the great dependence on family labour therefore underscores the problem posed by the guineaworm. Edungbola (1983) noted a low academic performance among school children and absenteeism. In endemic areas, the disease has been incriminated for deformity of the limbs and frustration (Onabamiro, 1953). Brieger (198) reported the lack of ability of women to carry out home duties due to dracunculiasis.

About 91.6 of the households interviewed were fully aware that guineaworm is contacted by drinking water from contaminated sources. This reflects the degree of public awareness. Among the water sources used for drinking in the four villages, the Dayi dam, pond at Lamuntanni showed a positive association with

guineaworm infection. It has been noted that dracunculiasis occurred in rural communities that depend for their drinking water on surface water especially ponds, waterholes, shallow unprotected wells and that of the species of cyclops recovered only those which could live in water with a pH of bewteen 6 and 8 play an important role in the transmission (Onabamiro, 1951, 1952). Dracunculus larvae discharged into moving water such as stream were doomed as the chances of their being swallowed by cyclops before they were swept away by the water current were almost non existent. The Gangara dam did not show any association with infection. Infected persons in Gangara village might have travelled to neighbouring villages some time in the course of the year. Three genera of cyclops were isolated from the Dayi dam, while two genera were isolated from the pond at lamuntanni. The streem at Fari (Lamuntanni) and the dam at Gangara didnot habour any cyclops. The report from the main health centre in Malumfashi Local Government Area indicated that the water sources had never been chemically treated. Replacement of filters was to be done once a month but this was not the case.The eradication of guineaworm cannot be achieved because those who donot use filters will suffer from this desease year after year. It was noted that health education lectures were confined only to endemic villages due to limited resources and finance. Gangara village where infection rate was low was not given health education lectures. Among the villages that heard health talk that is Yan Doka,Kalgo, Lamuntanni, none of the households filtered and boiled their

water before drinking. But seven households in Gangara did so. This shows great negligence on the side of the villagers. In both groups (those who heard the talk and those who did not), the prevalence of the disease was highest amongst members who neither filtered nor boiled their drinking water.

Of the various types of filters used, the monofilamentous filter served best in the control of dracunculiasis. The provision of nylon monofilamentous filters from Depot in 1991 resulted in 24.2% reduction of the cases in 1992, (Anon, 1989) From this study, the use of monofilamentous filters was seen to reduce the prevalance of guineaworm in households who used them, when compared to those who did not. Generally filters are to be used constantly if guineaworm disease is to be controlled.

CONCLUSIONS AND RECOMMENDATIONS:

Guineaworm is a major public health problem in the study area. The Dayi dam water, and pond at Lamuntanni had high cyclop population and were probably the major foci of infection for people who drink unfiltered and unboiled water.

Those who lack filters and those who do not want to use filters are at great risk of suffering from guineaworm disease, if they continue to use the Dayi dam and pond water sources for drinking. Malumfashi Local Government Area, carried out health education lectures, filter distribution and replacement as well as training of new trainees in eradiction of guineaworm. The total number of cases increased in the local government area from

1137 in 1988 to 5988 in 1989, 2448 in 1990, to 1683 in 1991 and 2904 in 1992. Such undulating results show that the disease is still a threat in this community. To successfully eradicate guinuea worm the health education lectures should shift from changing the villagers knowledge, attitude, and beliefs to one of securing political will, community commitment and participation.

The persistence of guineaworm disease in Malumfashi Local Government Area from this study was actually due to irregular distribution of the monofilamentous filters to households, shortage of resources such as temphos for water treatment, lack of filters and lack of incentive for the health officials to actively continue their expected functions. Furthermore, there was complete negligence on the part of the villagers to adhere to health education talks in the villages. Less than 50% of households at the time of survey were using their filters and they were not doing so always. Despite all efforts in preventing the disease, the villagers still consume contaminated unfiltered water.

The following recommendations are suggested based on the findings of this study:

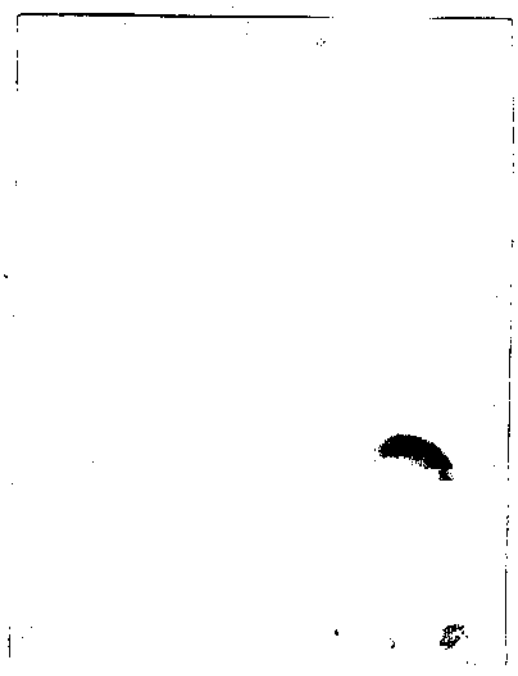
1) Health education lectures should center on the growing population. Villagers should be trained on health education to encourage community participation team. Schools should educate children on transmission of guineaworm disease. The villagers should be reminded from time to time.

2) In such communities where water treatment has not been done, the health officials should ensure the distribution and replacement of monofilamentous filters to all households in the villages.

3) Since 91.9% of cases occurred during the rainy season in this area, filter distribution and replacement as well as water treatment must cover this period, in order to prevent transmission.

4) The results on the use of filters revealed negligenece on the part of villagers. It is recommended that they should use their filters everyt[illegible] they have to drink water.

5) The Dayi dam served a great risk source of guinea worm disease, while the Gang[illegible] dam did not. Further studies should be done, to know why the Gand[illegible]a dam did not harbour cyclops as compared with the Dayi dam. Dayi dam should be treated to control cyclops.



Halicyclops sp (x10)

Thermocyclops sp. (x10)



Eucyclops sp. (x 10)

TABLE 1

DISTRIBUTION OF GUINEA WORM CASES ACCORDING TO VILLAGES/HAMLETS

VILLAGE	HAMLET	ESTIMATED POPULATION	NUMBER INFECTED	% INFECTION
YAN[illegible]KA	GIDAN ADAMU	308	112	36.4
	GIDAN BODO	510	163	32.0
TOTAL		818	275	33.6
KALGO	HAWAN SULE	175	70	40.0
	GIDAN SARIKI	69	21	30.4
	GIDAN BAWA	151	59	39.1
	GIDAN TAMBAYA	46	24	52.2
	GIDAN DAGI	273	74	27.1
	GIDAN GATARI	113	1	0.9
TOTAL		827	249	30.1
LAMUNTANI	GIDAN DANSHAYI	39	9	23.1
	GIDAN NAJUMI	54	15	27.8
	GIDAN [illegible]OKOKI	174	42	24.1
	GIDAN FARI	224	50	22.0
TOTAL		494	116	23.5
GANGARA	SABON GARI	176	6	3.4
	CIKIN GARI	386	19	4.7
TOTAL		562	25	4.5
OVER-ALL TOTAL		**2701**	**665**	**24.6**

TABLE 2

DISTRIBUTION OF GUINEA WORM CASES IN FOUR VILLAGES IN MALUMFASHI LGA ACCORDING TO SEX

SEX	NUMBER EXAMINED	NUMBER INFECTED	SEX SPECIFIC RATES (%)	ODDS RATIO
MALES	1324	382	28.8%	1.6
FEMALES	1377	283	20.5%	1.0
TOTAL	**2701**	**665**	**24.6%**	

TABLE 3

DISTRIBUTION OF DRACUNCULIASIS IN MALUMFASHI LOCAL GOVERNMENT AREA (1992/93) ACCORDISNG TO AGE GROUP.

AGE GROUP IN YEARS	NUMBER EXAMINED	NUMBER INFECTED	AGE SPECIFIC RATES (%)	ODDS RATIO
0-10	450	205	45.5	2.6
11-20	513	176	34.3	1.6
21-30	410	132	32.3	1.5
31-40	341	72	21.1	0.8
41-50	230	41	17.8	0.9
51-60	160	21	13.1	0.6
61-70	414	12	2.9	0.1
71-80	150	3	2	0.1
81-90	33	3	9.1	0.4
	2701	665		

TABLE 4

DISTRIBUTION OF GUINEAWORM CASES ACCORDING TO MARITAL STATUS IN FOUR VILLAGES IN MALUMFASHI LOCAL GOVERNMENT AREA, 1992-1993

MARITAL STATUS	NUMBER EXAMINED	GUINEAWORM PRESENT	DISEASE ABSENT	MARITAL STATUS SPECIFIC RATE (%)	ODDS RATIO
SINGLE	1063	314	749	29.5	1.5
MARRIED	1638	51	1287	21.4	1.0
TOTAL	**2701**	**665**	**2036**	**24.6**	

TABLE 6

DISTRIBUTION OF GUINEAWORM CASES IN THE FOUR VILLAGES ACCORDING TO WATER SOURCE USED FOR DRINKING.

WATER SOURCE	NUMBER OF USERS	NUMBER INFECTED	WATER SOURCE SPECIFIC RATE (%)	NUMBER NOT INFECTED	ODDS RATIO
WELL	-		-	-	
BOREHOLE	-		-	-	
PONDS (Lamu[illegible]ni)	460	121	26.3	339	1.1
STREAM	32	1	3.1	31	0.1
PIPE BORNE	-		-	-	
DAYI DAM	1813	519	28.6	1294	2.1
GANGARA D[illegible]	396	24	6.1	372	0.2
	2701	665	24.6	2036	1.0

TABLE 7

DISTRIBUTION OF GUINEAWORM CASES IN MALUMFASHI LOCAL GOVERNMENT AREA ACCORDING TO THE SITE OF EMERGING WORM AND THE PERIOD OF INCAPACITATION. 1992-1993.

SITE OF EMERGENCE	PERIOD OF INCAPACITATI 1 - 3 WEEKS	4 - 6 WEEKS	7 & Above WEEKS	CANNOT RECALL	NO INCAPACI-TATION	SITE PROPORTIONAL RATE (%)	TOTA
UPPER LIMBS ONLY	23	5	1	1	6	5 8	37
LOWER LIMBS ONLY	210	119	18	21	176	81.8	544
GENITAL ORGAN ONLY	5	2	0	1	4	1 8	12
STOMACH ONLY	1	1	0	0	3	0 8	5
CHEST/BREAST	2	1	0	2	1	0 9	6
UPPER/LOWER LIMBS	14	8	3	3	15	6 4	43
MULTIPLE SITES	2	4	1	5	6	2 7	18
	257	**141**	**23**	**33**	**211**	**0**	**66.5**
Weeks Specific rates (%)	**38.6**	**21.2**	**3.5**	**5**	**31.7**	**0**	**100**

TABLE 8

DISTRIBUTION OF GUINEAWORM CASES IN MALUMFASHI LOCAL GOVERNMENT AREA ACCORDING TO AGE GROUP AND PERIOD OF INCAPACITATION.
1992 - 1993

AGE GROUP	PERIOD OF INCAPACITATION 1 - 3 WEEKS	4 - 6 WEEKS	7 & Above WEEKS	CANNOT RECALL	NO INCAPACITATION	TOTAL
0 - 10	92	35	5	4	69	205
11-20	74	28	8	8	58	176
21-30	50	39	6	8	29	132
31-40	18	19	2	6	27	72
41-50	13	9	1	3	15	41
51-60	4	6	0	3	8	21
61-70	4	4	1	1	2	12
71-80	1	0	0	0	2	3
81-90	1	1	0	0	1	3
TOTAL	257	141	23	33	211	665

TABLE 5

DISTRIBUTION OF CASES IN THE FOUR VILLAGES OF MAKUMI ASHI LOCAL GOVERNMENT AREA (1992-1993), ACCORDING TO THE VARIOUS AGE GROUPS AND SITE OF EMERGENCE OF THE GUINEAWORM.

AGE (YEARS)	UPPER LIMBS	LOWER LIMBS	GENITAL ORGAN	STOMACH	CHEST & BREAST	UPPER/ LOWER LIMBS	ALL OVER THE BODY	TOTAL
1 - 10	12	171	5	1	1	11	4	205
11-20	14	146	2	1	0	9	4	176
21-30	3	108	1	1	2	10	7	132
31-40	3	57	2	1	2	5	2	72
41-50	3	34	0	1	0	3	0	41
51-60	1	14	2	0	0	3	0	21
61-70	1	8	0	0	1	2	1	12
71-80	0	3	0	0	0	0	0	3
81-90	0	3	0	0	0	0	0	3
TOTAL	37	541	12	5	6	43	18	665

TABLE 4

DISTRIBUTION OF CASES IN THE FOUR VILLAGES OF MALUMFASHI LOCAL GOVERNMENT AREA (1992-1993), ACCORDING TO THE VARIOUS AGE GROUPS AND SITE OF EMERGENCE OF THE GUINEAWORM.

AGE (YEARS)	UPPER LIMBS	LOWER LIMBS	GENITAL ORGAN	STOMACH	CHEST & BREAST	UPPER/ LOWER LIMBS	ALL OVER THE BODY	TOTAL
1 - 10	12	171	5	1	1	11	4	205
11-20	14	146	2	1	0	9	4	176
21-30	3	108	1	1	2	10	7	132
31-40	3	57	2	1	2	5	2	72
41-50	3	34	0	1	0	3	0	41
51-60	1	14	2	0	0	3	0	21
61-70	1	8	0	0	1	2	1	12
71-80	0	3	0	0	0	0	0	3
81-90	0	3	0	0	0	0	0	3
TOTAL	37	544	12	6	6	43	18	665

TABLE 10

DISTRIBUTION OF GUINEAWORM CASES ACCORDING TO THE SEASONS OF THE YEAR 1992 - 1993.

SEASON	INFECTION	TOTAL POPULATION	SEASON SPECIFIC RATE (%)
DRY SEASON	59 (8.9%)	2701	2.2
RAINY SEASON	606 (91.1%)	2701	22.4
TOTAL	**665**	**2701**	**24.6**

TABLE 11

DISTRIBUTION OF GUINEAWORM CASES IN MALUMFASHI LOCAL GOVERNMENT AREA AND THE IMPACT OF THE DISEASE ON THE VILLAGERS.

IMPACT	NUMBER INFECTED	IMPACT SPECIFIC RATES (%)
NO FARMING	208	31.4
ABSENT FROM SCHOOL	20	3.0
CANNOT MOVE FREELY	95	14.3
OTHERS (HOME DUTIES)	131	19.7
NOT APPLICABLE/ NO INCAPACITATION	211	31.7
TOTAL	665	

TABLE 12

THE DISTRIBUTION OF GUINEAWORM CASES ACCORDING TO HOUSEHOLDS IN MALUMFASHI LOCAL GOVERNMENT AREA 1992-1993.

VILLAGES	TOTAL HOUSEHOLDS IN EACH VILLAGE	NUMBER OF HOUSE-HOLDS INFECTED	HOUSEHOLD SPECIFIC RATES (%)
YAN DOKA	23	20	86.9
KALGO	58	47	81.1
LAMUNTANNI	61	43	70.5
GANGARA	74	18	24.3
	216	**128**	**59.3**

TABLE 13

ASSOCIATION OF WATER SOURCES USED BY THE FOUR VILLAGES WITH GUINEAWORM INFECTION IN MALUMFASHI LOCAL GOVERNMENT AREA (1992-1993).

YANDOKA/KALGO DAYI DAM USERS	GUINEAWORM INFECTION PRESENT	ABSENT	TOTAL	ODDS RATIO
YES	519	1294	1813	2.1
NO	146	742	888	1.0
TOTAL	665	2036	2701	
GANGARA DAM USERS				
YES	24	372	396	0.2
NO	641	1664	2305	1.0
TOTAL	665	2036	2701	
LAMUTANI/FARI STREAM USERS				
YES	1	31	32	0.1
NO	664	2005	2669	1.0
TOTAL	665	2036	2701	
LAMUTANI POND USERS				
YES	121	339	460	1.1
NO	544	1697	2241	1.0
TOTAL	665	2036	2701	

TABLE 13B

CYCLOPOID COPEPEPODS COLLECTED FROM WATER SOURCES
IN THE FOUR VILLAGES OF MALUMFASHI LOCAL GOVERNMENT AREA
1992-1993.

WATER SOURCES	AVERAGE TEMPERATURE AND PH	SUB-FAMILY	GENUS	CYCLOPS INFECTED YES OR NO
DAYI DAM	28oC 6.5	CYCLOPINAE EUCYCLOPINAE HALICYCLOPINAE	THERMOCYCLOPS [A FIG. 3] EUCYCLOPS [B FIG. 4] HALICYCLOPS [C FIG. 1]	YES YES NO
POND AT LAMUNTANNI	27oC 5.8	CYCLOPINAE EUCYCLOPINAE	THERMOCYCLOPS [FIG. 3] EUCYCLOPS [FIG. 4]	YES NO
STREAM AT FARI LAMUNTANNI	27oC 4.6	-	-	-
GANGARA DAM	28oC 5.3	-	-	-

TABLE 14B

HEALTH EDUCATION AND THE USE OF WATER IN 216 HOUSEHOLDS IN MALUMFASHI LOCAL GOVERNMENT AREA 1992 - 1993.
1992 - 1993

VILLAGES	TOTAL NUMBER OF HOUSEHOLDS	FROM CONTAMINATED DRINKING WATER SOURCES		NO RESPONSE
		YES (%)	NO	
YAN DOKA	23	22(95.7)	0	1
KALGO	58	55(94.8)	2	1
LAMUNTANNI	61	58(95.1)	3	0
GANGARA	74	63(85.1)	11	0
	216	**198 (91.6%)**	**16(5.7%)**	**2**

TABLE 16

HEALTH EDUCATION TALKS ON DRACUNCULIASIS AND THE HOUSEHOLD RESPONSE REGARDING THE WATER TREATMENT PRACTICE.

	WATER TREATMENT PRACTICE IN HOUSEHOLD			
	BOILD AND FILTER WATER	**FILTER WATER ONLY**	**DO NOTHING**	**TOTAL**
HEARD HEALTH EDUCATION TALK	**0**	58	**42**	100
DID NOT HEAR HEALTH EDUCATION TALK	**7**	46	**63**	116
	7	**104**	**105**	**216**

TABLE 18

EFFECT OF THE TYPE OF FILTER USED IN THE HOUSEHOLD AND GUINEAWORM DISEASE IN MAKURDI/MFASHI L.G.A. 1992-1993.

TYPE OF FILTER	GUINEAWORM DISEASE PRESENT	ABSENT	TOTAL HOUSEHOLD	ODDS RATIO
USE CLOTH	**50**	**6**	**56**	1.84
NO FILTER	**97**	**8**	**105**	2.67
MONOFILAMENTOUS FILTER	**30**	25	**55**	0.26
	177	**39**	**216**	

TABLE 17

EFFECT OF THE FREQUENCY OF USE OF MONOFILAMENTOUS FILTER IN THE HOUSEHOLD IN RELATION TO GUINEAWORM DISEASE IN THE FOUR VILLAGES OF MALUMFASHI L. G. A.

		GUINEAWORM DISEASE		
FREQUENCY	HOUSEHOLD	PRESENT	ABSENT	% INFECTION
ALWAYS	28	8	20	28.5
SOMETIMES	83	57	26	68
NEVER	105	48	57	45.79
	216	**113**	**103**	**52.3**

TABLE 18

YEARLY DISTRIBUTION OF GUINEAWORM CASES ACCORDING TO STATES AND BASED ON ENDEMICITY.

STATES	CASES 1987-1988	STATES	CASES 1988-1989	STATES	CASES 1989-1990	STATES	CASES 1990-1991	STATES	CASES 1991-1992	STATES	CASES 1992-1993
ONDO	197391	ANAMBRA	233278	ANAMBRA	93370	SOKOTO	52324	ONDO	73319	ONDO	11429
ANAMBRA	175432	ONDO	148730	ONDO	78456	ENUGU	51954	SOKOTO	28789	ENUGU	113229
IMO	53688	SOKOTO	57953	SOKOTO	69648	ONDO	40422	KATSINA	19259	SOKOTO	10309
KWARA	50306	BENUE	41337	BENUE	43118	BENUE	30121	ENUGU	16701	KATSINA	7820
BENUE	38317	IMO	31726	KATSINA	20757	ABIA	14774	KEBBI	11910	BENUE	7100
SOKOTO	33366	BAUCHI	27131	BAUCHI	17529	NIGER	14759	BENUE	11093	BAUCHI	4598
NIGER	16812	KATSINA	24716	IMO	16598	KATSINA	12641	KANO	9017	ABIA	3140
OYO	16578	NIGER	18050	KWARA	12133	BAUCHI	9664	ABIA	6446	JIGAWA	3105
BAUCHI	13197	KWARA	15798	NIGER	11846	BEKKI	6689	BAUCHI	6068	KANO	3049
KANO	12987	OYO	14169	OYO	10272	PLATEAU	6250	NIGER	4362	KEBBI	3026
KATSINA	12018	BORNO	9374	CROSS RIVER	7263	KANO	4965	OYO	4252	NIGER	2984
PLATEAU	11813	CROSS RIVER	6700	BORNO	5319	KWARA	4789	KWARA	2164	OYO	2231
CROSS RIVER	10959	KANO	5630	PLATEAU	4227	OYO	3883	CROSS RIVER	2061	CROSS RIVER	2043
BORNO	5246	PLATEAU	5627	GONGOLA	941	JIGAWA	3625	PLATEAU	1966	BORNO	1016
OGUN	2993	OGUN	1238	OGUN	886	CROSS RIVER	3444	BORNO	1685	TARABA	442
ABUJA	1405	ABUJA	779	BENUE	745	YOBE	2254	YOBE	1126	KWARA	352
GONGOLA	319	BENDLE	572	ABUJA	735	BORNO	1984	OGUN	781	YOBE	256
BENDLE	218	KADUNA	352	RIVERS	440	OGUN	1441	TARABA	373	OGUN	223
RIVERS	295	GONGOLA	269	KADUNA	15	KOGI	1139	DELTA	354	ADAMAWA	104
KADUNA	211	LAGOS	35	LAGOS	2	OSUN	974	EDO	345	EDO	74
LAGOS	41	AKWA-IBOM	0	AKWA-IBOM	0	DELTA	849	OSUN	276	RIVERS	36
AKWA-IBOM	6	RIVERS	NA	KANO	NA	EDO	786	ADAMAWA	244	DELTA	35
						ADAMAWA	347	RIVERS	99	LAGOS	35
TOTAL	653626	1.6% REDUCTION	643464	38.8%	394082	RIVERS	112	FCT	63	KOGI	12
						LAGOS	84	LAGOS	34	FCT	12
						FCT	76	IMO	18	IMO	8
						TARABA	39	KOGI	12	OSUN	2
						IMO	16	AKWA-IBOM	0	AKWA-IBOM	0
						AKWA-IBOM	0	ANAMBRA	0	KADUNA	0
						ANAMBRA	0	KADUNA	0	ANAMBRA	0
						KADUNA	0	JIGAWA	NA		
						31.4%	270404	24.9%	202917	63%	75752

NA = NOT AVAILABLE

OVERALL 68% REDUCTION FROM1987 TO 1993

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QUESTIONNAIRE CODING GUIDE

A total of 2701 Questionnaire were filled, and numbered serially as 0001 - 2701 written on column 1 - 4

	Question	Code	Column
1.	Village: YANDOKA	1	
	Kalgo	2	Column
	Lamuntanni	3	5
	Gangare	4	
2.	Has lived in this area for the past two years?		
	No	1	
	Yes	2	6
3.	Sex Male	1	
	Female	2	7
4.	Age groups:		
	1 - 10	1	
	11 - 20	2	
	21 - 30	3	
	31 - 40	4	
	41 - 50	5	
	51 - 60	6	8
	61 - 70	7	
	71 - 80	8	
	81 - 90	9	
5.	Marital Status:		
	Married	1	
	Single	2	9
	Divorced	3	

	Question	Code	Column
6.	Occupation: Farming	1	
	Cattle rearing	2	
	Schooling	3	10
	Housewife	4	
	Trader	5	
	Sewing	6	
7.	Did you have guineworm infection this year 1992?		
	Yes	1	11
	No	2	
8.	Where is the drinking water obtained?		
	Well	1	
	Borehole	2	
	Lamuntanni Pond	3	
	Lamuntanni Stream	4	12
	Borne	5	
	Dayi Dam	6	
	Others	7	
	The Gangara Dam	8	
9.	If diseased site of emerging worm?		
	Upper limbs	1	
	Lower limbs	2	
	Genital organ	3	
	Stomach	4	13
	Chest/breast	5	
	Upper/Lower limbs	6	
	All over	7	

Question	Code	Column
10. Number of worms:	1	
	2	14
	3	
	4	
	5	
11. Any incapacitation disablement from infection:		
Yes	1	
No	2	
12. For how long:		
1 - 3 weeks	1	
4 - 6	2	
7 - 9	3	16
Don't know	4	
13. Impact of incapacitation		
None		
No farming	1	
Absent from School	2	
Couldn't move around	3	
Due to the pain	4	17
14. What did you do to cure the infection:		
Nothing	1	
Have reported to health Centre	2	18
Native treatment	3	
15. If Native treatment, What type?		19

	Question	Code	Column
16.	During which Months/Season of the year		
	Dry season	1	
	Raining season	2	20
	Both	3	
17.	Can guineaworm be acquired from the water you drink?		
	Yes	1	21
	No	2	
18.	How can Dracunculiasis be controlled?		
	Do not know	1	
	Filtering water	2	
(temphos)	Use of chemicals	3	22
(Boreholes)	Provision of good	4	
(Pipe borne water)	drinking water		
19.	What do you practice in your home?		
	Boil and filter water	1	
	Pilter only	2	23
	Nothing	3	
20.	If filtering what type of filter do you use?		
	Monofilamentous	1	
	Any cloth	2	
	Nothing	3	24

	Question	Code	Column
21.	Have you being lectured guineaworm disease and its controls?		
	Yes	1	
	No	2	25
22.	If you were shown how to use and maintain the filters, how many times have you done so?		
	Always	1	
	Sometimes	2	26
	Never	3	

	Question	Code	Column
16.	During which Months/Season of the year		
	Dry season	1	
	Raining season	2	20
	Both	3	
17.	Can guineaworm be acquired from the water you drink?		
	Yes	1	21
	No	2	
18.	How can Dracunculiasis be controlled?		
	Do not know	1	
	Filtering water	2	
(temphos)	Use of chemicals	3	22
(Boreholes)	Provision of good	4	
(Pipe borne water)	drinking water		
19.	What do you practice in your home?		
	Boil and filter water	1	
	Pilter only	2	23
	Nothing	3	
20.	If filtering what type of filter do you use?		
	Monofilamentous	1	
	Any cloth	2	
	Nothing	3	24

	Question	Code	Column
21.	Have you being lectured guineaworm disease and its controls?		
	Yes	1	
	No	2	25
22.	If you were shown how to use and maintain the filters, how many times have you done so?		
	Always	1	
	Sometimes	2	26
	Never	3	