

SOCIAL IMPLICATION OF GUINEA WORM DISEASE IN BEJI  
AND ITS ENVIRONS

*BY*

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AWARD OF POSTGRADUATE DIPLOMA IN.  
ENVIRONMENTAL MANAGEMENT.

## CERTIFICATION

This thesis titled: Social Implication of Guinea Worm Disease in 8eji and it's Environs' by Abubakar Maimunatu (*PGD/GEO/2005/344*) meets the regulations governing the award of Post - Graduate Diploma (PGD) of the Federal University of Technology, Minna and is approved for its contributions to scientific knowledge and literal presentation.

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## DEDICATION

I felt obliged to dedicate this Project to my Mum and Dad who exposed me to the four corners of the world.

May Almighty God continue to be with them (Amen).

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## CHAPTER ONE

### INTRODUCTION

1.1 Guinea worm disease is a crippling water associated disease with severe impact on health, agriculture, school attendance and general socio-economic status of the inhabitant of the affected areas. Ironically the disease is easily preventable through the provision and utilization of safe drinking water. The benefits to the society of controlling and eradicating the disease is therefore, enormous and should' revive the support of the Government and International agencies like the World Health Organization and Unicef, Agency for International Development (AID) Water and Sanitation for Health Project, Global 2000, Vector Biology and Control Project (VBC) etc.

It is unfortunate that thus far, very little has been done in this country through a well-articulated programme to control guinea worm and ultimately eradicate it. The guinea worm disease is prevalent among people who live in rural areas such as peasant farmer, cattle herder etc. who during the dry season invariably depend on contaminated shallow ponds for their drinking water. (Guinea worm is a painful incapacitating affliction caused by the parasite *Dracunculus medinensis*)

The disease probably affects an estimated 10-15 million people in poor rural areas of Africa and Asia (Hopkins 1982). It is now well known that Guinea worm is the only communicable disease which is exclusively transmitted through contaminated drinking water (Toye 1985). Guinea worm is not primarily a fatal disease but its complications sometimes arise from the secondary bacterial infection.

Guinea worm diseases is also known to incapacitate about 30 - 40 % of any given population of rural people, predominantly farmers for an average of 3 months at the peak of agricultural activities.

Intervention efforts have also been successful in several African countries. A number of countries have eradicated guinea worm disease. As at April 1991 National Plans of action had been adopted in Benin, Burkina Faso, Cameroon, Ghana, India Kenya, Mali, Mauritania, Pakistan, Niger, Nigeria, Senegal, Togo and Uganda, countries with endemic guinea worm disease are conducting National survey to define the extent of the guinea worm disease problem and develop National plan of action for elimination. Most National programmes are directed by the Ministry of Health with the support of National and International agencies, non Governmental and Governmental organization have been collaborating in the eradication of worm disease. These agencies including UNDP, AID, WASH, VBC, EDC, GLOBAL 2000, THE African Cyanamid Company and Dupont corporation.

Guinea worm diseases enter the human body when people drink water containing copepods barely visible shrimp-like crustaceans infected with guinea worm larvae. When the copepods which is also known as "Water flea" are killed by the gastric juices in the stomach. The guinea worm larvae are liberated or hatch. **It** move to the small intestine, penetrate the intestinal wall migrate, to the abdominal muscle, where they begin to mature in the connective tissue. Male and female worm mate about 3 months after ingestion. After 8 months, the adult female worm which grows to 1- 3 feet's long usually moves to the lower limbs. Approximately one year



(range from 9 - 14 months) after the person is infected, the guinea worm is ready to emerge and emit larvae. The worm migrates to the tissue just under the skin and secretes a toxic substance that produce painful blister. Contact with causes the worm uterus to rupture and stimulate the worm to expel larvae into water. Each female worm releases about one million microscopic first stage into water. The larvae can remain active for up to five days in stagnant water, whereby they die, unless they are ingested by copepods, inside the copepods the larvae develop into their infective third stage in 10-14 days.

## SOURCE OF WATER SUPPLY

The inhabitants of Beji town use hand dug wells in their houses, these wells get dry and they have to resort to collecting their drinking water from streams and ponds. No provision of pipe borne water, the few boreholes contracted, because it cannot serve the whole settlements population, since they are few and not functioning properly, the wells get dry during the dry season.

## 1.2 STATEMENT OF PROBLEM

The impact of guinea worm disease is under-estimated or ignored at the regional or national level, because the extent of disease is not known or because the leaders believe little can be done about the extent of guinea worm disease problem and its impact in the community. While guinea worm disease is rarely fatal the pain can be great that victims discontinue many activities that are part of daily living. As many as 50% of guinea worm disease victims are severely disabled and unable to leave their compound for an average of one month (and up to three months). Incapacitation by guinea worm

disease can lead to diminished personal hygiene as well as loss of income and poor nutrition. In addition, psychological stress of worm emerging from the leg, chest or even genital can be considerable. Since the crippling effect of guinea worm disease usually occur during the height of agricultural labour season, the disease has an enormous negative impact on agricultural activity. On studies carried out, an estimate of about 5.3% of the total agricultural gross domestic product in Nigeria was lost because of the effect of the disease on local farmer Paul et; al (1986)

Women suffering from guinea worm disease are often unable to care for themselves, their children or their household or do work that will add to the family income.. Although guinea worm disease primarily affect adult, some children are also affected and suffer from temporary disability they may become permanently disable or die of tetanus. Children may also suffer disruption in education while attending to the need of an affected adult. Studies in Nigeria estimate school absenteeism due to guinea worm disease as high as 33.%in the study area.

### 1.3 RESEARCH OBJECTIVE

1. To assess the consequent economic loss caused by the disease in the study area.
2. To analyze the sources of water supply in Beji settlement.
3. To study the extent of the infection and the probable methods of controlling and eradicating the disease.
4. To suggest to the appropriate authorities on how to minimize or prevent guinea worm disease.

## CHAPTER TWO

### 2.1 LITERATURE REVIEW

A lot of work has been done on guinea worm disease in Nigeria. In (1983) Edungbola et; al carried out an investigation on the epidemiological assessment of the distribution and enderncity of guinea worm infection in Asa, Kwara State and showed the diseases to be widely spread and highly prevalent, 6,250 individuals in villages were examined and 530/0 had the infection and more adult that, children showed evidence of active dracunculus.

Udonsi (1986) carried out' a field study in Ohaozara, Imo state of Nigeria to determine the effectiveness of rural water supply project in the control of endemic dracontiasis in the area. In the pilot studies, prior to the water installation project 5,058 inhabitants 47.(% had' either drancunculus blisters or alcers. An overall reduction of (17./8%) was achieved in 18 months, following water supply provision. He attributed it to the fact that provision of pipe borne water reduces the dependence on streams and ponds water and this reduce transmission of the disease.

Still, in the same year (1986), Iligbodu, wise et; al carried out a study of guinea worm infection in Iba.rapa district in Oyo State and they arrived at different times, 12.3% and 350/0.They attributed it to the following reasons.

1. water supply to the district was generally low throughout the year
2. There were extruded period in which no water was pumped to the place

3. The volume of water pumped varied periodically, lower volume (considerably less than 40 litres per day recommended by World Health Organization (WHO) for a tropical climate, usually during the season.

Onabamiro (1951) and (1958) carried out a research in Southern Nigeria, which stand among the leading contribution world wide to the knowledge of early stages of development of *Dracunculus medienensis* in mammalian host

Abolarin (1979) reported the work he carried out in a village called wawa near Kanji Lake, in former Kwara State, now Niger State. Out of 1,768 persons he examined 98 patients had dracunculus disease and he trace the source to a small lake created by a cattle dam in close proximity to the village. Between (1981) and (1982), Steels, Chambers et al tried to show the impact the disease had on children in Nigeria 768 boys and 727 girls aged 6 -14 years were examined at 4 primary schools in the village in western Nigeria, 22% of the girls and 20% of children were absent for about 25% of school days, with 2.50% absentee rate for uninfected children nearly 6% of children left school permanently because of guinea worm infection.

Edungbola (1985) estimated that infection Nigeria and other West African Countries where the disease is endemic, active guinea worm transmission occur virtually in every state, although the level of endemicity varies. He projected that at present about 2.5 million Nigerians have guinea worm every year. About a million of these experience shows temporary incapacitation for 1-3 months, while about 12,000 individuals suffers irreversible disablement.

## 2.2 REVIEW OF STUDIES CARRIED OUT IN DEVELOPING COUNTRIES

Today the disease is largely confined to East and West Africa. Although the disease was highly endemic in India, it is anticipated that it had been eradicated in that Country by (1986). This is a result of the intensive nationwide eradication campaign programme launched in India about 15 years ago.

In East Africa, dracunculiasis is confined to Southern Sudan, Ethiopia and Northern Province of Uganda. In West Africa the disease is endemic in Chad, Cameroon, Nigeria, Benin, Togo, Burkina Faso, Ghana, Liberia, Senegal and Mauritania.

For along time now workers have been trying to draw people's attention to the problem of guinea worm infestation in the rural communities of Africa. A group of workers in Ghana were said to have reported that guinea worm disease is the major cause of agricultural work loss in the Danfo project area. Few other disease coincide with agricultural activities and even year round malaria cause little prolonged disability in relatively immune adult Muller (1979).

## 2.3 REVIEW OF STUDIES ELSE WHERE IN THE WORLD.

Interesting historical account of dracunculus has been given by several authors. These accounts indicate that dracunculiasis is an ancient parasitic disease which was known to the Greeks and Romans. It has been incriminated as a "Fiery serpent" that hit and killed many Israelites as contained in the Holy Bible. Among the early pioneers,

Rhazes who lived between (865-925), an Arabic physician first attributed the cause of the typical guinea worm swelling to a parasite. Avicenna, who lived between (980-1037), gave detailed clinical presentation of "medina sickness" so called because it was prevalent in Medina from where it was believed to have disseminated to other parts of the world by pilgrimage routes. Batian (1863) described the morphology of the parasite, while Fed-Shenko (1870) associated Cyclops with life cycle of the parasite. This was the first time an invertebrate host was implicated in the transmission of a medically important disease. In India about 30 million people were thought to be suffering from guinea worm infection annually. The disease is largely confined to East and West Africa, although the disease was highly endemic in India.

## CHAPTER THREE

### METHODOLOGY.

For this particular study, two methods of data collection were employed in the collection of data. These were questionnaires and observational methods. Below is the breakdown of what constitute the methodology in the forms of population, sampling technique and data collection methods mention above.

#### 3.1 STUDY POPULATION

The targeted population for this study is the Beji Community, in Bosso Local Government area of Niger State. Majority of the people living in these' settlement are fanners, the greater part of th~ settlement, population is made of Gwari, with some of the part consisting of some other ethnic group such' as the Hausa, Nupa, Yoruba, Ibo and the remaining part of the population are of educated elites such as Teachers of both primary and secondary schools

#### 3.2 SAMPLE

Though Beji and its environ is not big when considering the overall settlement, yet its size is considerable, given the unofficial population of 26,000 in 1991 census. The study area is therefore considered large for a complete study. So there had to be a sample drawn from the target population on which to base the findings of this research project. Three hundred and twenty six (326) people were drawn as a sample for this study. This number, includes children and adult of both sexes, were randomly selected.

### 3.3 METHOD OF DATA COLLECTION

#### QUESTIONNAIRES

Data were collected by the use of questionnaires, the information, collected were in the areas of sources of water supply associated disability .

#### OBSERVATION

In other to increase the quality and quantity of information the researcher had to observe those who were previously attacked and those presently suffering from the disease. Observation as a scientific method of data collection entails the assessment of the research cases in their natural setting.

This part of research project analyze the data collected for the study. The methodology used on the collection of data were interviews, questionnaires, revision of past records and finally observational method. The interview conducted was randomly, it was conducted under a pattern group. The aims were focused on important information that form the main aims and objective of the research project.

Three hundred and twenty six (326) questionnaires were issued out and only three hundred and six (306) were return. Past records of the area (NIGEP) office Nigerian Guinea worm Eradication Programmes office and the state ministry of Health Office, Global 2000 were contacted. Finally, observational methods were used to look at the action and behaviour of patients. Beji is one of the numerous communities in Niger State afflicted by guinea worm disease.



## CHAPTER FOUR

### 4.1 DISCUSSION OF RESULT

Table 4.1 FREQUENCY DISTRIBUTION AND PERCENTAGE OF GUINEA EORM IN BEJI AND ITS ENVIRON.

NO of people interview	Guinea Worm Infected people	Percentage %
306	263	85.9

*Source: field survey 2006*

The table above shows that out of the 306 people interviewed, about 86% of them had suffered or are still suffering from the disease ( Guinea worm).

This indicates that most of the people in the study area are affected by guinea worm and that the disease is very rampant in Beji and its environ.

Out of the two hundred and sixty three the probable explanation for the male preponderance in this study is because women boil the water they fetch from Cyclops laden stagnant water to prepare food for their infants. They are likely to drink the remaining boiled water, where as the male would be on farms, in the day and are to obtain water t drink whenever they are thirsty from a source that is near the farm and so drink from the cyclop laden stagnant water.

Table. 4.2 DISTRIBUTIONS AND PERCENTAGE OF GUINEA WORM IN BEJI TOWN BY AGE

AGE GROUP	%
0-10	9.5
11- 20	33.1
21- 30	29.3
31 - 40	14.8
41- 50	6.8
51 - 60	6.5

*Source: field survey 2006*

## AFFECTED

This table shows that those in the age group of 11-20 years were most affected. The group has a prevalence of 33.1% closely followed by the age group 21-30 years which has a prevalence of 29.3%. The least affected are those in the age group of 6.50/06.80/0and 9.50/0respectively. This can also be seen in fig 4.1

Table 4.3 source of drinking water in Beji and its environ.

Sources of drinking water	No of Respondent	Percentage (%)
Steam	198	75.3
Stagnant water	65	24.7
Total	263	100

*Source: field survey 2006*

The table shows that those that obtained their drinking water from the steam are about 75.0%. The streams are very dirty and are sometimes taken without boiling and treatment of any sort. The study shows that the majority of those who contracted the disease have streams as their source of drinking water. This is a deviation from the finding of other people who shown that more number of people get the disease from ponds. Those individual with guinea worm lesions on their legs are not prohibited from wading into the ponds, that provide drinking water for the town, this create the opportunity for continual inoculation of pond containing Cyclops with larvae of guinea worm medinensis. The possible explanation for the deviation found in this study is that during the dry season the stagnant water dry up while the streams still have water. The people are therefore left with no other option than to collect water from the stream. As can be seen in plate 1- 2.

Table 4.4 DISTRIBUTION AND PERCENTAGE OF SUMPTOMS OF GUINEA WORM IN BEJI AND IT'S ENVIRON.

Presenting symptoms	Number	0/0
Itching only	161	61.2
Itching and body pain	93	35.4
Itching and Headache	9	3.4
Total	263	100

*Source: field survey 2006*

The table above shows the distribution and percentages of symptoms of Guinea worm cases in the study area. Those who had itching as w~ile 93 respondent. REPRESENTING 35.4% had both itching and body pains as symptoms and only 3.4% had both body itching and headache as of guinea worm disease/cases Kale (1985) IN HIS STUDY. The finding in this study is in line with the finding in other studies. None of the people reported nausea, vomiting or fever as symptoms for guinea worm outbreak.

Table 4.5 DISTRIBUTIONS AND PERCENTAGE OF PART OF THE BODY AFFECTED BY GUINEA WORM CASES IN BEJI.

Point of Emergence	Number	%
Feet only	116	44.1
Joint only	5	1.9
Feet and joint	86	32.7
Feet, joint and other	56	21.3
part of the, body		
Total	263	100

*Source: field survey 2006*

The table above (table 4.5) shows that the worm appears much more in the feet, while in some cases the worm appears on the feet and some other part of the body. (see Plate 3).

In this study a higher number of respondents representing (116) 44.1% reported the emergence of the worm from the feet (plate 3) only five (5) of the respondents (1.9%) reported that the worm could emerge from the joints, knee and ankle. The table also shows that about 33% claim that the worm could emerge from both the feet and the joint as while (56) of the respondents (21.30%) reported that the worm could emerge from multiple parts of the body, which include feet, joint and other parts including unusual ones like the eyes (two children) and the scrotum (one adult.) Emergence of the worm at various other than the feet has been reported by many workers.

The emergence of worm from the feet of patient is in line with finding of other workers, Onabamiro (1952), Muller (1958). It was reported that no sooner have the limbs been immersed in water than the female worm protrude with their anterior end to shed the larvae into the water.

It is believed that the worms sensitivity to the immersion of limbs in water portrays a natural way for ensuring that new worms to complete their life cycle

The people affected observed the worms emerge at the beginning of rainy season. This is in conformity with the report of other workers. This disability caused by guinea worm disease is mainly physical which lead to social implication, the patients are unable to move or carry out their normal day to day activities different workers reported a mean periods of disability of months where as the median as 40 days. So also Edungbola (1985) reported the temporary incapacity as 1 - 3 months. Muller working in Ghana reported a mean period of 15 weeks has not been reported but

Eduntbola has estimated that about 12,000 people suffer irreversible disablement. Since temporary disabilities are more common, this led Kale (1977) to propose a classification for disability as follows.

GRADE 1 (Mild disability) Patient is mobile and he suffer little or no discomfort

GRADE II - (Moderate disability) Patient is mobile but suffers considerable discomfort.

GRADE III - (Severe disability) Patient is immobile or is unable to use the affected limb and suffer a considerable discomfort.

In this study the main disability is Physical, except in one patient who had the Worm emerging from the scrotum and the thought it will interfere with his ability to produce children and this lead him to attempt suicide.

None of my patient went to hospital for this illness. This is because they believed that there is no drug in the orthodox medicine for the treatment of guinea worm. The belief is not different from that of other people in other parts of the Country, reported by other workers. AboJarin (1976) reported from his study.

In Wawa village that few patient went to hospital or dispensary and he gave the reason for that as the people as the people believe that traditional treatment is more effective than modern medicine. To support this statement he quoted Belcher et al (1975) as having accepted that neither thiobedazole nor metronidazole was effective for guinea worm. So far, these have been the drugs in use. Paiko people carryout traditional medication by doing "SAKIYA (A thin iron rod placed in fire, until its red hot it is brought out place o~ the skin suspected to be harboring the Worm). The worm is extruded and thrown into the fire.

It is interesting to note that my patients know that guinea worm disease is got from bad drinking water. They are aware that the source is either the stagnant water or the stream they obtain their drinking water from. The possible explanation for why they continue to drink from the stream is that the wells they dug eventually dry up and people are left with no other alternative than to revert to drinking water from the streams.

In this study the incidence of the disease among infants and children is low. Out of two hundred and sixty three (263) infected, 25 were in the age group 1-10 years representing 9.5%, if this number is compared with those not affected in the age group (30 representing 69.70% of those not affected) one may conclude that their age group is among those who are least affected. Many workers have reported similar findings.

Edungbola and Watts (1983) while working in Asa district in Kwara State reported that more adults than children show clinical evidence of active guinea worm cases but there was no marked difference between sexes. In another study carried out in a district in former Kwara now Niger State, he observed that in dracunculus endemic adults' area, children are generally less infected than adults, this he attributed to long per patient period of guinea worm. Infection the destruction of infective guinea worm larvae in the unconscious process of boiling children water with medicinal products prior to ingestion and prolonged breast-feeding.

It was difficult to determine the economic loss and social implication of guinea worm infestation, because those examined are either men farmers, while the women or wives of the farmers long with their children sometimes help the men on the farm. They are subsistence farmers growing food only for consumption of their families. Only a few of the crops are taken to the

market for sale in order for them to be able to buy some of these things they need at home.

## CHAPTER FIVE

### 5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

This part of the research project form the conclusion which embraces summary and recommendation

#### 5.1 SUMMARY

Since the crippling effect of guinea worm disease usually occur during the height of agricultural season, the disease has an enormous impart on agricultural productivity, some families are affected more heavily than others with virtually all the family members incapacitated at the same time. Responsibilities for working in the field, may have to be given to other members of the family often to be given to the detriment of adequate child care and education of school age children. Women suffering from guinea worm disease are often unable to care for themselves. Their children or their household may have work for other family in order to add to its income.

This often leads to lack of money for children to feed, cloth and school fees. Guinea worm disease or incapacitation has also been found to lead to defaulting on children immunization because mothers are unable to bring their children to the clinic Although guinea worm disease primarily effect adults, some children are also infected and suffer temporary disability. They may become permanently disabled or die of tetanus. Children may also suffer from indirect adverse effects such as poor nutrition or distortion in education, while attending to the needs of affected adults. Studies in Nigeria estimated school absenteeism due to guinea worm disease as high & 33



## 5.2 SUGGESTION AND RECOMMENDATION

The quickest least expensive and the most effective way to provide safe drinking water supplies, and the public should be educated not to enter water if they have guinea worm disease.

For food sufficiency to be achieved in Beji and other part of the country proper attention must be given to guinea worm disease.

1. Provision of pipe borne water is the alternative answer to the problem. Sinking of wells may not achieve the desired objective just as Gills et al in (1964) reported the Akufo people in western Nigeria prepared pond water to well water. Hopking (1982) reported that the supply of pipe born water to a town of 30,000 people in Nigeria in (1960s) reduced the incidence of guinea worm disease from over 60% to zero within 2years. Another findings reported by Udonsi (1987) in Ohaozara Village in Imo State confirm this, he stated that an Over all reduction of 71.8% in the disease was achieved in 18'months following water supply prevision
2. Wells or Boreholes should be constructed by the Government for the people.
3. Health Education, Health workers should be sent to give health talks with the aid of posters on the importance of personal hygiene.
4. They should be informed that the disease could be prevented by filtering water for drinking through the use of cloth or boiling or the u~e of chemical such as Tempos. It should be noted, however that providing safe water alone is inadequate. The population concerned must be motivated to help maintain the

wells of pumps and how to use the new source of drinking water. In several instances some community have persisted in drinking water From contaminated sources, despite a new source having been provided, because the contaminated water is felt by them to be physically easier to collect, chapter. Or tastier, so some health education should be indicated in any case.

## CONCLUSION

This study has shown that the rate of guinea worm disease in the study area is high is surprising that people are aware that the disease is caused by bad drinking water, yet they continue to obtain their drinking water from the same sources.

Many people might have continuous or repeated attack of the infection but because they do not attend hospital, none of such attack has been reported, secondary infection like Tetanus is the one recognized attack which was reported by some workers like Laucker, Rankin and Adi, (1961) further said that lack of education about personal hygiene worsened the situation because secondary infections aggravate the nursery. Beji, being one of the guinea worm endemic areas in the country, need aid to control or eradicate the disease.

It is hoped that a more comprehensive study will be carried out in future when data are readily available and the study may need to extend to other guinea worm endemic areas.

APPENDIX I

RESEARCH QUESTIONNAIRE

This question is set by Mrs Maimunat Abubakar, a student of PGD Environmental Management Federal University of Technology Minna. The aim is to let me share your knowledge on an Epidemiological and social implication of guinea worm infection in Beji and its environ of Niger ~tate.

I shall be grateful Sir/ madam to you for sparing sometime in answering the following set of question in the appropriate space provided for each question. Thick where necessary.

The information or answer given by you will assist me in carrying out the research and will be treated confidenti ally. Your prompt honest response is highly solicited please, and thanks for the co-operation given.

1. Name of Head of Household Date .

Age:

Sex:

Tribe:

Religion:

Occupation.

Marital Status:

2. How long have stayed in Beji

3. Source of drinking water: well ----- stream ----- Dam----- pipe borne

4. How many people in the house hold guinea worm between 1998 :-  
200'4-

NAME AGE ABSENT PRESENT

Time interval between them.

5. How do you feel at the beginning of the illness? Fever Headache  
 -- Nausea ----- Itching ----- other-----
6. Which part of your body does the disease frequently appear?
7. What season of the year did you notice the illness? Dry season -----  
 Raining Season -----
8. What do you think is the cause of guinea worm?
9. Which method have you employed for the treatment? Hospital -----  
 Traditional/concoctions ----- How?
10. Any associated disability? Physical ----- mental/psychological
11. How many acres of land did you farm during 1998/2004- farming  
 season
12. Income for 1998/2004-----
13. What assistance do you need from the Government to help eradicate  
 the disease
14. How does the society view the infection? -----
15. Have you ever read about guinea worm infection in general? If yes  
 , which writer and when did the writer write (date) -----
16. What professional advice do you have to give on how to control the  
 menace of this guinea worm infection -----  
 -----?
17. What should the society (Nigerian) do in order to dominate this  
 infection-----  
 -----?
18. Which professional advice can you give me in order for me to base  
 finding for this research project -----  
 -----

19. Do you think social institution are free from guinea worm disease? ---

B. Why the answer -----

20 Please give list of book articles or paper and magazine that I can find very relevant to my project. In terms of articles, papers and magazine state dates and years in order for me to find it easy to trace

Thanks for your co-operations.

HAJIA MAIMUNATU ABUBAKAR (MRS).

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Plate 1: Source of drinking water in the study area



Plate 2: Source of drinking water in the study area

## Plate 3: Guinea Worm Disease

### CASE DEFINITION:

Any person with a skin lesion (boil/blister) and emergence of .  
Guinea worm from the skin lesion.

