DRACUNCULIASIS IN SI X VILLAGES OF DAWAKIN-KUDU LOCAL GOVERNMENT AREA KANO STATE

BY

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DECLARATION

The work presented in this thesis is original and was carried out by me in the Department of Veterinary Public Health and Preventive Medicine, Ahmadu Bello University, Zaria, under the supervision of Professor J. U. Umoh and Dr. V.C. Ogbogu.

Reference is made to the work of other investigators and is duly acknowledged. No part of this thesis has previously been submitted for a degree or Diploma.

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CERTIFICATION

This thesis titled "DRACUNCULIASIS IN SIX VILLAGES OF DAWAKIN-KUDU LOCAL GOVERNMENT AREA, KANO STATE, NIGERIA" by DOGARA MUSTAPHA MUSA meets the regulations governing the award of the degree of Masters of Science of Ahmadu Bello University, Zaria and is approved for it's scientific contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to the teeming masses in the villages where this work was carried out

Musa Mustapha Dogara

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ABSTRACT

A survey of dracuncullasls was conducted among humans and animals In six vlllaaes of Dawaki n Kudu district of Dawakin-Kudu Local Governnment Area, Kano 5tate between Aprll, 1990 to Febuary,1991. An overall prevalence of 75 persons per 1000(7.5%) was recorded, with Gunaka village havinq the highest prevalence of 237 persons per 1000 (23.7%) while Fagojl had the lowest, 7 persons per 1000 (0.7%).

Group of villages with handpumps has lower prevalence, 48 persons per 1000(4.8%) than the qroup of vi llages without handpumps with a prevalence of 115 persons per 1000 (11.5%. The association between lack of handpump and guineaworm Infection was hiqhly significant (P<0.001).

The age specific prevalence In the six villages revealed an Initial Increase of Infection with age reachlnq a peak at the 3rd and 4th decade of life. The highest pre-valence of 90 persons per 1000(9.0%) was found a mong the 20-29 year aqe group. The difference In association was found to be hlqhly significant (P<0.02). There were more cases of gulneaworm among farmers than any other occupational groups In all the villages. About 518 persons per 1000 (51.8%) were found to be previously Infected n all the vil-laqes. Of the 880 current cases, 509(57.8%) were recurrent cases while 371 (42.2%) were having the Infect on for the flrst ti me.

Users of "Ruguzal"/Well have the highest prevalence of 328 persons per 1000(32.8%) while the lowest prevalence of 11 persons per 1000(1.1%) was found a mong users of well. Those who depended ori "Ruguzal" In combination with other water sources have hi gher pooled prevalence of 150 persons per 1000(15%) than those who depended on pond or handpump In combination with other sources with a pooled prevalence of 70 persons per 1000(7.0%).

Of the 880 Infected Individuals, 345(39.2%) had only one worm emerglng while about 793(90.1%) had the wormemerglng from the lower limbs. Of the 31,722 animals examined only 2(0.006%) animals were found to be Infected.

About 21,595 man-days were lost due to gu i nea worm Infection In the six villages. When this was translated Into the amount paid to hired labour it amounted to nine hundred and seventy one thousand seven hundred and seventy five Nai ra (N971,775). Of the 880 Infected Individuals, 17(1.9%) were disabled. Of the 880 Infected persons, 464(52.7%) were aware of the mode of transmission of the disease. Very few of the Infected persons depended on Western medicine majority 788 (89.5%) depended on traditional medicine. Of the 1,421 households v/lslted 1,357 (95.5%) never filtered their drlnklnq water while none of them cared to boll the water before drlnklnq. However, all house-holds agreed that they have been Informed to dc so.

TABLE OF CONTENTS

	Page
Title	i.
Declaration	ii
Certification	iii
Dedication	iv
Acknowledgements	v
Abstract	vii
Table of Contents	ix
List of Tables	xii
List of Figures	xiv
List of Plates	xv
CHAPTER ONE	1
1.0 Introduction	1
CHAPTER TWO	2
2.0 Literature Review	2
2.1 Development and Life Cycle of *D. medinensis*	2
2.2 Epidemiology	11
2.2.1 Transmission	11
2.2.2 Distribution	12
2.2.3 Vector of dracunculiasis	17
2.2.4 Zoonotic aspect	17
2.2.5 Economic Impact	19
2.3 Pathogenesis	20
2.4 Complications of Guineaworm Infection	27

	Page
2.5 Diagnosis	29
2.5.1 Clinical	29
2.5.2 Parasitological	29
2.5.3 Immunological	30
2.6 Treatment	31
2.7 Prevention and Control	35
2.7.1 Chemical treatment of water bodies that act as sources of transmission	35
2.7.2 Biological Control	37
2.7.3 Improvement of water supplies	37
2.8 Global Eradication Campaign	39
CHAPTER THREE	44
3.0 Materials and Methods	44
3.1 The Study Area	44
3.2 Method of Survey	47
3.3 Examination of Water Sources for the preeence of cyclopoid copepods	49
3.4 Identification of cyclopoid copepods	52
3.5 Data Analysis	53
CHAPTER FOUR	54
4.0 Results	54
4.1 Prevalence Survey	54
4.2 Impact of Dracunculiasis in the Six villages	76
4.3 Health Education Measures and Guineaworm Infection	80
4.4 Examination of Water Bodies and Identification of Cyclopoid Copepods	84

	Page
CHAPTER FIVE	89
5.0 Discussion	89
5.1 Prevalence Survey	89
5.2 Impact of Guineaworm Infection in the Six Villages	93
5.3 Guineaworm Infection and Health Education Measures	94
5.4 Examination of Water Bodies for the Presence of Cyclopoid Copepods	95
Summary and Conclusions	96
Bibliography	102
Appendix	117

LIST OF TABLES

Tables		Page
1	Prevalence of dracunculiasis in individual hamlets/villages	55
2.	Prevalence of dracunculiasis in villages with and without handpumps	57
3.	Analysis of the relationship between guineaworm infection and presence or absence of handpump in the study area	59
4.	Overall age-specific prevalence of dracunculiasis in the six villages	60
5.	Distribution of current cases of dracunculiasis by occupation in the six villages	61
6.	Reported previous cases of dracunculiasis in individual hamlets/ villages	63
7.	Distribution of current cases of dracunculiasis by previous infection in the six villages	65
8.	Dracunculiasis infection according to water sources used in the six villages	66
9.	Distribution of current cases of dracunculiasis according to number of worms emerging per individual in the six villages	69
10	Distribution of current cases of dracunculiasis according to site of emergence in the six villages	70
11	Prevalence of dracunculiasis in animals in the six villages	71
12	Distribution of current cases of dracunculiasis according to period of incapacity in weeks in the six villages	77

Table		Page
13	Distribution of current cases of dracunculiasis according to number of disablement in the six villages	78
14.	Distribution of current cases of dracunculiasis according to whether the patient is aware of how the disease is contracted or not	81
15	Distribution of current cases of dracunculiasis according to treatment sought by infected individuals in the six villages	82
16	Preventive measures (boiling and filtering) taken by households in the six villages	83
17	Results of screening of water bodies for the presence of Cyclopoid Copepods in the six villages	85

LIST OF FIGURES

		Page
1.	Life Cycle of *D. medinensis*	10
2.	Map of Kano State Showing Dawakin-Kudu District and the villages where the study was conducted.	45
3.	Prevalence of Infection based on water sources.	67

LIST OF PLATES

		Page
1.	A "Ruguji" examined for the presence of Cyclopoid copepod	50
2.	A "Ruguji" showing the part containing water	51
3.	An infected individual with a worm protruding near his knee	72
4.	An infected individual with a worm emerging near his ankle	73
5.	An infected individual with three guineaworm ulcers on his stomach	74
6.	An infected donkey	75
7.	An infected individual with guineaworm ulcer that degenerated into a secondary bacterial infection	79
8-9.	Male Cyclopoid copepods of the genus mesocyclops encountered in the study area	87
10-11.	Female Cyclopoid copepods of the genus mesocyclops encountered in the study area	88

CHAPTER ONE

1.0 INTRODUCTION

Dracunculiasis (Guinea-worm disease) is caused by a thread-like nematode Dracunculus medinensis. Man acquires the infection by ingesting infected cyclopoid copepods containing the infective third stage larvae in contaminated water.

Guineaworm disease is considered endemic in four Asian and nineteen African countries (WHO 1989). The major Asian foci of transmission are located in India and Pakistan. The most severely affected African countries are Burkina-Faso, Ghana and Nigeria, where the disease occurs nation-wide. In Nigeria, the level of endemicity varies from one state to another and is conceived that about 2.5 million people spread in rural areas are infected annually (Edungbola, 1985b).

Dracunculiasis is primarily a disease of remote, poor and rural communities without portable water sources(Muller 1971a). With a few exceptions all reported studies indicated that guineaworm infection is rare at the first year of life (infancy), and the main reason being the long incubation period of the worm which is on the average twelve months (Kale, 1985). The frequency of the disease rises with age reaching a peak at different ages in different communities (Kale, 1985).

.../2

Most studies, notably those of Belcher et-al (1975) and Kale (1977) have shown that there is substantial drop in frequency in the 3rd and 4th decade of life. Sex, occupation and marital status are not predisposing factors to guineaworm infection, but rather increased exposure to sources of infection (Kale,1985).

Dracunculiasis in man is rarely fatal and, in the absence of any complications, it is not particularly painful or incapacitating (Muller,1971a). However, complications are too common and result in much crippling disease and economic hardships in agricultural communities during the planting season. Guineaworm disease has been associated with low agricultural productivity (Nwosu et-al,1982 and Nwosu,1988); absenteism and low academic performance among school children (Edungbola,1983); habitual abortion among pregnant women (ST George,1975) and susceptibility to tetanus infection through the guineaworm ulcer (Lauckner et-al,1961; Prime and Becquet,1963 and Labegorre et-al,1969).

The life cycle of D. medinensis centres around certain species of cyclopoid copepods, the intermediate host and man, the definitive host. The embryo or larva reaches its infective stage in the intermediate host within 14 days of its entry.

When man swallows the infected cyclopoid copepod; the larvae are released in the duodenal wall. In about three to six months they develop into adults and then copulate after which the male dies. The females migrate to the subcutaneus tissue and subsequently emerge through the ulcer from any part of the body, but mainly from the lower extremities (legs and ankles). It is the emerging gravid females that are of public health importance with respect to transmission (Kale, 1985). It is from these females that numerous embryos are released into water by an infected individual for the intermediate host, the cyclopoid copepod to ingest.

Although many species of cyclopoid copepods are capable of transmitting dracunculiasis, only few, usually not more than two have been incriminated as intermediate host. In Nigeria, only three: mesocycops aequatorialis, Thermocyclops crassus and T. oblangatus nigerianus are known as vectors (Braide and Boxshall, 1988).

Infection with D. medinensis have been reported from a wide variety of domesticated and wild animals from many parts of the world, but most reports are from dog. (Muller, 1971b). Although infection in animals is presumably through accidental ingestion of cyclopoid copepods while drinking water; a likely mode of transmission is through paratenic transport hosts such as frog or fish (Muller, 1990).

However, no animal reservoir host have been identified in case of guineaworm infection. So far only two cases of transmission from animal to man have been documented in the literature (Muller, 1990).

The designation of 1981-1990 as the International Water Supply and Sanitation Decade (IWSSD) by International agencies such as United Nations Development Programme (UNDP), United Nations Children's Emmergency Fund (UNICEF), World Health Organisation (WHO) and World Bank has provided an opportunity for eradicating dracunculiasis by the year 2,000 (Muller, 1985b). Already, several endemic countries in Asia and Africa have seized this opportunity by mounting eradication programmes assisted by the International agencies and private donor agencies such as Global 2,000. The eradication programme is centred on active surveillance, health education and provision of safe drinking water.

Nigeria hopes to eradicate guineaworm disease by 1995 and had its eradication programme in place since March, 1988. Kano State ranked 9th with 12,987 cases in the first active case search conducted nationwide in 1988/89 (Guineaworm Report, 1990a). The State sets 1992 as its target of elliminating the disease mainly through it's portable water supply scheme. Considering the large number of rural communities in the state, providing clean water in form of piped

or boreholes will certainly be expensive and may not be feasible. Equally, difficulties may arise in the maintenance of boreholes in particular and achieving exclusive use of them both of which require change in human behaviour.

There is only scanty information on the epidemiology and management of guineaworm infection in Kano State. Such information is vital in planning and executing a successful control or eradication programme. The present study aims at bridging this gap with the following specific objectives:

1. To determine the prevalence of disease in human beings and animals in the study area.
2. To compare the infection rates of guineaworm disease in villages with handpumps with those without handpumps.
3. To determine water sources that likely serve as sources of transmission in the villages.
4. To identify the cyclopoid copepods as far as possible in the study area.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 DEVELOPMENT AND LIFE CYCLE OF D. medinensis

The life cycle of D. medinensis revolves around man, the definitive host and a suitable species of cyclopoid copepod, the intermediate host. When an infected individual (patient) immerses his guineaworm ulcer in a water source several thousands of embryos are released by the female worm. The total number of embryos contained in the worm was estimated at three million (Turkhud, 1919) and in two dissected worm from rhesus monkey were 1,890,000 and 1,436,000 (Muller, 1971a). The embryos measured about 550μm X 15 - 30μm. They remain active in water for about 4-7 days (Moorthy, 1932; Southwell and Krishner, 1938).

The embryos soon develop into the first stage larvae. The cyclopoid copepod ingest the larvae (Roubard, 1913; Chatton, 1988a&b; Issajev, 1934; Moorthy, 1938; Southwell and Krishner, 1938) as opposed to active penetration through cuticle suggested by Fedchenko (1871), Manson (1895) and Wenyon (1908). Through powerful bending movements the larvae penetrate through the gut wall into the haemocoel in about four hours depending on temperature (Muller, 1985a). The larvae moult twice and develop into a third stage in about twelve days, but only become infective at fourteen days (Muller, 1985a). And only one larva is found in naturally infected cyclopoid copepod, but up to five larvae have been found in experimentally infected cyclopoid cope-

pod. Immature stages of cyclopoid copepod have been found infected, but with only one larvae (Onabamiro, 1956).

Man becomes infected when he swallows the cyclopoid copepod cohtaining the third stage larvae while drinking water. On reaching the duodenum, the action of digestive juices leads to the death and disintegration of the infected cyclopoid copepods thereby releasing the larvae(Kale, 1985). Over the ensuring 10-14 months, the larvae develop and mature into adulthood. Male and female guineaworm copulate soon after which the male dies and the fertilized female migrates to the subcutaneous tissues of the victim (Kale, 1985). From the studies of Onabamiro among others, it is apparent that the survival rate of most ingested guineaworm larvae is extremely low, and only a small proportion of fecund female worms reach their ultimate destination under the skin (Kale, 1985). Most of the migrating worms are arrested; some causing no problem, others give rise to cold sterile abscess at the point of arrest.

The development of D. medinensis in the definitive host has been described through experimental infection of non-human hosts - dogs, cats and rhesus monkey(Muller, 1971b). The early route of migration determined in dogs, cats and rhesus monkeys (Muller, 1968a, 1968b) showed that larvae were found in the duodenal wall 13hrs after infection, on the abdominal mesenteries for upto 12 days and the thoracic

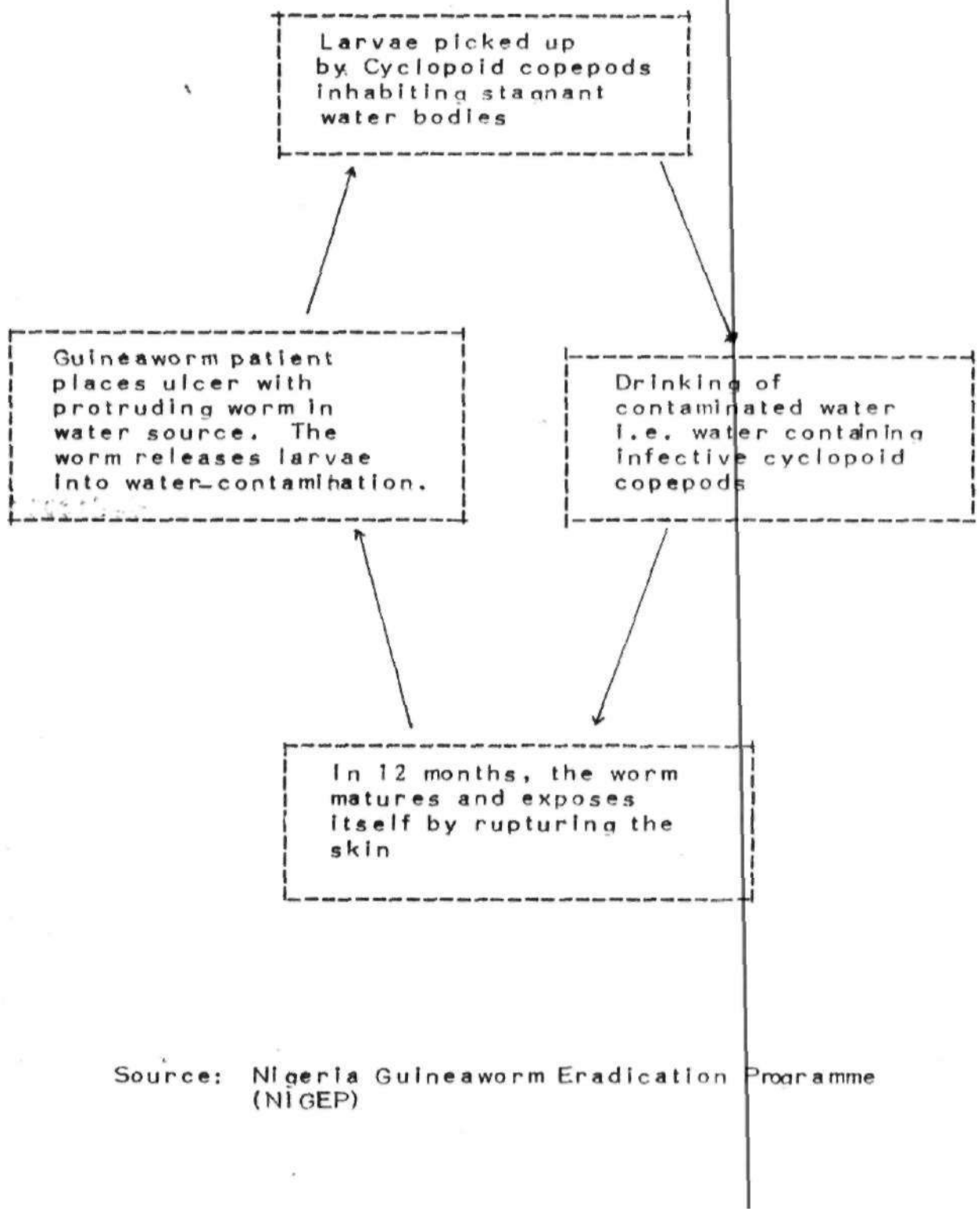
abdominal muscles at about 15 days. Almost no increase in length occurs during this migration and the larvae have an average length of only 0.59mm after 15 days. Muller (1968a) suggested that there is probably another moult between 15 and 22 days. The young worms then migrate across the subcutaneous tissue to the auxillary and inguinal regions. The recovery of majority of worms in the subcutaneous tissues surrounding the auxillary and inguinal lymph nodes in dogs (Onabamiro,1956) suggest that the young worms migrate via the lymphatic system. Males and females recovered 3½ months of infection in dog were in close association and the females had mucous plug in their vagina (Onabamiro,1956) indicating that they had been fertilized.

In monkeys the female worms move to the extremities at the 8th month and contain fully formed embryos at the 10th month (Muller,1971a). The males after copulation die between 3rd and 7th month and become encysted. The mature female emerges 10-14 months after infection. In man, this information is based chiefly on the accounts of travellers making short visits to an endemic region(Manson 1903; Powell,1904; Wurtz and Sorel,1912; Fairley,1924a) includes one experimental infection (Liston,1914) and is strongly supported by epidemiological evidence. A similar

developmental period has been observed in laboratory infections in dogs (Moorthy and Sweet, 1938; Onabamiro, 1956) and a mean of 340 days in rhesus monkey(Muller, 1971a).

When a female worm is ready to emerge it secretes a toxic substance that provokes a painful blister and subsequently an ulcer (Kale, 1985). At this stage the symptoms of dracunculiasis becomes manifest and the worm protrudes through the ruptured ulcer due to accidental or deliberate scratching by the victim. Therefore, when the infected individual immerses the ulcer in water, larvae are released which are then ingested by the cyclopoid copepods. When these infected cyclopoid copepods are swallowed by an individual with water, the cycle is repeated, (figure 1 - life cycle of guineaworm).

Figure 1: Life cycle of *D. medinensis*



Source: Nigeria Guineaworm Eradication Programme (NIGEP)

2.2 EPIDEMIOLOGY

2.2.1 TRANSMISSION

The ingestion of an infective cyclopoid copepod in water is probably the only method of transmission to the definitive host (man or other animals). However, transmission through paratenic (transport) hosts such as frog or fish, which ingest cyclopoid copepod and are capable of concentrating the infective larvae in their tissues is currently being speculated (Muller,1990). Such mechanism has been postulated for Dracunculids or racoons, mustelids and reptiles (which drink very little if any water), and has been experimentally confirmed by some workers notably Brackett(1938). Transmission to cyclopoid copepod is through ingesting the larvae in water by them.

For transmission to occur the following conditions must be met: suitable water body that harbours the cyclopoid copepods, introduction of guineaworm larvae into the water by an infected person, a temperature of between 25°C - 30°C, presence of right species of cyclopoid copepods in which the larvae are capable of developing to infective stage; and the ingestion of the larvae by the cyclopoid copepods within five days of their deposition in water (Edungbole,1985). The reason being they loose their capability of developing to infective stage after that period (Muller,1971a).

2.2.2 DISTRIBUTION

Dracunculiasis is considered endemic in four Asian and nineteen African countries(WHO,1989). The major Asian foci of transmission are in India and in Pakistan. In Africa the most seriously affected countries are Benin, Burkina Faso, Ghana, Mali, Mauritania, Niger, Togo and Nigeria (Watts,1987). The situation is severe in Ghana, Burkina Faso and Nigeria where the disease occurs nationwide. The disease is present but less widespread in Chad, Cote-d'Ivoire, Cameroun, Gambia, Guinea and Senegal.

The East African endemic foci are located in Southern Sudan, Ethiopia, Northernand Eastern Uganda and Northwest Kenya. The disease appears to be widespread in Ethiopia and Southern Sudan but very little is known about its distribution and endemicity (Watts,1987). Infection in all the endemic countries of Africa is found in all ecological zones from the forests through Savannah to the semi desert Sahel, to the desert. In Africa, there is no documented transmission in the desert as is the case in Pakistan, therefore cases recorded might have originated elsewhere(WHO 1985b).

The total population at risk in Africa is put at 120 million, about 42% of the total population of affected countries (Watts,1987). The annual incidence is estimated to be 3.32 million which is about 2.7% of the population at risk. In Nigeria, about 30 million people are thought to be at risk (Watts,1987). Although the level of endemicity varies from one endemic foci to another, at present it is conceived that 2.5 million people spread in rural communities are infected annually (Edungbola,1983; Watts,1987).

Guineaworm infection appears not to confer immunity and therefore everybody in an endemic area is at risk (Edungbola,1985; Muller,1985b). However, infection rate may vary by age and sex from one place to another(Edungbola, 1985). With few exceptions all reported studies indicated that guineaworm infection is rare in the first year of life (Infancy) (Kale,1985). Edungbola(1983) attributed this to long prepatent period of infection, the destruction of infective guineaworm larvae in the process of boiling children's water with medicinal products prior to ingestion and and prolonged breast feeding. Infection increases with age reaching a peak at different age groups in different places (Kale,1985). A substantial drop in the frequency of infection has been reported in the 3rd and 4th decades of life (Belcher et-al, 1975; Kale,1977).

Although differences in frequency of infection by sex have been reported, sex does not seem to be a predisposing factor to infection (Kale, 1985). Males have been reported to have higher prevalences than females in India (Bhatt and Palan; 1978; Bildhalya, 1969; Johnson and Joshi, 1982; Ohja and Johri, 1980; Rao; 1942 and Reddy et-al, 1969) while the infection rate is higher for females than males in Ghana (Lyons, 1972; Scott, 1960). In Nigeria, earlier works revealed almost equal prevalences among both sexes (Edungbola and Watts, 1984; Onabamiro, 1952; Kala, 1977). However, higher prevalences were reported among males (Onwuliri et-al 1988-90a&b, Ogunba et-al, 1985; Sulelman and Abdullahi, 1988-90). Ilegbodu et al (1987) showed higher prevalence among girls than in boys below the age of fifteen in Idere community, Oyo State. These contrasts reflect occupational and other factors which may influence water consumption rates and habits (Edungbola, 1985). The suggestion that gastric acidity may protect some people from dracuncullasis (Onabamiro, 1958 ; Scott, 1960) has been strongly refuted (Gilles and Ball, 1964; Sita et-al, 1969 and Muller, 1971b).

Most studies revealed that the farming population were most affected since farmers predominate over-whelmingly in guineaworm endemic communities (Kale, 1985). However, there is no conclusive evidence to show that farmers are

more prone than other occupational groups. Rather the high frequency is a factor of increased exposure to infection (Kale,1985; Edungbola,1985). Demographic variables such as religion or marital status have not been shown to affect infection (Kale,1985). There has been no satisfactory explanations as to why some individuals in guineaworm endemic community appear to escape infection most or all the time while some are afflicted virtually every succeeding guineaworm season (Kale,1985).

Infection rates have been reported to vary according to water sources used in endemic communities. Infection rates were highest among those who solely depend on pond for drinking and other domestic purposes in Rajasthan/sind desert of India and in Pakistan (Muller,1971a) and in many parts of Africa (Nwosu et-al,1982; Stelb and Mayer,1986; Tayeh and Caircross,1988 and Onwuliri et-al,1988-90a). In India, the major sources of transmission are the step wells while cisterns were the major sources in Iran when dracunculiasis was endemic (Muller,1971a). Wells, rivers and streams are not important in the transmission of dracunculiasis (Nwosu et al,1982).

Rouberd (1913) observed the varying seasonality of guineaworm disease in different Climatic zones. In Southern parts of West African endemic region with high annual rainfall, the monthly incidence builds to a peak in the dry season (Onabamiro,1951; Scott,1960; Belcher et al, 1975; Kale,1977; Abolarin,1981; Nwosu et al, 1982; Edungbola,1984; and Onwuliri et al ,1988-90b). This was attributed to the behaviour of infected cyclopoid copepods whereby they sink to the bottom and are not likely to be picked up unless the water level in the pond is low (Onabamiro,1952). The density of cyclopoid copepods is essentially highest during the dry season due to decrease volume of water in ponds (Onabamiro,1951,1956). In Sahel Savannah areas of Africa where the annual rain-fall is less than 75cm, transmission is confined to rainy season (Ramsy,1935; Steib and Mayer,1986). In the desert of Pakistan transmission build up to a peak before the ponds completely dry up while in Iran is when the cistern were half-full (Muller,1971a).

2.2.3 VECTOR OF DRACUNCULIASIS

Although a large number of species of cyclopoid copepods have been described, only the predatory species seem capable of transmitting D. medinensis (Muller, 1971a). Of these, only one or two species have been found naturally infected in endemic regions (Muller, 1985a). However, other species present in the same habitat can easily be infected experimentally; the reason is unknown. Published records so far shows the following species:

Mesocyclops species unknown (formerly identified as Mesocyclops leukarti), M. aequatorialis, Thermocyclops Hoplnus, T. oblangatus nigerianus and T. incissus, T. crassus and M. kieferi, M. margaretes as vectors in different parts of Africa (Onabamiro, 1950; 1951, 1952; Muller, 1970; Abolarin, 1981; Nwosu et al, 1982; Edungbola, 1984 and Johnson et al, 1988-90).

2.2.4 ZOONOTIC ASPECT

Alleged infection with D. medinensi have been reported from a wide variety of animals in many parts of the world, but most are from dogs (Muller, 1971a). However no animal reservoirs have been identified, but infection is said to still occur in regions where human dracunculiasis was formerly endemic example Southern USSR (Litivnov, 1982) and Tamil Nadu State in India (Joseph, 1930; Lalitha, 1980).

Animals become infected presumably by accidental ingestion of infected cyclopoid copepods while drinking water. Though, this mechanism is possible, its rare occurrence is attributed to the lapping action of the animals while drinking water which drive cyclopoid copepods from the point where the animals drink and the sinking of infected cyclopoid copepods to the bottom of the water(Muller,1990).

Transmission via paratenic (transport) hosts, such as frog or fish has been postulated and experimentally confirmed for Dracunculiasis in mustelids or racoons and reptiles which drink very little, if any water has been reported by some workers (Muller,1990).

So far, there are two reported cases of transmission of D.medinensis from animals to man; one case from Korea and the other from Japan (Muller,1990). In both cases there was no evidence that the patients had been to endemic countries during 12-24 months preceeding patency and there is no record that the foci of human dracunculiasis in Korea or Japan have ever existed. Common to both was a history of ingestion of uncooked loaches (small fresh-water fish belonging to family cobitidae) which are effective predators of cyclopoid copepods.

There have been few studies on the incidence of the disease in animals. Crichton and Beverly-Burton found developing stages of Dracunculus sp.in 81% otters, 36% Mink and 14% raccoons examined in Ontario (Muller,1971a), although there has only been one previous report of infection in animals in Canada (Chitwood,1939).

2.2.5 ECONOMIC IMPACT

Dracunculiasis causes considerable suffering and poses a major problem to the health and economy of the rural population in endemic areas (Nwosu et.al,1982). The fact that the incidence of the disease in endemic regions of Africa and India coincides with peak period of agricultural activities and that the disease affects the working population 15-45 age groups results in considerable loss in agricultural productivity and fall in food production (Edungbola,1985 and Muller,1985b). Guinea-worm disease causes more protracted disablement during peak agricultural activities than any other disease including malaria (Muller,1979). Ward in 1982 put the annual wage loss due to dracunculiasis at about $170 million while Golladay in the same year estimated global loss of marketable goods to be about $300 million-billion (Edungbola,1985).

It was estimated that among 12.8 million people residing in Indian endemic villages, the annual total man-days in an economically productive population of about 176,640 is about 7 million man-days, or about 19,000 man-years (Edungbola,1985). In Nigeria, of the 2.5 million annual sufferers about 12,000 suffer irreversible disablement, economically productive farmers lose about 50 million man-days annually while fall in school attendance may be about 40 million pupils day (WHO,1985a). The estimated rice output lost due to guineaworm infection in some rice producing areas in Anambra, Benue, Cross River and Imo States with an estimated prevalence of 27.4% in a total of 89 households sampled was put at 27.5 metric tons valued at N19,764 (Nwosu,1989).

The disease also affects the observances of local celebrations and religious festivals, politics and malnutrition among children (Edungbola,1983 ; Muller,1979; Edungbola and Watts, 1985; Edungbola,1984; Nwosu et-al 1982 and Belcher et-al,1975).

2.3 PATHOGENESIS

Published works have consistently reported that the commonest site of emergence of the female is the lower limb (over 80% in which about 50% occur at the ankles and feet (Kale,1985). However, worms have been found to emerge from any part of the body including genital areas, breastss trunks and buttocks (Edungbola,1985). The emergence of the

worm at those parts that frequently come into contact with water is thought by some workers notably (Edungbola, 1985) as an adaptation but Muller (1968a) thought otherwise. Kale (1985) speculated fecundity as stimulus for the emergence of guineaworm.

Usually one to three worms emerge at a time but in the occasional patient there may be multiple infections with up to 40 worms in one season (Blacklock and O'farrell, 1919; Core, 1932; Rao, 1942; Lindberg, 1948; Ferreira and Lopes, 1948; Onabamiro, 1951; Lucas et al, 1969; Raffler, 1969 Reddy et al, 1969a). In West Africa most patients have one worm emerging at a time (Muller, 1971a). For example Onabamiro(1958) found in 158 cases in Western Nigeria that 136 (86%) had one worm, 16(10%) had two six (4%) had three worms. The universal average is about 1.5 worms per person which may be higher in hyperendemic and lower in hypoendemic areas (Kale, 1985).

The incubation period of guineaworm infection is invariably symptomless (Kale, 1985). The infection becomes apparent in any of these three ways: recognition of palpable sometimes moving worm, allergic symptoms and formation of blister or bleb (Muller, 1971a). Prodromatal symptoms have been recorded in 80% of patients in whom the adult female worm emerged (Kale, 1985).

The prodromata lasts for less than 24 hours and consists of one or more of the following symptoms; generalized urticarial rash accompanied by erythema, nausea, vomitting, mild to moderate itching, fever, dizzness, dyspnoea, diarrhoea and infrequently intraorbital oedema and syncope(Kale, 1985). The prodromata are allergic in nature and is attributed to the release of histamine-like substance triggered off by the presence of the worm.

In many patients the formation of blister or bleb is the first pathognomonic sign of active guinea worm infection (Kale, 1985). The formation of blister is often stated to be due to production of necrotizing fluid by the adult worm, but may be caused by the liberation of embryos into the tissues (Muller, 1971a). Fairley and Liston, (1924c) refuted this as they found that intradermal and subcutaneous injection of thousands of larvae to human volunteers produced pus-filled abscess but not blister or allergic manifestations. Muller(1979) observed shock in un-infected rhesus monkey when injected with soluble extract of embryos. The blister when formed is initially minute but grows to a few centimetres in diameter before bursting in 3-5 days (Kale, 1985). The blister is formed at the site of emergence between 1-6 days after prodromatal period. The accompanying skin irritation and a variable degree of burning sensation at

the site of emergence compels the patient to scratch leading to formation of a bleb in a matter of hours (Kale, 1986). The bleb or blister after expanding ruptures spontaneusly or accidentally or deliberately by the victim.

The fluid of the blister consists of a bacteriologically sterile serum containing monocytes, eosinophils and usually embryos; polymorphs were also reported by Fairley (1924b) but this was thought to be a mistake by Reddy et al, (1970). Muller (1979) found in rhesus monkey principally polymorphs then increasing proportion of macrophages, lymphocytes, eosinophils and larvae with white cells adhering to them.

Once the blister had burst the uterus of the female worm is extruded through the ulcer, the edges of which consist of pinkish granulation tissue (Muller, 1971a). After few days the anterior end of the worm is exposed by sloughing of the white central eschar of the ulcer and more of the worm protrudes, particularly after immersion in water. Histological examination of the worm before blister formation in rhesus monkey revealed the worm with its uterus filled with larvae, surrounded by thin connective tissue sheath, containing fibroelastic tissue with few eosinophils, within which the worm could move freely (Muller, 1979). At this stage, the worm could easily be extracted if a small incision is made on the skin.

However, once the blister is formed there was intense tissue reaction along the whole length of the worm not just at the anterior end (Muller, 1979). Host tissue adhered closely to the cuticle of the worm and made the entire extraction of the worm no longer possible.

After few days of bursting of the blister in rhesus monkeys degenerating polymorphs, eosinophils, macrophages, multinucleate foreign body giant cells, epithelioid cells and fibroblasts were present (Muller, 1979). A chronic type of inflammatory response with some necrosis and cellulitis persisted while the worm was present but quickly resolved on complete expulsion of the worm. Similar effects were reported in man by Fairley and Liston (1924b). Adeyaba (1985) noted hyper-proteinaemia (9.1g/100) in infected individuals which were mainly due to increased serum globulin.

In the absence of any complications, the worm is usually expelled completely on the average in four weeks (Muller, 1971a). However, complications have been found to be common especially in areas without adequate medical attention (Muller, 1971a; 1985; Edungbola, 1985). It may lead to reversible incapacity or in severe cases permanent disability (Edungbola, 1985). Complications are of two categories: primary and secondary (Kale, 1985).

Primary complications are due to host tissue reaction against the worm products, repeated multiple infections and the presence of the worm at an unusual anatomical locations (Edungbola, 1985).

Secondary complications results mainly from bacterial infection which gain access through the ulcer (Kale, 1985). Edungbola (1985) attributed this to negligence, ignorance and unsatisfactory methods of local management. Fairley and Liston (1924b) listed acute abcess, cellulitis, arthritis, synovitis, epidimyo-orchitis, bubo, chronic ulcerations, fibrous alkylosis of joint and contractures of tendons resulting from local bacterial infections.

The most common species of bacteria cultured from leslons were Staphylococcus aureus, Escherichia coli, Streptococci sp., Enterobacter sp. and Corybacterium tetani (Fairley and Liston, 1924b Adeyaba, 1985a). Muller (1979) cultured Streptococcus pyrogenes and Staphylococcus aureus from infected rhesus monkeys.

Many female worms that fail to emerge became encysted and calcified and their presence in X-ray has been shown by many workers (Muller, 1971a). Encystment, followed by absorption or calcification (Cohen, 1959) is the normal fate of the male worm.

The pelvis and abdomen followed by the knee were found to be the commonest calficication sites (Reddy, et-al, 1968). The presence of the encysted worm at unusual sites causes more serious symptoms which may lead to complications like paraplegia (Donaldson and Angelo, 1961; Reddy and Vasanta valli, 1967; Mitra and Hoddock, 1970). Sometimes non-emergent worms form large filled abscess which may occur in many sites of the body(Dejau1951; Reddy et-al, 1969c) but if near the knee joint may cause arthritis. In cases of arthritis of the knee joint reported by Ghandhi (1962); Reddy and Sivaramappa(1968) and Reddy et al,(1970) in India showed that embryos were recovered from the synovial fluid which was sterile on culture. The synovial membrane had oedema, congestion and infiltration of plasma cells. Giant cells were found after six days and after four months the wall was grossly thickened and fibrosed with the worm calcified (Reddy et al, 1969b, 1970 and Sivaramappa et al, 1969). No pathological changes occurred in articular cartilages and bones. On the other hand Kothari et al,(1968) found no larvae in the synovial fluid in two cases of arthiritis and believed that it was toxin released by the adult that caused arthritic lesion, irrespective of its actual location.

In Western Nigeria, cases of aseptic arthritis occur in the knee joint and also in the ankle, wrist and elbow. The condition is not improved by antibiotics, but some may recover spontaneously (Greenwood, 1968).

2.4 COMPLICATIONS OF GUINEAWORM INFECTION

A number of complications due to unusual anatomical location of the worm have been reported (Edungbola, 1985). These include occular involvement (Verma, 1966); blindness (Edungbola and Adekeye, 1980); abortion and sterility due to retroplacental location of the worm (George, 1972); paraplagia due to the worm in the extradural space (Mit and Huddock, 1970); complicated pregnancies due to location of calcified worm in the broad ligament (Neal Smith and Siddique, 1965); constructive pericarditis due to the presence of the worm in the thoracic cavity (Kinare et al, 1962); urinary obstruction resulting from infection of the bladder (Raffi and Dutz, 1967); quadraplegia due to the infection of the subdural space of the cervical vertebra (Donaldso and Angelo, 1961); Osteomyelitin of the fifth lumber vertebra causing the collapse of the vertebra (Mathur et al, 1982); Intrapulmunary calcification (Reinhard, 1961), and acute synovitis and arthritis caused by the presence of the worm in the knee joint (Reddy and Sivaramappa, 1968 and Kotharl et al, 1968).

Secondary bacterial infection is the major cause of death in complicated dracunculiasis. A study in Burkina-Faso revealed that 7% of villagers that died of tetanus were from guineaworm secondary tetanus (Prime and Beequent, 1963). Guineaworm ulcer was reported to be the third most portal entry of tetanus spores at the University College Hospital, Ibadan by Lauckner et al(1961).

The severity and duration of incapacity varies among the victims of the disease and depend on the number of infections, anatomical location of the worm, status of health and personal hygiene of infected person, the duration of infection and the activities engaged by the infected individual such as walking long distances or riding a bicycle (Edungbola, 1985). Kale(1985) classified disabilities into: Grade I (mild) is where the patient is mobile and suffers little or no discomfort; Grade II (moderate) is where patient is mobile but suffers considerable discomfort and Grade III (severe) is where the patient is immobile or unable to use the affected limb and suffers considerable discomfort.

Although the duration of incapacity varies widely among infected individuals, the mean period is about three months (Kale, 1977; Belcher et al, 1975). The pre-emergence stage was more incapacitating (Nwosu et al, 1982).

2.5 DIAGNOSIS OF DRACUNCULIASIS

Guineaworm disease can be basically diagnosed at three main levels: clinical, parasitological and immunological.

2.5.1 CLINICAL

Prodromatal symptoms especially local itching, urticaria and severe burning pain at site of emergence of the worm are the first clear symptoms of infection(Nwosu et al 1982; Kale,1985). These symptoms are so clear that a patient in an endemic region has no doubts about the diagnosis even before the emergence of worm (Muller,1971a).

Eosinophilia common to helminth infection has been recorded many times in infection with D. medinensis when worms were emerging; usually the relative figure of between 13% to 18% has been reported by many workers (Muller,1971a).

2.5.2 PARASITOLOGICAL

An outline of the worm seen or palpated before its emergence is another means of diagnosis (Muller,1971a and Kale,1985). In doubtful cases the parasite may become more evident when cold water is poured over the affected area (Muller,1971a).

Embryos can be collected by placing cold water on the ulcer or spraying ethyl chloride near the ulcer. These can be examined under a low powered microscope and the embryos may be seen to be actively moving(Muller, 1971a). Once the portion of the worm had emerged there is no difficulty in recognizing it, although it had been mistaken for sparganum in some areas of East Africa(Muller, 1971a). If only very small length of the worm is visible a forcep can be used to pull out a few centimetres until resistance is felt.

2.5.3 IMMUNOLOGICAL

The tests designed for diagnosis of dracunculiasis are intradermal test (Ramsy, 1935); complement fixation test (Stefanopaulo and Daniaud, 1940) and Flourescent antibody technique (Muller, 1970; Gentilini et al, 1972 and LeBras et al, 1977). Alyedun(1985) also tried immunodiffusion and haemoglutination tests. All have been found to be ineffective in detecting particularly asymptomatic infections(Alyedun, 1985) coupled with lack of specificity and reliability. However, an enzyme linked immunosorbent assay (ELISA) devised by Garate et al,(1990) showed a high sensitivity (100%) and reliability (80%) when a conjugate directed against antibody of IgG4 subclass was used. Garate et al(1990) felt that it could be used as a valuable tool for the rapid assessment of pre-and post seroprevalence infections in areas with about 30% prevalence rate especially where the prevalence of filariasis is very low.

2.6 TREATMENT

In the absence of bacterial infection or other complications regular winding out of the worm on a small stick, combined with sterile dressing and acriflavine cream usually results in complete explusion of the worm in about three weeks with little or no inconvenience(Muller,1971a). If the worm breaks a clinical relapse ensures(Kale,1985). Local dressing of ulcer reduces the risk of bacterial infection, quickens healing of the ulcer and controls the rate of transmission as dressed patients avoid contaminating water bodies (Kale,1977).

Surgical removal of the worm after local anaethesis is widely practiced in India and Pakistan (Muller,1971a). If the outline of the worm is seen or palpated and is not firmly attached to the underlying tissue, a single incision suffice the complete removal of the worm. When the worm has burst in tissues or it has broken in the skin a few days previously, multiple incisions are necessary to remove the worm. If the worm is in deep fascia or wound around a tendon it is very difficult or impossible to remove it intact (Johnson,1968).

Reddy and Sivaramappa (1968) recommended the surgical removal of worms located in the synovial cavity, but Greenwood (1968) followed a few cases and found that if there was no bacterial infection, the condition regressed eventually.

Native doctors (Vaidya) in India use razor blade to cut down to the worm and then suck it up by means of metallic aspirator placed over the wound (Fairley and Liston, 1924d). In Sokoto, Nigeria the most popular method is "Sakiya" and involves puncturing the guineaworm abscess or ulcer with a hot iron rod (Sulelman and Abdullahi, 1988-9.

In West Africa, palm oil, kerosene or a concoction of leaves are often placed on the ulcer (Muller, 1971a). Fairley and Liston (1924d) gave a list of topical remedies used in India, most of which served only to increase the likelihood of cellulitis. In India various oral potions have been recommended. Richards (1922) advocated a pound of raw sugar a day on an empty stomach for easier extraction of the worms while Chitale (1912), Bhajekar(1951), Parekh and Kulkarni(1958) and Vad(1963) all found that an extract of the adventitious roots of banyan tree possibly containing cyanogenic glycosides ("draculan") was effective in reducing the aggravation caused by the breaking of the worms and resulted in quicker extrusion.

Although intravenous injection of tartar emetic had been reported (Jeanselime,1919, Macfie,1920a,1920b; Tournier,1922; Le Dentu,1923; Trewn,1937 and Shastry, 1946), but Fairley(1924a) showed that it had no action on the adult female or on the contained larvae.

Modern chemotherapeutic agents have been tried over the years in endemic regions. A single injection of 5mg/kg of Trimelarsan(mel W) caused the expulsion of living or dead worms in 23 out of 45 patients during a trial(Macario, 1965). While intramuscular injection of 1gm of phenothiazine near the site of the worm reduced the number of days spent in hospital by infected troops in West Africa(Elliott,1942). Diethyl carbamazine appears to have no action on adult worms, but circumstantial evidence showed that it kills developing stages (Rousset,1952). The larval stages in cyclopoid copepod are killed in about 10 hours in one percent of its solution in water.

Drugs used in the treatment of guineaworm infection include niridazole, metrinadazole, thiabendazole and mebendazole (Muller,1971a); Kale,1974,1975 and 1983). From the results of controlled trials, the drugs are of limited value, but have beneficial effects on the patient as they relieve symptoms, speed up expulsion of the worms and quick healing of the ulcers (Kale,1985).

Some of them notably niridazole appear to prevent clinical and parasitological relapse. Muller (1971a) suggested that their beneficial effects derives from their anti-inflammatory properties since they have little or no effect on the larval stages or adultworm.

Chemotherapy has positive psychological effect on the treated patient, compliance with other control measures, reduction in the duration of infection and the period during which the communal water supply is exposed to contamination by infected patients (Kale, 1982).

None of the compounds (Diethyl-carbazine citrate, methyridine, metriphonate, metronidazole, carbamendazole and thiabendazole) except metriphonate was found to have any effect on the adult worm or enclosed larvae in experimentally infected rhesus monkeys(Muller, 1979). Metriphonate was found to immobilize the adult worm and the contained larvae were unable to infect cyclopoid copepods although they were moving slowly (Muller, 1979).

2.7 PREVENTION AND CONTROL

2.7.1 CHEMICAL TREATMENT OF WATER BODIES THAT ACT AS SOURCES OF TRANSMISSION

Provision of safe drinking water is the most ideal in the control of dracunculiasis, but the treatment of water sources in order to kill the cyclopoid copepods, the intermediate host will ba a necessary interim measure in many villages surrounded by many small pools(Muller,1985a)

A wide range of compounds have been suggested for use as cyclopsicides, but the report of Washington D.C. Workshop concluded that only hypochtorite and temephos (Abate) can be recommended at present (Anon,1983). Hypochlorite is favoured because of its low mammalian toxicity and is effective in purifying the water. The disadvantages of it is that is expensive, unstable, has no residual effect and so may require frequent application. Reports indicated that villagers object to the taste and smell of free chlorine where trials have been carried out (Krishna et al.,1982;1978 and Muller,1985a). The concentration of hypochlorite necessary to kill cyclopoid copepods is dependent on the amount of organic matter to amount of chlorine produced (Muller,1985a).

Of the various organic chemicals tested, temephos is not the most potent but has very great advantages that it has low mammalian toxicity, is easy to apply with limited solubility, so over-dosing is unlikely (Muller, 1970; Krishna-Rao et al., 1982). It is cheap, has good residual effect and can be stored in tropical conditions.

Temephos was found effective at 1ppm with effect lasting over five weeks and two applications proved effective for a transmission season in northwest Ghana (Lyons, 1973). 1ppm was found effective for about five weeks in a single step well in a village in India and is well tolerated by local people (Sastry, et al., 1978). In both trials there were few cases of dracunculiasis the following year which were believed to have been contracted elsewhere.

Chbrination of the cisterns combined with other measures designed to prevent the larvae from reaching the water led to almost complete eradication of the disease (Sabokbar, 1968). The application of DDT at 10ppm markedly reduced the incidence of dracunculiasis from an average of 26.5% to 6% in five out of seven villages treated in Ghana the following year (Nugent et al. 1955). The lack ofsuccess in the two villages was thought to be due to foulty technique (Muller1971a). Were it not for its commulative toxicity to other forms of life, DDT would have probably been the most satisfactory compound on a cost/effective basis, in addition to its proven success in the field (Muller, 1971a).

2.7.2 BIOLOGICAL CONTROL

Moorthy and Sweet (1936) found that the addition of small fishes (Gambusia and Barbus species) to Step-wells in two villages in India, after treatment with perchloron or copper sulphate, markedly reduced the infection rate the following year. Gideon(1942) recommended the addition of fish Rasbora donlconlus to wells in the area.

2.7.3 IMPROVEMENT OF WATER SUPPLIES

The provision of a year round protected water supplies which are used all the times can effectively elimlnate the disease from an endemic community(Hopkins, 1984).

The provision of piped water in 1966 to two towns in Western Nigeria, Fiditi with an incidence rate of 20% among grammer school children and Igbo-Ora with an incidence rate of 60% in the general population led to its complete eradication two years later, although the disease was still endemic in surrounding villages(Muller,1971a).

Provision of safe drinking water combined with other measures was responsible for the reduction of cases from 39,792 in 1984 to 14,296 in 1987 in six endemic states of India (Hopkins,1988). Similar efforts in Cote d'Ivore led to the drop of the total number of cases reported in the country from 67,123 in 1966 to 4,971 in 1976, and to 592 in 1985 (Niamey Workshop,1986).

The incidence of dracunculiasis was lowest among those who use handpumps (boreholes), eventhough not exclusively in some endemic villages of southern Sudan (Cairncross and Tayeh,1988). The provision of boreholes reduced the prevalence of guineaworm in some communities in Kwara State, Nigeria from more than 50% to near zero in three years (Edungbola et-al,1986).

Many of the sophisticated method of water supply are not feasible in the poor rural areas where the disease occurs, but much could still be done to check transmission of dracunculiasis (Muller,1971). The replacement of step-wells by draw wells has resulted in a dramatic fall of cases in three villages in Rajasthan area of India (Johnson,1966). Similar conversions in an area of Andhra Pradsh have reduced the number of infected villages from 103 in 1957 to 52 in 1961 (Rao and Reddy,1965). The same measure was responsible for the eradication of the disease in the 1940s in Samarankand and Taskehts (Muller, 1971a). The use of raised edges and concrete surrounds to draw wells helps prevent contamination and subsequently the incidence of dracunculiasis (Muller,1971a).

The role of self halp activities in the elimination of guineaworm disease has of recent been documented by Edungbola et al,(1990)and Kodje ,(1986). The construction of wells combined with other intervention strategies led to the fall in the incidence rate from 59.2% in 1978 to 33% in 1979 and zero in 1982-83 transmission season in the village of Igbon, Oyo State, Nigeria (Edungbola et-al, 1990). Similar efforts in the village of Kati in Togo has reduced the incidence from 428 cases in 1981 to 7 cases in 1985 (Kodje,1986).

In some areas the provision of wells does not solve the problem (Muller,1971a). In the village of Akulo Western Nigeria the annual incidence stood at nearly 26% despite of the construction of a properly designed well few years ago as pond water was apparently still used because of the extra effort involved in drawing water (Gilles and Ball,1964).

2.8 GLOBAL ERADICATION CAMPAIGN

The successful eradication of dracunculiasis in the USSR by 1931 (Litvinov,1991) could be described as a first attempt towards eradication efforts. However, the designation of 1981-1990 as the International Drinking Water Supply and Sanitation Decade by International agencies UNDP, UNICEF, WHO and the World Bank provided a unique opportunity for the global eradication of dracunculiasis (WHO,1985a).

The decision to eliminate guineaworm disease within the decade was officially adopted and approved in 1981 by the steering committee for Water Supply and Sanitation Decade and was acknowledged by the 39th World Health Assembly, the same year (Niamey Workshop, 1986). Since the endorsement of this commitment, international meetings such as the one held in Washington D.C. in 1982 and the 1985 national conference held in Kwara State, Nigeria (Muller, 1985b) has sparked off the initiation of eradication programmes in the endemic regions of Asia and Africa.

Hopkins, (1986) stressed need for all endemic countries to seize the opportunity provided by the water Supply and Sanitation Decade to eradicate dracunculiasis by drawing up plan of action against dracunculiasis. All countries are expected to use a combined strategy of health education, provision of safe water, chemical treatment of contaminated water sources and active surveillance. Prior to designation of Water Supply and Sanitation Decade, India had already embarked on an eradication programme in 1979 using the following strategies: case search operation conducted twice a year on simultaneous basis in endemic states, provision and maintenance of safe water supply, chemical treatment of drinking water sources and health education (Hopkins, 1986).

The total number of cases in the six endemic states declined from 39,792 in 1984 to 14,296 in 1987 and it appears that the disease may possibly be eradicated by 1990 (Hopkins, 1988).

Pakistan launched her eradication campaign in 1987 with aim of eradicating the disease by the end of 1990 (Hopkins and Ruiz-Tiben, 1991). The number of cases fell from approximately 2,400 in 1987 to 1,110 in 1988, to 534 in 1989 and to 160 in 1990 (Kappus et al, 1991). With introduction of case containment strategy with objective of maximizing the effectiveness of surveillance and control efforts, and ending transmission of dracunculiasis, Pakistan may have well met it's target of eradication by 1990(Kappus et al., 1991).

Similar campaigns have cropped up in Africa. International and private donor agencies such as the Carter Global 2,000 are giving moral, technical and financial support towards the eradication campaigns in those countries that have initiated eradication programme(Hopkins, 1988). Already, three regional Workshops; in Niamey, Niger, 1986; in Accra, Ghana, 1988 and in Yamoussoukro, Cote d'Ivoire, 1990 have been held with the help of such agencies.

The Niamey workshop was aimed at assisting African endemic countries to review baseline data for necessary action surveillance, to clarify the extent of the disease and its adverse socio-economic impact, to review the various intervention measures and strategies available for guineaworm control and their relative cost effectiveness and identify areas in which specific research is required (Niamey Workshop, 1986). The Accra Workshop was aimed at assessing the progress made in the implementation of the recommendations of the Niamey Workshop, to review the current status of dracunculiasis and projects for its control as part of the Primary Health Care (PHC), and Water Supply and Sanitation projects; to facilitate the formulation and development or the strengthening of national plans of action in all endemic countries and to help mobilize public and international support for the elimination of dracunculiasis (Accra Workshop, 1988). The Yamaussoukro conference was a follow-up to Accra Workshop (Guineaworm Report, 1990b).

Already most of the endemic countries notably Ghana, Burkina Faso, Benin, Cameroun, Mali and Nigeria have put in place machineries for the eradication of dracunculiasis (WHO, 1989). In Nigeria, following the resolution passed at the National Conference on dracunculiasis in Ilorin, in 1985,

the National Council of Health declared guineaworm disease as an officially reportable disease in 1988 and sets 1995 as the target date for the elimination of the disease (WHO, 1989). An agreement had since been entered with Carter Global 2,000 and Bank of Credit and Commerce International(BCCI) in order to achieve the set target (Ransome-Kuti, 1989). This led to the birth of the Nigeria Guineaworm Eradication Programme (NIGEP) with national task force and branches in all the states of the federation and Abuja, the Federal Capital (Guineaworm Report, 1988). The main thrust of the campaign is to eliminate the disease through health education, provision of safe drinking water to all guinea-worm endemic villages and active surveillance (Hopkins, 1989).

The first active case search conducted in 1988-89 transmission season in about 6000 villages revealed about 0.7 million cases (WHO, 1989). Two other case search have been conducted by the end of 1990 (Guineaworm Report, 1990b). Reports so far revealed some degree of success and it is hoped that the following states: Akwa Ibom, Bauchi, Bendel, Cross Rivers, Gongola, Kaduna, Kano, Katsina, Plateau and Rivers; Abuja the Federal Capital may record zero cases by the end of 1991(Guineaworm Report, 1990a).

CHAPTER THREE

3.0 MATERIALS AND METHODS

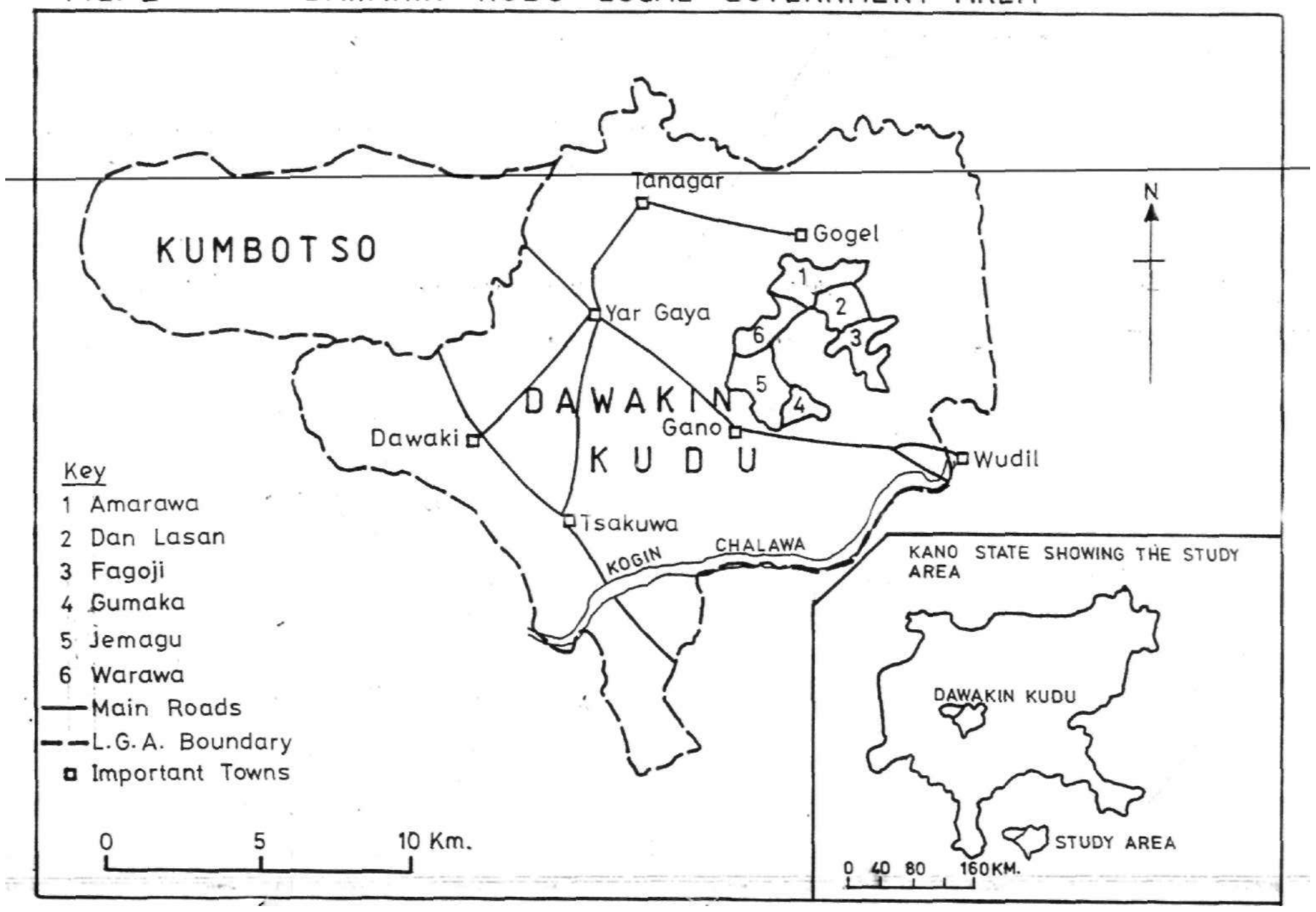
3.1 THE STUDY AREA

Kano State is located in the extreme north central part of Nigeria. Dawakin-Kudu district is located in former Dawakin-Kudu Local Government area (LGA) which then comprised Kumbotso and Dawakin-Kudu districts. The LGA is located about 22km east of the state capital, Kano. The six villages where the research was conducted are in Dawakin-Kudu district (figure 2).

According to the 1988 Primary Health Care (PHC) Survey former Dawakin-Kudu LGA has an estimated population of about 283,977 people. Dawakin Kudu district has an estimated population of about 201,146 inhabitants. The six villages where the study was conducted have an estimated population of about 11,721 people residing in about 1,421 households. The villages are located close to another. With exception of Gumaka each of the villages consist of two or more hamlets. Some of the villages/hamlets have scattered type of settlement.

The main occupation of the people is farming, but they also engage in others such as animal rearing, weaving, trading, hunting, blacksmithing etc. The types of animals kept include cattle, goats, sheeps, donkeys, cats, horses, dogs, chickens, guineafowls, ducks and pigeons. The inhabitants are Hausa and Fulani, and Islam is the only religion practised by the people.

FIG. 2 DAWAKIN KUDU LOCAL GOVERNMENT AREA



The sources of drinking water and other domestic purposes in the villages include boreholes, wells, ponds, "rapuzai" and earthdams. There is no electricity. Only one village, Jemagu had recently been provided with a health clinic. However, there are two dispensaries in the neighbouring villages.

The mean annual rainfall is about 1000mm. However, variation have been recorded from year to year. The mean annual temperature is 26°C, but the mean monthly range is between 21°C in the coolest months (December/ January) and 31°C in the hottest months (April/May). The duration of sunshine ranges between 6.0h/d to 9.8h/d with a mean annual of 8.5h/d. The relative humidity range is between 23% to 79% with a mean annual of 50%.

The area has four seasons: dry and cool ("Kaka") starts around mid-November and ends in Febuary; dry and hot ("bazara") is a short transitional period between Harmattan and wet seasons which occurs from Febuary to April; wet and warm season starts in May and ends in mid September and dry and warm season ("rani") begins at the end of rains and ends in about mid-November (Olofin, 1987).

3.2 METHOD OF SURVEY

A total of six villages reported to have substantial number of cases of dracunculiasis by the local government officials of the Nigeria Guineaworm Eradication Programme (NIGEP) were selected. Three of the villages namely; Jemaau, Warawa and Dan-Iasan had been provided with handpumps 2-4 years ago as part of the intervention programme before the commencement of the study. However, some hamlets located far away from these villages rarely make use of these pumps, instead they rely on other water sources. The remaining villages of Gumaka, Amarawa and Fagoji depend on ponds, wells, earthdams and "raguzai" for their water supply.

With the cooperation of the personnel of the local health authority, village and hamlet heads a house to house search of active guineaworm cases was conducted among humans and domesticated animals population of the six villages. The survey was carried out between April, 1990 to Febuary, 1991 which made it possible to record all the guineaworm cases during the transmission season.

A questionnaire directed against all households and all infected individuals was prepared and administered in the villages. With regard to households, it covered such questions as family size, number infected per family size,

age groupings in the family, number previously infected in the family, health measures practiced (boiling and filtering of water) in the household and the type(s) of water sources obtained for drinking in the family. It also covered the types of domesticated animals kept, their number and the number infected in a household.

In the case of an infected individual, the questions bothered on age, sex, marital status, history of previous infection, number of worms emerging, site of emergence which is categorized into upper limbs which include trunk and head, lower limbs which include buttocks and both limbs period of incapacity, whether disabled or not, knowledge of how the disease is transmitted and the treatment sought. Period of incapacity was purely based on the number of days an infected individual could not do his/her normal work example farming or performing house-chores as a result of guineaworm infection. Disablement was regarded as a situation where a person lost an organ or becomes deformed due to guineaworm infection.

The head of a household or if absent another adult was interviewed to give information about the whole household. The interview was conducted in the local language, Hausa (See appendix A).

A case of dracunculiasis was defined as the emergence of at least one female worm on the subject, the presence of pre-emergent adult worm seen or palpated on the subject and reliable history of the clinical features of guineaworm by the patient or by a grown up if the patient was a minor (Steib and Meyer, 1986). In case of animals dracunculiasis was defined as the emergence of at least one female worm from the body of the animal.

3.3 EXAMINATION OF WATER SOURCES FOR THE PRESENCE OF CYCLOPOID COPEPODS

During the same period, a search for cyclopoid copepods in the various water bodies in the six villages was conducted. The various water sources being used as sources for drinking and other purposes were identified and categorized into either handpumps, wells(concrete with or without raised mouth and none-concrete with or without raised mouth), ponds, earthdams and "raguzal". Of all these the "raguzal" are less familiar (Plates 1 and 2). They are well-like water bodies usually dug in marshy areas or near water run-offs.

Plate 1: Shows one of the 'ruguzai' examined
for the presence of cyclopoid copepods.



Plate 2: A 'ruguji' showing the part containing water.



They may be between one to four metres deep and the mouth as much as two metres or more wide. At times stair case are constructed which enables a person to move close to or enter right inside in order to fetch water. About half of the water bodies were randomly selected and examined for the presence of cyclopoid copepods.

About five litres of the water sample was taken from each of the selected water bodies with the aid of a bucket. It was first passed through a seive of mesh size 3mm to strain off the larger animals (tadpoles, insects) and pieces of plants. The sample was then passed through a plankton net of mesh size 75μm. This proved sufficient to retain all the developmental stages of cyclopoid copepods (Stelb and Meyer, 1986). All the developmental stages were concentrated into a small cylinder attached to the tapering bottom of the net. The content was then emptied into labelled sample bottles containing 5% formalin and transferred to the laboratory for subsequent examination and identification.

3.4 IDENTIFICATION OF CYCLOPOID COPEPODS

The content of each sample bottle was emptied into a petridish. It was examined under low powered microscope for the presence of cyclopoid copepods. The cyclopoid copepods were identified using various keys - Vande-Velde, 1984; Jeje, 1987 and Dussart, 1974. Slides were then prepared using glycerine as a mounting agent.

3.5 DATA ANALYSIS

The data generated was processed using a Computer to establish the relationship between infection and variables such as age, sex, occupation, history of previous infection, water sources usage, treatment sought and knowledge of how the disease is contracted. The proportion of number of worms emerging at a time and site of emergence among infected individuals was calculated. The proportion of the type of health education measures undertaken by households was calculated. Parameters such as chi-squared, oddsratio and confidence interval were calculated in order to find out the degree of association between (i) lack of handpump and guineaworm infection and (ii) different water sources used by the people and guineaworm infection.

CHAPTER FOUR

4.0 RESULTS

4.1 PREVALENCE SURVEY

An overall prevalence of 75 persons per 1000(7.5%) of active guineaworm cases were recorded in the entire population of the six villages (Table,1). Gumaka village had the highest prevalence of 237 persons per 1000(23.7% followed by Amarawa with an infection rate of 169 persons(16.9% per 1000. Fagoji village had the lowest prevalence, 7 persons per 1000(0.7%).

The prevalence of the disease among the hamlets showed that Jigawa had the highest, 329 persons per 1000(32.9%) while Wangara, Asabarawan Yamma and Karchawa had no cases. The disease was prevalent in all the hamlets that make up Amarawa, Dan-Lasan and Jemaru villages.

The prevalence of the disease according to family size in the entire villages revealed that a family size of four had the highest prevalence of 147 persons per 1000 (14.7%) while family size of one, twenty eight, thirty-five and thirty seven had no cases.

The infection rate pattern in relation to the presence or absence of handpumps revealed that those group of villages without handpumps (with exception of Fagoji) had higher prevalences than those group with handpumps(Table,2).

TABLE 1: PREVALENCE OF DRACUNCULIASIS IN HAMLETS/VILLAGES

Village	Hamlet	Population	Number of Infected	Rate Infected/ 1000
Gumaka	-	333	79	237.0(23.7%)
Fagoji	Fagoji	737	11	15.0(1.5%)
	Bulun	237	1	4.0(0.4%)
	Wangara	701	0	0.0(0.0%)
Village	Total	1675	12	7.0(0.7%)
Amarawa	Amarawa	406	46	113.0(11.3%)
	Badabaki	347	32	92.0(9.2%)
	Cinkilawa	261	7	27.0(2.7%)
	Dagazawa	862	110	128.0(12.8%)
	Jigawa	753	248	329.0(32.9%)
Village	Total	2629	443	169.0(16.9%)
Dan-Iasan	Dan-Iasan	448	2	4.0(0.4%)
	Sabon Gari	378	1	3.0(0.3%)
	Jumar Fulani	589	41	70.0(7.0%)
	Yangurge	375	3	8.0(0.8%)
	Sankiyawa	191	20	145.0(14.8%)
	Dangawa	126	1	8.0(0.8%)
	Iyatawa	432	64	148.0(14.8%)
Village	Total	2539	133	52.0(5.2%)

Warawa	Asabarawan Yamma	91	0	0 (0.0%)
	Karchawa	388	0	0(0.0%)
	Asabarawan Gabas	398	7	18(1.8%)
	Yan-daci	450	52	116(11.6%)
	Warawa	741	1	1(0.1%)
Village	Total	2068	60	29(2.9%)
Jemaau	Yan-laya	212	5	24(2.4%)
	Maboyi	280	4	14(1.4%)
	Jemaau	1985	144	73(7.3%)
Village	Total	2477	153	62(6.2%)
Overall Total		11,721	880	75(7.5%)

TABLE 2: PREVALENCE OF DRACUNCULIASIS IN VILLAGES WITH OR WITHOUT HANDPUMPS

Village	Handpump	Population	Number Infected	Rate infected 1000
Dan-Iasan	Present	2539	133	52(5.2%)
Warawa	Present	2068	60	29(2.9%)
Jemagu	Present	2477	153	62(6.2%)
Total		7084	346	48(4.8%)
Gumaka	Absent	333	79	237(23.7%)
Fagoji	Absent	1675	12	7(0.7%)
Amarawa	Absent	2629	443	169(16.9%)
Total		4637	534	115(11.5%)

The villages with handpumps - Dan-Lasan, Warawa and Jemagu have an overall prevalence of 48 persons per 1000(4.8%) while those without handpumps - Gumaka, Fagoji and Amarawa have an overall prevalence of 115 persons per 1000(11.5%).

The odd ratio and 95% confidence interval (CI) values obtained indicated a positive association between lack of handpump and guineaworm infection (Table,3). The X^2 analysis ($P \leq 0.001$) showed the association to be highly significant.

The age specific prevalence in the six villages as shown in Table,4 revealed that the 20-29 year age-group had the highest prevalence of 90 persons per 1000(9.0%) while 0-4 year age group had the lowest, 7 persons per 1000(0.7%). The pattern of the age specific prevalence rate increases with age upto 3rd decade of life and then begins to drop down in the 4th decade of life. The X^2 analysis ($P<0.02$) showed the difference in the prevalence to be highly significant among the different age groups.

The farming population have the highest number of cases in the entire population of the villages followed by the housewives (Table,5). The overall prevalence based on previous infection in the six villages was 518 persons

TABLE 3: ANALYSIS OF THE RELATIONSHIP BETWEEN GUINEAWORM INFECTION AND PRESENCE OR ABSENCE OF HANDPUMP

Lack of Handpump	Guineaworm infection		Total	Odd Ratio	Confidence Interval(CI)	X^2
	Present	Absent				
Yes	534	4103	4637	2.53	0.136-0.146	177.5 (P<0.00
No	346	6738	7084			
Total	880	10841	11,721			

TABLE 4: AGE SPECIFIC PREVALENCE OF DRACUNCULIASIS IN THE SIX VILLAGES

Age group in years	Population	Number infected	Rate Infected/ 1000.	X^2
0 - 4	1001	7	0.7(0.7%)	5.926
5 - 9	1461	105	7.2(7.2%)	0.217
10 - 19	2696	208	7.7(7.7%)	0.168
20 - 29	3240	292	9.0(9.0%)	10.681
30 - 39	1589	136	8.6(8.6%)	2.557
40 - 49	892	75	8.4(8.4%)	1.033
50 - 59	577	42	7.2(7.2%)	0.042
60 - 69	163	10	6.1(6.1%)	0.428
70+	102	5	4.9(4.9%)	1.023
Total	11,721	880	7.5(7.5%)	15.844

X^2 = 15.844 DF = 9 - 1 = 8 $0.05 < P < 0.02$

TABLE 5: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS BY OCCUPATION IN THE SIX VILLAGES

Occupation	Number Infected	Percentage Infected
None	11	1.3
Farming	310	35.2
Trading	2	0.2
Housewife	267	30.3
Schooling(Westerm)	105	11.9
Schooling(Arabic)	104	11.8
Farming/Rearing	51	5.8
Farming/Trading	3	0.3
Farming/Weaving	16	1.8
Farming/Village Head	1	0.1
Farming/Schooling(Western)	7	0.8
Farming/Schooling(Arabic)	2	0.2
Farming/Hamlet Head	1	0.1
Total	880	99.9

per 1000(51.8%). Jemagu village had the highest infection rate of 852 persons per 1000(85.2%) while Fagoji had the least, 63 persons per 1000(6.3%). The pattern varied among hamlets, with Jemagu having the highest prevalence of 987 persons per 1000(98.7%) while Wangara had no infection (Table,6).

Of the 880 current cases, 509(57.8%) were recurrent while 371(42.2%) had the infection for the first time. The infection in all the villages except Amarawa showed that more than 50% of the cases were recurrent (Table,7). The same pattern was maintained in most hamlets.

The prevalence according to water sources (Table,8) showed higher prevalence rate of 328 persons per 1000 (32.8%) among users of "Ruguzal"/well while the lowest prevalence of 11 persons per 1000(1.1%) was among users of well. The pattern in figure 4 revealed the following in order of increasing prevalence; 2 10 6 3 5 4 1 8 11 7 9. It appeared that users of "Ruguzal"in combination with other water sources with exception of users of "Ruguzal"/earthdam/well have higher prevalence than users of handpump in combination with other water sources with exception of users of Pond/ handpump/well/earthdam.

Those who depended on single water sources generally had lower prevalences than those who depended on more than one sources. Of the single water sources users, the pond users had the highest prevalence of 96 persons per 1000

TABLE 6: REPORTED PREVIOUS CASES OF DRACUNCULIASIS IN THE HAMLETS/VILLAGES

Village(s)	Hamlet(s)	Population	Number Previously Infected	Rate of Previous Infection/1000
Gumaka	Gumaka	333 (333)	277 (277)	832 (832‰)*
Fagoji	Fagoji	737	93	126(12.6‰)
	Bulun	237	13	55(5.5‰)
	Wangara	701 (1675)	0 (106)	0 (0.0‰) (63.0‰)*
Amarawa	Amarawa	406	348	610(61.0‰)
	Badabaki	347	23	66 (6.6‰)
	Cinkilawa	261	49	188(18.8‰)
	Dagazawa	862	800	928(92.8‰)
	Jigawa	753 (2629)	363 (1583)	483(48.3‰) (60.0‰)*
Dan-Iasan	Dan-Iasan	448	166	371(37.1‰)
	Sabon Gari	376	115	304(30.4‰)
	Jumar-Fulani	589	334	567(56.7‰)
	Yangurge	375	58	304(30.4‰)
	Sankiyawa	191	100	524(52.4‰)
	Dangawa	126	19	151(15.1‰)
	Iyatawa	432 (2539)	363 (1155)	840(84.0‰) (45.5‰)*
Warawa	Asabarawan Y.	91	2	22(2.2‰)
	Karachawa	388	25	64(6.4‰)
	Asabarawan G.	298	215	543(54.3‰)
	Yandaci	450	268	818(81.8‰)
	Warawa	741 (2068)	235 (846)	317(31.7‰) (40.9‰)*

- Figures in bracket in columns 3 & 4 are totals.
* ( ) are village percentages.

Jemagu	Yan-laya	212	81	382 (38.2%)	
	Maboyi	280	69	246 (24.6%)	
	Jemagu	1985 (2477)	1960 (2110)	989 (98.9%)	(85.2%)*
Overall Total		(11721)	(6077)	518 (51.8%)	

- **Figures in bracket** in columns 3 & 4 are totals.

* ( ) are village percentages.

TABLE: 7: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS BY PREVIOUS INFECTION AND FIRST TIME INFECTION

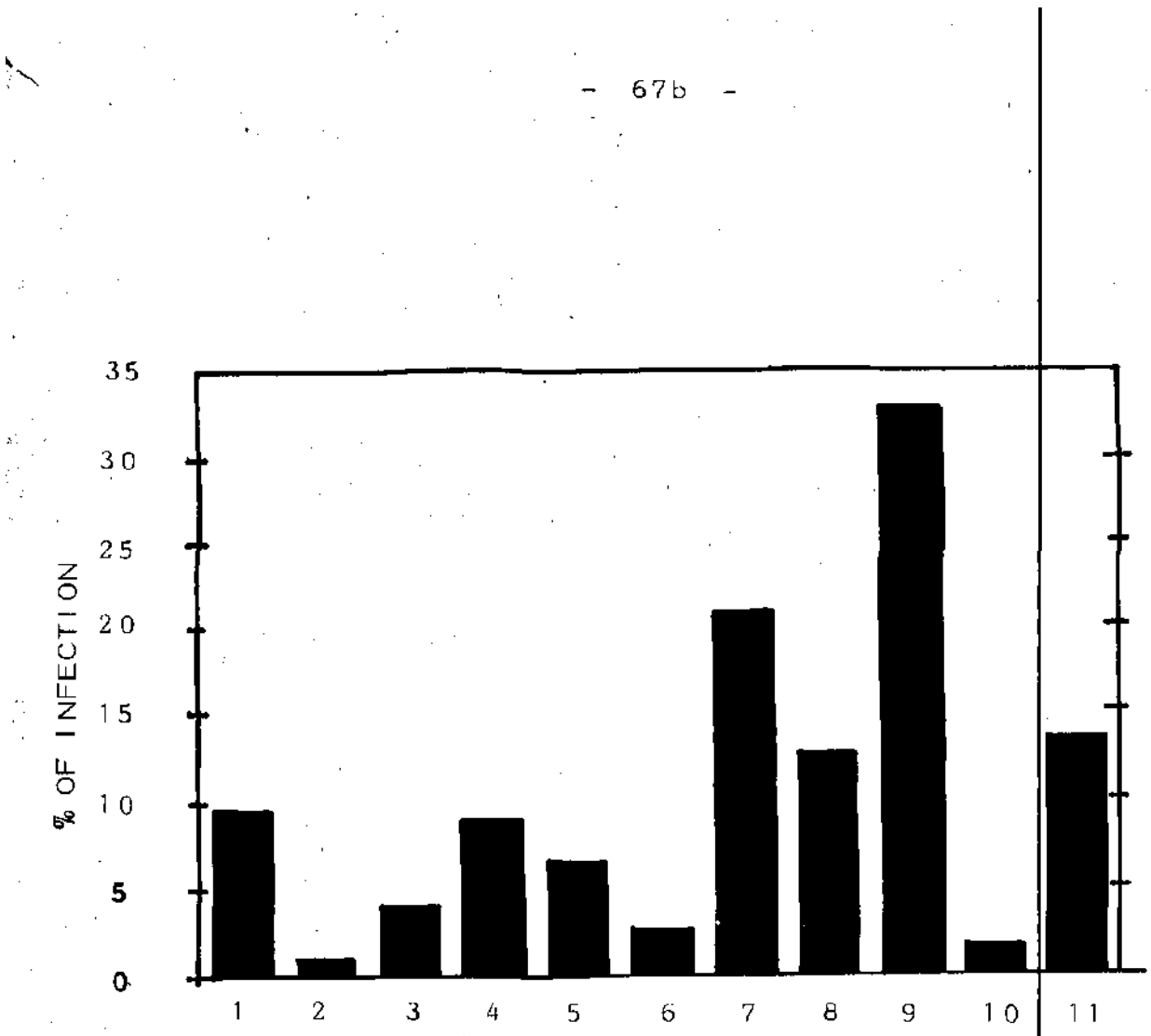
Village	Hamlet	Number of Currently Infected	Number of previously and currently infected	Number infected for the first time
Gumaka	-	79	46 (58.2)*	33(41.8)*
Fagoji	Fagoji	11	9 (81.8)	3(18.2)
	Bulun	1	0 (0.0)	1(100.0)
	Wangara	0	0 (0.0) *(75.0)	0(0.0) *(33.3)
Amarawa	Amarawa	46	43 (93.5)	0 (6.5)
	Badabaki	32	1 (3.10)	31 (96.9)
	Cinkilawa	7	5 (71.4)	2 (28.6)
	Dagazawa	110	98(89.0)	12 (11.0)
	Jigawa	248	44(17.7) *(43.1)	204 (82.3) *(56.2)
Dan-Lasan	Dan-lasan	3	3(100.0)	0 (0.0)
	Sabon-gari	1	1(100.0)	0 (0.0)
	Jumar Fulani	41	39(95.1)	2 (4.9)
	Yangurge	3	1(33.3)	2(66.7)
	Sankiyawa	20	16(80.0)	4(20.0)
	Dangawa	1	1 (0.0)	1(100.0)
	Ilyatawa	64	56(87.5)*(87.2)	8(12.5) *(12.8)
Warawa	Asabarawan Yamma	0	0(0.0)	0.(0.0)
	Karchawa	0	0(0.0)	0 (0.0)
	Asabarawan Yamma	7	5(71.4)	2(28.6)
	Yandaci	52	47(90.4)	5(9.6)
	Warawa	1	0(0.0) *(86.0)	1(100.0)*(13.3)
Jemagu	Yan-laya	5	3(60.0)	2 (40.0)
	Maboyi	4	4(100.0)	0 (0.0)
	Jemagu	144	134 (93.0) *(92.2)	10 (6.9) *(7.8)
Overall Total		880	509 (57.8)	371 (42.2)

Note: (i) Figures in bracket are percentages

(ii) *( ) Village percentages

TABLE 8: GUINEAWORM INFECTION BY WATER SOURCES USED IN THE VILLAGES

	Pond	Well	Handpump	Pond/Well	Pond/Handpump	Pond/Well/Handpump	Pond/Handpump/Well/Earthdam	Pond/Well/Earthdam	"Paguzal"/Well	"Paguzal"/Earthdam/Well	Pond/Well/"Paguzal"	Total
Yess	51	19	3	100	152	40	9	50	251	20	175	880
No	478	1645	712	1102	2145	1428	34	341	551	1242	1199	10841
Total	529	1664	715	1212	2297	1468	43	391	766	1262	1374	11721
Percentage of Infection/1000	96 (9.6%)	11 (1.1%)	42 (4.2%)	91 (9.1%)	66 (6.6%)	27 (2.7%)	209 (20.9%)	128 (12.8%)	328 (32.8%)	16 (1.6%)	127 (12.7%)	75 (7.5%)
Odd Ratio	9.2	--	0.36	8.6	6.1	2.4	22.9	12.7	42.2	1.4	12.6	8.1
Confidence Interval(C.I)	1.7-27	--	0.1-2.5	1.7-27	1.3-23	0.3-1.4	2.2-38	2.1-32	0.54-0.14	2.2-32	2.71-3.14	
Chi-Squared (X^2)	3.5	97.0	52.0	4.3	2.6	48.3	10.4	15.7	625	63.6	54.3	976.7



WATER SOURCE

1. POND
2. WELL
3. HANDPUMP
4. POND/ WELL
5. POND/ HANDPUMP
6. POND/ WELL/ HANDPUMP
7. POND/ WELL/ HANDPUMP/ EARTHDAM
10 WELL/ RUGUZAI/ EARTHDAM
8. POND/ WELL/ EARTHDAM
9. RUGUZAI/ WELL
11 POND/ WELL/ RUGUZAI

(9.6%). The calculated odd ratios using well as a basis for comparison indicated that there was association between guineaworm and all the water sources with exception of handpump. The established confidence interval (CI) also revealed positive association between guineaworm infection and all the water sources with exception of handpump, pond/well/handpump and /Ruguzal"/earthdam/well. The Chi-squared analysis ($P<0.001$) showed the difference of guineaworm infection between all the water sources to be highly significant.

Of the 880 infected individuals, 345(39.2%) had only one worm emerging at a time while 4(0.5%) had nine worms emerging at a time (Table,9). The highest number of worms emerging per individual recorded was twenty at a time. About 793(90.1%) of the infected persons had the worms emerging from the lower limbs as shown in plates 3 and 4. 18(2.0%) from the upper limbs as shown in plate 5 and 69 (7.8%) from both upper and lower limbs (Table,10). Worms were found to emerge from the genital areas and the breast during the survey.

The prevalence of the disease among domesticated animals (four legged) surveyed was very low (Table,11). Of the 31,722 animals surveyed only 2(0.006%) were infected. The infection was found in a cat and donkey (Plate 6). However, seven animals comprising 3 donkeys and 4 cats were reported to be previously infected.

TABLE 9: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS BY NUMBER OF WORMS EMERGING PER INDIVIDUAL IN THE SIX VILLAGES

Number of Worms Emerging/Individual	Number of Infected Individuals	Percentage of Number of Worms emerging per Individual
1	345	39.2
2	247	28.1
3	129	14.7
4	59	6.7
5	41	4.7
6	11	1.3
7	14	1.6
8	7	0.8
9	4	0.5
10	13	1.5
11+	10	1.2

TABLE 10: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS BY SITE OF OF EMERGENCE IN THE SIX VILLAGES

Site of Emergence	Number Infected	Percentage
Lower limb	793	90.1
Upper limb	18	2.0
Both Upper and Lower limbs	69	7.8
Total	880	99.9

TABLE 11: PREVALENCE OF DRACUNCULIASIS IN ANIMALS IN THE SIX VILLAGES

Types of Animals	Number of Animals	Number Infected	Percentage Infected	Number Previously Infected
Sheep	9468	0	0.00	0
Cat	875	1	0.11	4
Goat	13601	0	0.00	0
Donkey	1267	1	0.08	3
Dog	35	0	0.00	0
Horse	7	0	0.00	0
Cow	6469	0	0.00	0
TOTAL	31.722	2	0.06	7



Plate 4: An infected individual with a worm emerging near his ankle.



Plate 5: An infected individual with three Guineaworm ulcers on the stomach.

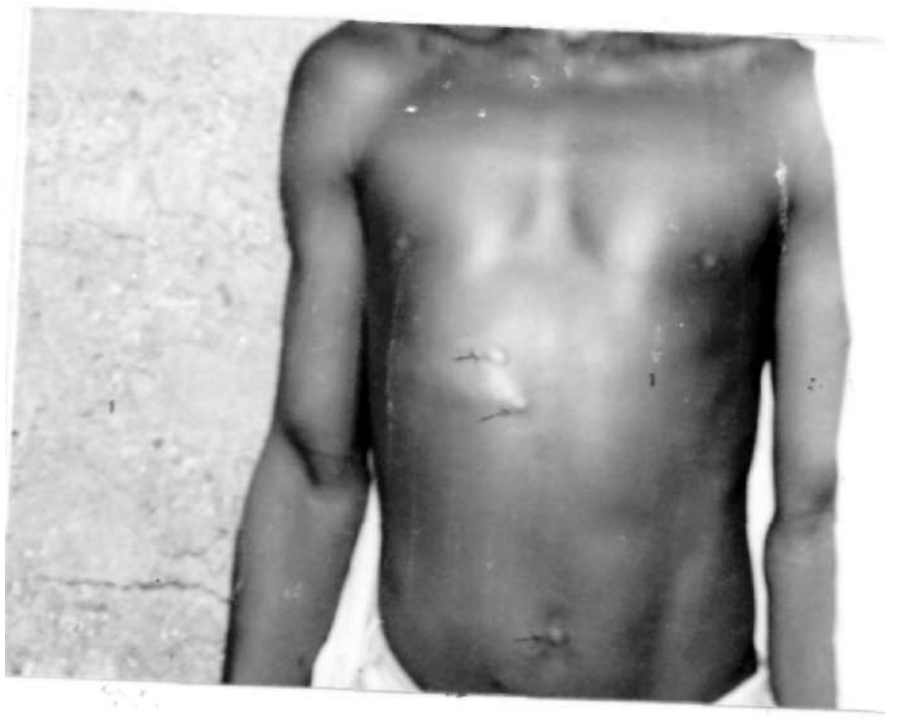


Plate 6: An infected donkey



4.2 IMPACT OF DRACUNCULIASIS IN THE VILLAGES

Attempt was made to determine the impact of the disease in terms of the period of incapacity (man-day loss) and the number disabled due to guineaworm infection (Table 12 and 13) respectively. The disease was found to incapacitate individuals between a period of one week to over eleven weeks. The degree of incapacity was more among those whose ulcer had bacterial infection (Plate,7). All together it was estimated that 21,595 man days were lost in the six villages. On the average it was found out that a farmer produces about twenty sacks of both millet and guineaworm. A sack of either millet or guineaworn cost about three hundred naira (₦ 300=). An individual afflicted with guineaworm may loose upto half of his annual harvest which amounts to three thousand naira (₦3,000). In addition, he has to pay for hired labour and the daily cost of this amounts to forty five naira (₦45=). Therefore, when the number man-days lost (21,595 days) in the villages were to be translated into money paid for hired labour it amounts to about nine hundred and seventy one thousand seven hundred and seventy five Naira (N971,755=). Of the 880 cases 17(1.9%) were disabled.

TABLE 12: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS BY PERIOD OF OF INCAPACITY IN WEEKS IN THE SIX VILLAGES

Period of Incapacity in Weeks	Number of Persons Infected	Number of Man-days Lost
One	90	630
Two	151	2114
Three	150	3150
Four	134	3752
Five	-	0
Six	37	1554
Seven	-	0
Eight	68	3808
Nine	-	0
Ten	5	350
Eleven and above	81	6237
Total	880	21,595

TABLE 13: DISTRIGUTION OF CASES OF DRACUNCULIASIS BY NUMBER OF DISABLEMENT IN THE SIX VILLAGES

Village	Number Infected	Number Disabled	Percentage of Disablement
Gumaka	79	1	1.3
Fagoji	12	1	8.3
Amarawa	443	6	1.4
Dan-Lasan	133	3	2.3
Warawa	60	2	1.6
Jemagu	153	2	1.3
TOTAL	880	17	1.9

Plate 7: An infected individual with Guineaworm ulcer that degenerated into a secondary bacterial infection.



4.3 HEALTH EDUCATION MEASURES AND GUINEAWORM INFECTION

Of the 880 infected individuals 464(52.7%) were aware of the mode of transmission (Table14). The level of awareness ranged from 67(84.8%) in Gumaka village to 180(40.6% in Amarawa village. Very few of the infected persons sought western medicine (Table 15). majority 788(89.5%) depended on traditional medicine. The most commonly sought traditional medicine is "Sakiya". This is a process whereby a red-hot iron with a pointed end is used in puncturing the guineaworm ulcer. Only 2(0.2%) depended on western medicine while 74(8.4%) on both traditional and western medicines. 14(1.6%) did not treat the disease at all.

Of the 1,421 households visited 1,357(95.5%) claimed that they had never filtered their drinking water, 51 (3.6%) did so sometimes and only 3(0.2%) did so always. All the households visited said that they have not been provided with any filtering material, but use a piece of cotton or nylon cloth if at all they do filter their drinking water. All the 1,421 households had never boil their drinking water (Table 16). However, households admitted being advised by the NIGEP officials or through the radio to filter or boil their drinking water. The reasons given for none compliance with instructions especially with regard to boiling and filtering are lack of time to do so, large size of the family, change of taste of water after boiling and the belief by some that the disease is simply an act of the Almighty God.

TABLE 14: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS ACCORDING TO WHETHER A PATIENT IS AWARE OF HOW THE DISEASES IS CONTRACTED OR NOT

Village	Number Infected	Knowledge of how the disease is contracted	
		YES	NO
Gumaka	79	67 (84.8)	12 (15.2)
Fagoji	12	9 (75.0)	3 (25.0)
Amarawa	443	180 (40.6)	263 (60.4)
Dan-Lasan	133	74 (55.6)	59 (45.4)
Warawa	60	39 (65.0)	21 (45.0)
Jemagu	153	95 (62.1)	58 (37.9)
TOTAL	880	464 (52.7)	416 (47.3)

*Figures in bracket are percentages

TABLE 15: DISTRIBUTION OF CURRENT CASES OF DRACUNCULIASIS ACCORDING TO TREATMENT SOUGHT BY INFECTED INDIVIDUALS

Village	TREATMENT SOUGHT			
	Modern	Traditional	Both	None
Gumaka	1 (1.3)	68 (86)	3 (3.8)	7 (8.9)
Fagoji	0 (0.0)	10 (83.3)	0.(0.0)	2 (16.7)
Amarawa	0 (0.0)	413 (93.3)	25 (5.6)	3 (0.7)
Dan-Lasan	0 (0.0)	131 (98.5)	2 (1.5)	0 (0.0)
Warawa	0 (0.0)	58 (96.7)	0 (0.0)	2 (3.3)
Jemagu	1 (0.7)	108 (10.6)	44 (28.8)	0 (0.0)
TOTAL	2 (0.23)	788 (89.5)	74 (8. 4)	14 (1.6)

*Figures in bracket are percentages

TABLE 16: PREVENTIVE MEASURES (BOILING AND FILTERING OF DRINKING WATER) TAKEN BY HOUSEHOLD IN THE SIX VILLAGES

Villages	Number of Households	FILTERING			BOILING		
		Never	Sometimes	Always	Never	Sometimes	Always
Gamaka	37	37(100)	0(0)	0(0)	37(100)	0(0)	0(0)
Fagoji	173	173(100)	0(0)	0(0)	137(100)	0(0)	0(0)
Amarawa	297	292(98.32)	5(0.16)	0(0)	287(100)	0(0)	0(0)
Dan-Lasan	350	300(85.7)	47(13.42)	3(0.85)	350(100)	0(0)	0(0)
Warawa	276	264(98.9)	3(1.12)	0(0)	267(100)	0(0)	0(0)
Jemagu	297	291(97.98)	1(0.34)	0(0)	297(100)	0(0)	0(0)
TOTAL	1421	1357(99.5)	51(3.6)	3(0.21)	1421(100)	0(0)	0(0)

*Figures in bracket are percentages

4.4 EXAMINATION OF WATER BODIES AND IDENTIFICATION OF CYCLOPOID COPEPODS

Cyclopoid copepods were found to be present in all the ponds and earthdams examined in the villages (Table 17). Cyclopoid copepods were also found in most of the "Raguzai" examined especially those located in Amarawa village. Although cyclopoid copepods were not recovered from any of the wells examined, some of them were found to contain organisms such as Amoeba, paramecium and euglena. The temporary pools near the handpumps or wells examined contained large number of such organisms but not cyclopoid copepods. Water from the handpumps harboured neither cyclopoid copepods nor any other organism when viewed under the microscope. The Cyclopoid copepods encountered in the study area incidently belong the genus Mesocyclops (Plates 8-11). Some species belonging to the genus are known to serve as vectors of guineaworm in Nigeria.

TABLE 17: RESULTS OF SCREENING OF WATER BODIES FOR THE PRESENCE OF CYCLOPOID COPEPODS IN THE SIX VILLAGES

Village	Type of water sources examined	Number of water sources	Number examined	Presence or absence of cyclopoid copepod
Gumaka	Dam reservoir	1	1	Absent
	Dam	1	1	Present
	Well(concrete type with raised mouth)	2	2	Absent
	Ponds	3	2	Present
Fagoji	Well(concrete type with raised mouth)	2	2	Absent
	Well(non-concrete type with raised mouth)	5	4	Absent
	Ruguzai	6	5	Absent
Dan-Lasan	Handpump	4	4	Absent
	Temporary Pool near handpump	3	3	Absent
	Well(concrete type with raised mouth)	2	2	Absent
	Well(non-concrete with raised mouth)	5	3	Absent
	"Ruguzai"	2	2	Absent
	Ponds	2	2	Absent
Amarawa	"Ruguzai"	10	6	Present
	Earthdam	1	1	Present
	Pond	2	2	Present
	Well(Non-concrete type with raised mouth)	4	4	Absent

Village	Type of water sources examined	Number of water sources	Number examined	Presence or absence of cyclopoid copepod
Warawa	Well(concrete type with raised mouth)	6	5	Absence
	Earthdam	1	1	Present
	Pond	2	2	Present
	Handpump	2	2	Absent
	Temporary Pool near handpump	2	2	Absent
Jemaqu	Handpump	4	4	Absent
	Temporary Pool near handpump	4	4	Absent
	Pond	2	2	Present
	Well(concrete type with raised mouth)	3	3	Absent
	Well(non-concrete type without raised mouth)	1	1	Absent

Plate 8: A female cyclopoid copepod belonging to the genus mesocyclops.

Plate 9: A female cyclopoid copepod belonging to the genus mesocyclops.

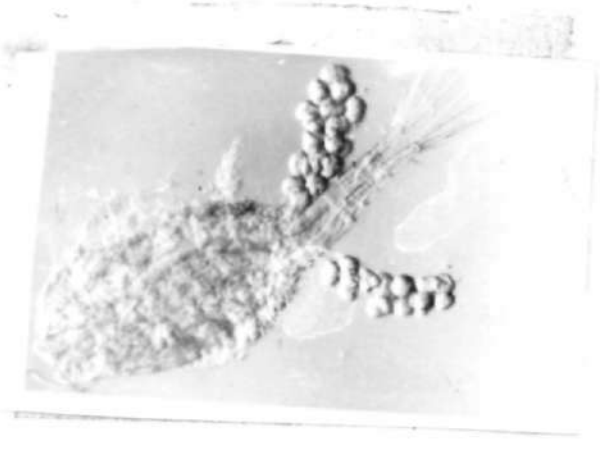
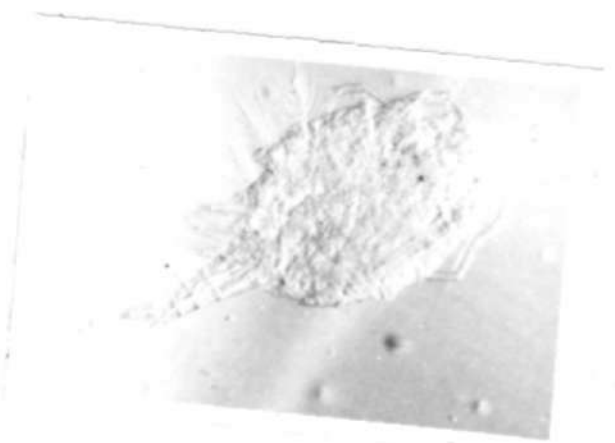
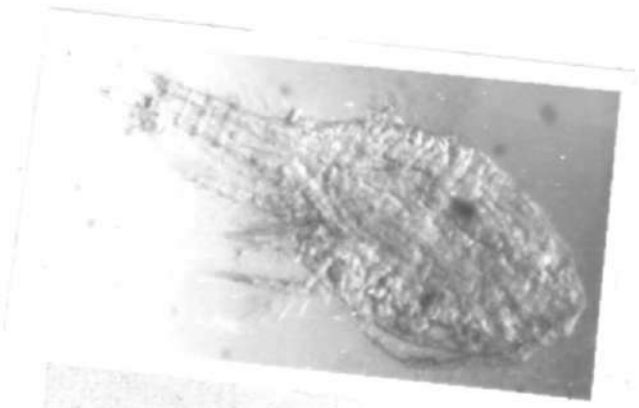




Plate 10: A male cyclopoid copepod belonging to the genus mesocyclops.

Plate 11: A male cyclopoid copepod belonging to the genus mesocyclops.





CHAPTER FIVE

5.0 DISCUSSION

5.1 PREVALENCE SURVEY

Although, Kano State ranked nineth in terms of number of cases during the first case search conducted in 1988/89 (Guineaworm Report 1990a), there has been no detailed epidemiological study of the disease until the present one. The disease was found to be endemic in all the villages, but the level of endemicity varied.

The overall prevalence of 75 persons per 1000 in the entire villages though low when compared with other surveys in sub-saharan areas - 540(48.4%) in Dukku, Bauchi State (Onwulliri et al, 1988-90a), 219(56.6%) in Kiri-Manal village, Sokoto State (Sulelman and Abdullahi; 1988-90) and 201(16.1%) in Ungushi village Sokoto State (Danial and Oslsanya, 1985) is not unexpected. This may be due to the apparent success of the current eradication programme. The highest prevalence obtained in Gumaka village is a reflection of the fact that the inhabitants depended largely on water from ponds. The high infection rate in Amarawa is also because the people depended largely on ponds, earthdams and "Raguzai" for drinking water. All these sources seem to constitute the major sources of transmission in the area. The lowest prevalence obtained in Fagoji could be attributed to the fact that the populace depended mostly on wells for their drinking water. The wells were found to be free from cyclopoid copepods.

The variation in the infection rates among the hamlets was also a reflection of the water sources in use in these hamlets. That could account for why Wangara hamlet had zero infection rate as wells are the major source of drinking water.

The lower prevalence of guineaworm infection in the group of villages with handpumps in relation to the group without suggest that the provision of clean water is a major means of controlling/eradicating guineaworm infection. Similar observations have been reported in endemic communities (Edungbola et al, 1988; Cairncross and Tayeh, 1988). However, the reason why the disease still rages in the villages with handpumps could be due to occasional breakdown, inadequate yield, distance, absence of handpumps in some hamlets, queing and refusal of people to make exclusive use of the handpumps some of which were observed by Cairncross and Tayeh (1988). Distance seems to explain why hamlets like Iyatawa in Dan-Lasan village have high prevalence when compared with other hamlets as they are located far away from the handpumps. This is in addition to the fact that the inhabitants mainly depended on pond and "Raguzal" for their drinking water. The least prevalence recorded in Fagoji eventhough the village is without handpumps could be due to large numbers of protected wells from which the people obtain their drinking water.

The low prevalence of the disease among children under the age of four is consistent with other fundings notably those of Edungbola et al,(1983) and Nwosu et al,(1982). Low degree of exposure, long incubation period of the worm and the destruction of infective guineaworm larvae in the process of boiling children's water with medicinal products prior to ingestion (Edungbola,1983) could account for the low prevalence of guineaworm infection in children.

The overall age-specific prevalence in the six villages revealed an initial increase in the prevalence reaching a peak at the 3rd and 4th decade of life and then falls down, is in agreement with reported patterns in most endemic communities (Nwosu et al,1982; Ugwu and Angela,1988-90; Suleiman and Abdullahi,1988-90; and Onwuliri et al,1988-90 a&b). Similar patterns were observed in the villages. The reason could be due to higher exposure to sources of infection with age. That is why 20-29 year age group are the most infected because of their greater involvement in activities like fetching water, farming, swimming and animal rearing which brings them closer to water bodies that serve as sources of transmission.

The higher number of cases among farmers than any other occupational groups is in agreement with most findings such as those of Onwuliri et al,(1988-90a&b) and Ugwu and Nwaorgu, (1988-90). But, this difference results mainly from increased exposure.

The prevalence of the disease by previous infection showed that a little over half of the population were previously infected at one time or the other in their life time indicating that the disease had been endemic in the villages for quite sometimes. The fact that 509/(57.8%) of those with current infection have had the infection previously suggest the absence of immunity against guineaworm infection.

The high prevalence of the disease among users of pond or "Raguzal" in combination with other water sources suggest that these water bodies constitute the major sources of transmission in the area. This is coupled with the fact that cyclopoid copepods were found in these water bodies. The lower prevalence among well and handpump users coupled with the absence of cyclopoid copepods in them go to confirm the suitability of these water bodies in the control of guinea-worm. Those who claimed to be using well or handpumps exclusively and still had infection could have done so from drinking contaminated water from other sources. The fact that the interview was based on recall it was not possible to reach every member of the family to confirm the information given by the head of the household could account for this.

Although, many of the infected individuals had only one worm emerging at a time, it is not in the line with other studies in West Africa where an over-whelming majority

(over 50%) had only one worm emerging at a time (Ferreira and Lope,1948; Onabamiro,1958; Muller,1969; Litinov,1968 and Abdullahi and Suleiman,1988-90). The lower limbs was found to be the most preferred site of emergence is in agreement with most findings in literature(Kale,1985).

The low prevalence of the disease found in animals is no different from previous findings (Muller,1990). The low rate is probably because animals extract the worms with their teeth (Muller,1979). Although high prevalence was recorded among Otters, Mink and Racoons in Ontario, Canada on dissection (Muller,1972), but prior to this there was only one reported infection (Chitwood,1939). This study confirms the fact that animals could be infected in an endemic area.

5.2 IMPACT OF GUINEAWORM IN THE VILLAGES

Guineaworm was found to incapacitate infected individuals for period of at least a week. Because of the coincindence between the occurrence of the dracunculiasis lesions and the peak agricultural activities and as it affects the 15-45 year age group - the working population it results in fall in food production (Edungbola,1985, Muller,1971a and Robert,1986). This implied that the six villages being agrarian in nature suffered considerable economic loss due to the number of days lost as a result of incapacitation caused by guineaworm infection. It also affects other spheres of life such as school attendance by children, observation of housechores by housewives, rearing of

animals etc some of which were observed by Nwosu et al, (1982). The effect takes its toll by causing permanent disability in some instances renders them completely dependent or severely reduces their full productive capacity.

5.3 GUINEAWORM INFECTION AND HEALTH EDUCATION MEASURES

Health education is one of the measures adopted by endemic countries in Africa and Asia for the eradication of guineaworm disease (Hopkins, 1987). The importance and need for health education in the control/eradication of dracunculiasis in Nigeria have been emphasized (Adesina and Egunjobi, 1985; Daniel and Oslsanya, 1985; Ogunba et al, 1985; Suleiman and Abdullahi, 1986-90 and Ugwu and Nwaorgu, 1988-90). However, embarking on health education campaign may not produce the desired result especially where it requires a change in habit or behaviour of the people.

From the data collected it seems very unlikely that health education had an appreciable impact on the spread of the disease. Although, over 50% of the infected individuals in the six villages knew how the disease is contracted, the awareness was not matched with implementing of measures needed to reduce the risk of infection. Similar observations have been made by Adesina and Egunjobi(1985),

Onwulirl et al(1988-90a), Sulelman and Abdullahl(1988-90) and Ugwu and Nwaorgu(1988-90). The fact that 788(89.5%) of the infected individuals depended on traditional medicine confirms the findings of Nwosu et al,1982) and Onwulirl et al,(1988-90a), that very few infected individuals cared to visit hospital for medication. In fact, the few that obtained Western medication did so when the local government NIGEP officials visited the villages.

5.4 EXAMINATION OF WATER BODIES FOR THE PRESENCE OF CYCLOPOID COPEPODS

The presence of cyclopoid copepods of the genus mesocyclops of which some species have been found to serve as vectors of guineaworm in Nigeria in all ponds and earthdams and most "Raguzai" strongly suggest that these water bodies might be the major sources of transmission in these villages. This confirms the generally held views that ponds constitute the foci for Dracunculus infection in endemic area of the Savannah region of West Africa (Nwosu et al,1982).

SUMMARY AND CONCLUSION

A prevalence survey of dracunculiasis was undertaken between April, 1990 and Febuary, 1991 among humans and animal population in six villages in Dawakin-Kudu district of Dawakin Kudu Local Government Area of Kano State.

An overall prevalence of 75 persons per 1000(7.5%) of active guineaworm cases were recorded among humans. The infection rate varied among the villages with Gumaka having the highest of 237 persons per 1000(23.7%) while Fagoji had the lowest of 7 persons per 1000(0.7%).

The prevalence rate among the group of villages with handpumps was significantly lower than those without handpumps($P<0.001$). The overall age-specific prevalence in the six villages showed an initial increase with age reaching a peak in the 3rd and 4th decade of life with 20-29 year age group having the highest infection rate of 90 persons per 1000(9.0%) while those below the age of five the lowest, 3 persons per 1000(0.3%). The overall pattern of age specific prevalence rate in the six villages varied slightly from that of individual villages ($P<0.02$).

The farming population were found to have more cases than any other occupational group. Over 50% of the population of the six villages have had the infection previously, thus indicating that the disease had been endemic for quite sometime in the area. In all the villages except Amarawa

a little over 50% of the cases recorded were recurrent which stronaly suggest the absence of immunity against guineaworm infection.

The higher prevalence recorded among users of ponds or "Raguzai" in combination with other water sources go to confirm that these water bodies are the major sources of transmission. This is in addition to the fact that cyclopoid copepods were recovered from them. The lower prevalence among users of handpumps or wells alone or in combination with other water sources coupled with the fact that they were found to be free of cyclopoid copepods brings out their suitability in control/eradication of guineaworm infection. About 345(39.2%) of the infected individuals had only one worm emerging at a time. While about 90.1% of the infected patients had the worms emerging from the lower limbs.

The prevalence of the disease was found to be very low among animals, 2(0.006% . Only seven animals were reported to have previously been infected.

In terms of man-day loss, altogether 21,595 man-days were lost in the six villages while 17(1.9%) of infected individuals were disabled.

The health education was found to have made little impact on the spread of the disease as very few of the households filtered their drinking water while no house-

hold in the area boiled their drinking water. A vast majority 788(89.5%) of the infected patients depended on traditional medicine. However, 464(52.7%) of the infected individuals were aware of the mode of transmission of the disease.

Cyclopoid copepods were recovered from all the ponds and earthdams examined. So also in most of the "Ruguzai" examined. This confirm their involvement in the transmission of guineaworm in the village.

My findings shows that provision of boreholes is capable of checking guineaworm infection, but for the problem of maintenance and is expensive it may not be the best option. But the provision of well protected wells in these rural areas is the most ideal. It is without the maintenance problem and is less expensive as is the case with handpumps.

The health education aspect should be more aggressive and persistent especially during transmission seasons for it to be effective. The provision of filtering devices will go along way in encouraging compliance. The prompt dressing of ulcers will reduce contamination of water sources.

The treatment of water bodies with cyclopsicides should be tried especially in the ponds and earthdams since people fall back on them for water especially during rainy season

eventhough there is water available in the wells and hand-pumps. The "Ruguzal" should be converted into wells.

At this stage I would like to suggest the introduction of "case`containment" programme (Kappus et al, 1991) as was done in Pakistan especially in the villages with low prevalence. The basic operational elements of this programme is the identification of all cases not more than 24 hours after worm emergence, management of each case by application of topical antiseptics, occlusive bandages and health education in order to reduce opportunities for contamination of drinking water, obtaining a history of travel and activities during the period of worm emergence so as to identify any source of drinking water contaminated by infected persons, mobilization of community to undertake preventive measures and reporting of cases to sector supervisors and regional managers to permit confirmation of each case within a week of worm emergence. This could be modified to meet needs and resources available.

Finally, I would like to highlight on community involvement. Although, I have noticed that the villages/hamlet heads are fully involved, bringing in self help groups will do a lot of good. They could easily be encouraged to participate in digging new wells and repairing old ones. They could be taught the tenets of health education towards the eradication efforts sc that they could educate their communities.

My findings revealed that:

(i) provision of handpumps could reduce the incidence of dracunculiasis;

(ii) Wells are suitable for the control/eradication of guineaworm infection;

(iii) Knowledge of how the disease is transmitted had little impact on the spread of the disease;

iv) Animals could be infected; however, there is the need to carry out this study for a longer period in order to make definitive conclusion.

This is more so in the case of (i) to (iii) considering the current intervention programme.

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Appendix A: A Questionnaire on the Epidemiology of Dracunculiasis (Guineaworm Diseases) Administered in the Six Villages

1. General Information

a) Date: _____

b) Village Name: _____

c) Hamlet Name/Number: _____

d) Household/Name/Number: _____

e) Family Size: _____

f) Number Infected/Family: _____

11. Age group in the family:

0 - 4	5 - 9	10 - 19	20 - 29	30 - 39
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------	------	------	------	--------
40 - 49	50 - 59	50 - 59	60 - 69	70 +
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11. Information on individual/household

a) Name: _____

b) Status: Infected: _____

Non-Infected: _____

c) Age _____

_____

f) History of previous infection: Infected _____

Non-Infected _____

g) Number previously infected in the family [___]

h) Number of worms emerging [___]

i) Site of emergence: Lower limbs [___]

Upper limbs [___]

both upper and lower limbs [___]

iv Water sources used for drinking

a) Pond [___] b) Well [___]

c) Handpumps [___] d) Earthdams [___]

e) "Ruguzal" [___] f) Pipeborne [___]

g) Stream/river [___]

v. Health Education Measures

a) Filtering of drinking water

Always [___] Sometimes [___]

Never [___]

b) Boiling of drinking water: always [___]

Sometimes [___]

Never [___]

c) Any idea of how the disease is contracted YES [___]

NO [___]

d) Treatment sought: Traditional [ ]

Western [ ]

Both(Western + Traditional) [ ]

None [ ]

V. Information on animals in a household

a) Types/number/number infected

	Number	Number Infected
Sheep		
Goat		
Dog		
Cat		
Donkey		
Camel		
Horse		