PREVALENCE OF BANCROFTIAN FILARIASIS AND ASSOCIATED FACTORS IN THE URBAN DISTRICT OF LINDI, TANZANIA

BY

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Signed

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ABSTRACT

In September 1995, a cross sectional study was done in Lindi urban. The aim was to determine the magnitude of filarial infection and the population perceptions on its causes, transmission, prevention and treatment.

A total of 872 people aged 10 years and above from four wards were interviewed. Clinical examination to detect hydrocele and elephantiasis was carried out. Also, nocturnal blood samples were collected and examined to detect microfilaraemia.

The results show that hydrocele and elephantiasis were recognized as health problems in the community (79.2% and 77.8% respectively). However, only 26.6% and 42.2% of respondents, respectively knew that the conditions were mosquito transmitted.

Various beliefs of causation for hydrocele and elephantiasis were reported. However, higher proportions of respondents believed in the "will of God" (31% and 36.4% respectively). Whereas, 85.9% of the respondents knew that hydrocele can be surgically treated, 57.1% believed that hydrocele cannot be prevented and 51.3% believed so for elephantiasis.

A total of 76.2% of the respondents were using anti-mosquito measures; the mosquito-net was the most popular, used by 60% of the respondents.

People using nets had statistically significant lower microfilaria prevalence than non users.

The prevalence of microfilaraemia was 12.1% (95% CI 9.6% - 14.6%). The prevalences of the chronic sequelae were 13.5% (95% CI 9.9% - 17.1%) for hydrocele, 5.2% (95% CI 3.7% - 6.7%) for limb elephantiasis and 0.5% (95% CI 0% - 1.3%) for scrotal elephantiasis.

The current prevalence of microfilaraemia and hydrocele suggests that transmission continues unabated in the community due to general lack of knowledge on causes, transmission, prevention and organized control programme for Bancroftian filariasis. It is recommended that an intervention programme for prevention be developed for the area.

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DECLARATION

I, Dr. Mahemba Alex Mwita do hereby declare that this work is my original work and that it has not been submitted for a similar degree in any other University.

.....31.10.96.

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CHAPTER 1

INTRODUCTION AND REVIEW OF LITERATURE

1.1 Global magnitude of lymphatic filariasis

Filariasis is a group of human and animal infectious diseases caused by nematode parasites of the order filariodea. The adult worms live in lymphatic vessels, tissues or body cavities of vertebrate hosts except fish. The female worms produce larva (microfilaria).
Larvae development takes place in certain blood sucking invertebrate intermediate hosts like mosquitoes, flies, midges, fleas, mites and ticks.

The human parasites are classified into three groups according to the place of domicile of the adult worm. The groups are: 1. The lymphatic group (Wuchereria bancrofti, Brugia malayi, and Brugia timori). 2. The cutaneous group (Loa loa, Onchocerca volvolus and Mansonella streptocerca) and 3. The body cavity group (Mansonella perstans and Mansonella ozzardi). Serious human morbidity is caused by the lymphatic group and Onchocerca volvolus. Dr. Patrick Manson was the first person to link the nematode Wuchereria bancrofti to human disease (Manson-Bahr, 1959).

Since Dr.Patrick Manson carried out the first clinical and microfilarial prevalence survey in Amoy, China in 1877,

(Manson-Bahr 1959) and through his other works on filariasis transmission, particularly the mosquito linkage to the disease, the science of filariology was opened up, paving the way to understanding of the disease that has afflicted man since time immemorial.

The World Health Organization estimates that 106 million people worldwide are infected with lymphatic filariasis due to Wuchereria bancrofti and 12.5 million have B. malayi and B. timori(WHO 1995)

Bancroftian filariasis is found in areas bounded by 30°N-30°S in the Western hemisphere and 40°N-28°S in the Eastern hemisphere (Faust,et.al. 1970). The areas in the Western hemisphere include the Pacific Islands, Papua New Guinea, Australia and the countries of Central and South America. Those in the Eastern hemisphere include countries in South East Asia, India, China, Japan and Korea. Other countries are in Africa including its Islands (Madagascar, Mauritius, The Comoros etc). Brugia malayi, is confined to South East Asia (Indonesia, Malaysia, Thailand, Vietnam, Philippines etc.) and Brugia timori is confined to the Indonesian Island of East Timor. There is no known focus of human filariasis in Europe except in the city of Alanya in Turkey (WHO 1974).

Prevalence surveys for Bancroftian filariasis have been done in different endemic areas of the world since the turn of this century. The aim of such surveys had been to establish the magnitude of infection in the human population, especially before control programs were instituted and to evaluate the success of filarial control programs. Sasa (1976) also a summary of worldwide surveys of up to 1976 that depicts the world filarial situation.

In 1974, The World Health Organizaton reported on areas that have had decreasing microfilarial prevalences and those where prevalences have been increasing (WHO 1974). A decrease in the prevalence of Wuchereria bancrofti has been noted in the Pacific Islands, Islands of Cape Verde, Mauritius and Reunion and also in Egypt, Japan, Puerto Rico, Sri Lanka and South Togo. For Brugia malayi, a reduction in prevalence has been noted in some areas of Indonesia, in Kerala State (India), Southern Thailand and the parasite has disappeared in Sri Lanka.

The decrease is attributed to one or more of the following factors:

1. Control efforts through organized mass drug administration (The Pacific Islands), vector control (Japan, Rangoon-Burma, South India) or as by products of malaria control (Cape Verde, Mauritius, Reunion).

2. Improved social-economic development in the aspects of improved housing, supply of piped water and improved sewerage systems, all of which have had the effect of reducing the vector Culex quinquefasciatus.

3. Raising the general standard of living and literacy rates has led to increased awareness of the health hazards. The use of mosquito nets and utilization of treatment facilities including purchase of diethlycarbamazine by the people themselves have also contributed to the reduction of infection.

An increase in the prevalence of filariasis is thought to have occurred in parts of Africa and Asia. This has been due to increase in uncontrolled urbanization that has resulted into breakdown of sanitary services and led to proliferation of Culex quinquefasciatus. Moreover, developmental projects involving dam construction for irrigation and electricity, land deforestation for agriculture have increased mosquito vector breeding sites.

1.2 Magnitude of lymphatic filariasis in Tanzania

Filariasis in Tanzania, like elsewhere in endemic places of the world, must have been afflicting man since time immemorial. With the coming of the Europeans to Africa in

the late 19th century and early part of this century, the European health experts started documenting the health problems they encountered among the people. Filariasis was one of the many health problems that was found prevalent in Tanzania.

Three periods are clearly distinct in filarial research in Tanzania. These are: the period between 1918 and 1940, the 1950's and the 1970's. The first period (I918 -1940) saw filarial research mainly in the coastal areas and the nearby Islands of Zanzibar, Pemba and Mafia. During this period high prevalences of Wuchereria bancrofti microfilaraemia were reported, ranging from 15.5% to 40.0%. However these findings were based on hospital patients and surveys involving small numbers of people. There is no indication of systematic clinical examinations for chronic sequelae although some of the reports indicate to have noted hydrocele, lymph scrotum and inguinal hernia believed to be due to filariasis (Howard, 1918; Dunderdale, 1921; McCarthy, 1930).

In the 1940's, Hawking (1940) mapped the distribution of filariasis in the country using hospital based data supplemented with annual hospital returns. The coastal strip and nearby Islands had microfilaria prevalences averaging 30%. An area south of lake Victoria embracing

Mwanza, Shinyanga, and extending to Kigoma had microfilaria rates of 0.8-23.0% and an area North of lake Nyasa had a microfilaria prevalence of 10.0%. Hydrocele was the commonest complication, with rates ranging from 0.27% in Dodoma to 16.2% in Mwanza. Elephantiasis ranged from 0.03% in Dodoma to 3.8% in Shinyanga. Noted also, were lower rates of infection in Arabs and Indians compared to Africans and this was attributed to the anti-vector measures which the the Arabs and Indians were known to be deploying compared to the Africans. Mansonella perstans was also identified in Bukoba area (microfilaria prevalence of 24%-86%), Liwale-Kilwa (micofilaria prevalence of 13.4%) and along the Mbwemkuru river valley (microfilaria prevalence of 43.0%).

In the 1950's, Jordan (1954, 1955 and 1956a,b,c) essentially confirmed the findings of Hawking (1940). He found that in the Lake province (Mara, Mwanza, Shinyanga and Kagera) microfilarial rates ranged from 0% in Kagera to 40% in Shinyanga. Hydrocele rates ranged from 0% in Tarime to 19% in Misungwi village, Mwanza. Elephantiasis prevalence was in the range of 0-4% and the highest in the lake province was found at Itwangi village in Shinyanga region.

In the western province (Rukwa, Kigoma and Tabora) microfilaria rates ranged from 0 - 6%; and infection was thought to be of little public health importance in this area. The prevalence of hydrocele ranged from 0-2% and elephantiasis was in the range of 0-3%, the highest was at Mabamba village in Kibondo district and was thought to be of non-filarial origin.

In the Eastern province (Coast, Morogoro and Dar es Salaam), microfilaria rate ranged from 8% in Mgeta, Morogoro to 46% in Ilonga, Mahenge. The hydrocele prevalence in the province ranged from 0% in Mgeta, Morogoro to 27% in Mikese, Morogoro.

In the Tanga province (Tanga), a microfilaria rate of 53% was found in some villages in Pangani district where 20% of examined men had hydrocoeles. Elephantiasis was found in the range of 0-2.4%, the highest was at Mwangoi village (in Tanga region). In the Northern province (Arusha and Kilimanjaro, like in the Western province, the microfilaria rate was less than 10% and therefore of little public health importance.

The Southern province (Lindi, Mtwara & Ruvuma) had the highest rates, with 73% of examined people having microfilaria in the village of Kilwa. Microfilaria were

absent in some populations of the villages of Ruvuma region that were examined. The prevalence of hydrocele was highest (38%) at Likawage village in Kilwa. In the Southern Highlands province (Iringa and Mbeya) microfilarial prevalences of 0-7% were found but on the Northern shores of lake Nyasa, hyperendemicity with rates between 23%- 61% in children, was evident.

Filarial research in the 1970's and 1980's done along the coast (Crans, 1970; Menu and Kilama,1971; Abaru, 1973; Wegesa, et.al 1979) did not reveal much difference in rates of infection from that of earlier studies.
Worth noting is the study by Minjas (1986) indicating a microfilarial prevalence of 13.1% and a hydrocele prevalence of 12.1% in a community survey in Dar-es-Salaam. These rates seem to be lower compared to 23.6% microfilarial and 40% hydrocele prevalence rates that Hawking (1940) got in hospitalized patients in Dar-es-Salaam. They were also lower compared to a microfilarial prevalence of 34% that Jordan (1956a) got in a community survey in the same area.

An assessment of filarial research data in Tanzania reveal several shortcomings. These include non availability of data in many places where it is known that the disease exist. Secondly a lot of the existing data is quite old,

for instance the commoly quoted Jordan studies (Jordan 1954, 1955 1956a,b,c) are fourty or more years old. The problem with old data is that it may not reflect the current disease situation. There has been an increase in the population that may have led to changes in the transmission dynamics of the disease. Moreover changes in the social-economic conditions that have occured over the years may also have affected disease prevalence rates. Thirdly, the old data is of questionable reliability today. Many of the previous surveys involved volunteers, some were hospital based and many involved small sample sizes. The current study was geared to fill some of those gaps in filarial research in Tanzania.

1.3 Statement of the problem

The coastal belt of Tanzania is known to be endemic for filariasis for a long time. The studies of Hawking (1940), Jordan (1954,1956a), Crans (1970), Menu and Kilama (1971), Wegesa et.al (1979) and indeed several earlier studies reviewed above attest to this problem. These studies indicate a prevalence of microfilaria of 20-73%, hydrocele prevalence of 20-38% and elephantiasis prevalence of 0-4% along the coastal belt. From these data it is clear that human suffering in terms of morbidity due to filariasis is, and has been an important health problem. However, there are areas where studies have never been done and there are

areas where records exist but are too old and may not indicate the realistic magnitude of the problem, taking into account the changed social-economic factors which may have affected the disease prevalence.

Jordan (1954), noted that the southern province, in particular the coastal belt of Lindi and Mtwara regions had very high prevalence rates of microfilaraemia. These rates were on average higher compared to other provinces of the country (Tanganyika). For instance in the villages neighbouring Urban Lindi (the villages of Kilwa, Mchinga, Rondo and Mtama) microfilaria prevalence rates were found ranging from 21-73%. We can only speculate that for Urban Lindi (a much smaller town then), the rate might have been similar to some of those villages. Moreover, Lindi town like many urban centres in Tanzania has had remarkable population growth (1988 National Census) which has not matched with provision of proper sewerage systems and water supply. It is possible that there has been an upsurge of the vector Culex quinquefasciatus and the risks of filarial infection could be considerably high.

In addition to that, filarial research in Tanzania has mainly concentrated on the aspect of detecting the magnitude of infection among the people. There are very few published studies that have looked into what people

know about the causes and ways of prevention of lymphatic filariasis. Muhondwa (1983) found that even in a place where there had been a project for filariasis control, 56% of the respondents interviewed still thought that hydrocele and elephantiasis could not be prevented and that only 40% of the respondents knew that these conditions were mosquito-borne.

On the basis of the above, this study was designed to delineate the magnitude of Bancroftian filariasis in Lindi urban and to systematically study the community's perceptions on causes transmission and prevention of Bancroftian filariasis.

1.4 Rationale of the study.

Although the coastal belt of Tanzania is long known to be endemic for filariasis, a need still exists of doing prevalence surveys. This is due to the fact that there are areas where studies have never been done and baseline data is needed. There are areas on the other hand, where records exist but are too old and need to be updated taking into account the changed social, economic and environmental situations which may have affected disease prevalence. Lindi urban, unlike Tanga and Dar es Salaam has never been studied for filariasis. There was a need therefore, of undertaking this study in Lindi. Availability of such

baseline information was thought of as vital because it may be used by the ministry of Health or any other concerned organization wishing to launch a filarial control programme. Secondly information gathered might be of use in helping design appropriate health education messages should need arise. Thirdly, but not least, the feedback results to the Lindi community may spur the community itself to start a community based filarial control project.

1.5 Study hypotheses

The study sought to test the following hypotheses

1. That microfilarial infection is closely related to non deployment of anti-vector measures by the household/family.
2. That the mode of transmission of filariasis and methods of prevention are largely unknown by the population.

1.6 OBJECTIVES

1.6.1 Broad objective

To determine the prevalence of filariasis and associated factors in a sample population aged 10 years and above.

1.6.2 Specific objectives

1. To determine the prevalence of microfilaraemia.
2. To determine the prevalence of microfilaraemia and clinical disease namely hydrocele and elephantiasis.
3. To determine the proportion of people with microfilaraemia and chronic sequelae of lymphatic filariasis namely elephantiasis and hydrocele.
4. To determine the association of microfilaraemia with occupation, type of dwelling and level of education.
5. To find out the perceptions of the study population on hydrocele and elephantiasis in terms of cause, transmission, treatment and prevention.

CHAPTER 2

METHODOLOGY

2.1 Description of the study area

The Lindi Urban District is located in the south eastern coast of Tanzania, about 486 km. from Dar-es- Salaam. It is one of the four administrative districts of Lindi Region. Other districts being Kilwa, Lindi Rural, Liwale and Nachingwea. The district is comprised of 13 wards with 10,324 households with a population of 41,701 people.

Of these 20,578 are males and 21,123 are females (National census results;1988). Lindi town, the regional capital,is located in a depression of land alongside a four kilometre stretch of the coast. The water table there is appreciably high. The district has high humidity with temperatures averaging 25^{0}C. Rainfall totalling 800-1200 mm/year is received in the periods October to January and from March to May. Major occupations in the area include subsistence farming, petty business, government employment and small-scale fishing. There are only small-scale industries like carpentry, saltworks and cashewnut processing.

Social services include a hospital, eight dispensaries, two secondary schools and thirteen primary schools. The demand

for water is about 2 million gallons daily but only half of this amount can be met by the water department.

2.2 Study design and study population:

The study design was cross sectional with a target population consisting of urban residents aged 10 years and above. The study population consisted of residents from households in four wards within Lindi urban. The four wards were selected by simple random sampling from the thirteen wards that make up Lindi urban.

2.3 Sample size determination.

The sample size was calculated using the formula $n = z^2.p.q/d^2$; Where:

n = No of subjects required.

p = Estimate of proportion of people with microfilaraemia.

d = Margin of error on p.

z = Standardized normal deviate corresponding to significance level of 0.05.

q = Proportion of people without microfilaraemia = 100 - p.

p was estimated to be 40% according to previous research that showed microfilarial prevalence along the coast to be in range of 20-73%, and d was set at 5%.

Thus: $n = 1.96^2 \times 0.4 \times 0.6 / 0.05^2 = 368$. The calculated sample size was then multiplied by 2 to adjust for the design effect. That is, 2 was taken to be the correction factor for cluster sampling (Moser and Kalton, 1971). Hence the minimum sample size was obtained to be 368 x 2 = 736 people.

2.4 Sampling procedure

A two stage cluster sampling method was deployed, that is, at ward and at household levels. The four research wards were selected by simple random sampling. It was proposed to register all households in the four wards and then to randomly select 300 of them for the study. However, following logistical and administrative difficulties this strategy could not work. Therefore, after liaison with respective ward leaders, household interviews were undertaken. The goal was to visit all localities within a ward in order to get a total number of respondents that was proportional to the total population of each ward (appendix 7.4). Following this procedure, the minimum required sample size of 736 respondents was exceeded by 136, hence adding the sample size to 872 people. This was because even as ward quotas were fulfilled, it was unethical not to include some more people who had kept waiting for us in their homes.

2.5 Operational definitions of terms

1. Hydrocele in the male person was diagnosed by palpation of the scrotal contents to detect the presence of fluid.

2. Oedema. In this context oedema of the limbs was diagnosed by exerting firm finger pressure on a limb for a few seconds. If a small depression formed on the limb and if it refilled shortly after removal of the finger, reversible oedema was diagnosed. If on a swollen limb exerted pressure did not result in a depression on the limb, irreversible oedema was diagnosed.

3. Elephantoid scrotum was diagnosed by visual examination and palpation of scrotal skin. An unusually thickened scrotal skin sometimes with small nodules or vesicles constituted an elephantoid scrotum.

4. House screening. A house was regarded to be well screened against mosquito entry if its windows had untorn mesh-wire, had an intact ceiling board where eaves were open and did not have obvious other entry sites. A partially screened house failed to meet one or several of those criteria.

2.6.1. Administration

The Lindi regional and Town Council authorities were consulted and the study explained to them. The reasons, nature and likely benefits of the research to the community were also detailed. Permission to conduct the research was granted. Subsequently, the Town Director wrote an introductory letter to the respective Ward Executive Officers in whose wards research was to be conducted. The Ward Executive Officers, Chairpersons of localities and the Ten-Cell leaders of the wards were of great assistance in helping mobilize the people.

2.6.2 Questionnaire design

The Kiswahili version of the questionnaire was used. It was designed to collect information on the social-demographic characteristics of the respondents, recall knowledge on some aspects of hydrocele and elephantiasis namely cause, transmission,prevention and treatment and also on mosquito vector prevention practices. The quetionnaires were serially numbered. There was also a form for clinical and parasitological examination. Questions on perceptions of the disease and preventive practices were administered to those aged 15 years or more on account of their maturity.

2.6.3 Pilot study and survey procedure

Pilot testing of the questionnaire was done on 80 people outside the research wards. The aim of the pilot survey was to acquaint the four investigators with the techniques of conducting a research in order to minimize the errors. The results of the testing have not been included in the final results. No changes on the questionnaire design were found necessary following the pilot study.

2.6.4 Clinical examination

Clinical examination was conducted on individuals aged 10 years and above at an arranged place (normally, a house provided by a local leader). The examinations were performed by the author (Principal Investigator). All men had limb examination for oedema as well as a genital examination. Females had limb examination for oedema; in both males and females, inguinal nodes as well as other nodes (axillary and trochlear) were examined. Genital examination in females was not done because of cultural sensitivity associated with the procedure.

2.6.5 Parasitological survey

After physical examination, each individual was given a small piece of paper bearing the number on his/her questionnaire. He/she was briefed on the procedure of blood collection and then requested to come back at night

at a specified house for blood specimen collection. The specimens were collected between 8-10pm. From each individual, 100 microlitres of blood were collected from the pulp of the finger using a micropippete (Epindorf) after disinfecting and pricking the finger with a sterile lancet.

The blood was emptied in a small tube containing 0.5mls of 3% acetic acid and labelled with number corresponding to that on the questionnaire of the respondent. From the same finger prick, a blood smear was prepared and similarly labelled for subsequent staining to identify the species of microfilaria, if any.

2.6.6 Blood examination

Blood examination was conducted at the regional hospital laboratory with assistance of a qualified technician. The blood collected in the 3% acetic acid was individually examined in a counting chamber under low magnification (x100) of a binocular microscope. Care was taken to scan the whole chamber. For those specimens that revealed microfilaria, careful counting was done and recorded per 100 microlitre. The blood smears were left to dry overnight and then stained with giemsa stain. Then they were examined under low power objective of the microscope (x100). Those found positive were examined under high

power (x400 and x1000) for the microfilaria species identification.

2.7. Ethical considerations

People found to harbour microfilaria were given a two week course of diethylcarbamazine at a daily dosage of 6mg/kg body weight in three divided doses. Those with hydroceles were encouraged to go to the hospital for surgical consultation.

2.8 Data analysis.

Open ended questions were coded after categorization. Data were then entered into a computer at the department of epidemiology and biostatistics. Analysis using the SPSS/PC and EPINFO programs was performed and tables created to answer research questions.

2.9 Study limitations

1. Although the study does offer a statistical glimpse of the filarial situation in Lindi urban, it is constrained in sample selection. It was intended to select a random sample from the households of the four wards but this could not be achieved following logistical and administrative difficulties; instead unrandomized household interviews were resorted to.

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Hence, its inferential credentials cannot be free from criticism.

2. Respondents who declined to come back for night blood examination were 192, reducing the sample size to 680. Therefore, analysis on microfilaraemia levels is based on this sample.

CHAPTER 3

RESULTS

3.1 Demographic characteristics of the study population

Eight hundred and seventy two people (872) were interviewed and physically examined for the chronic sequelae of Bancroftian filariasis. A total of 192 individuals however, did not turn up for night blood taking.

Analysis of the social-demographic information of the study sample indicate that out of 872 respondents, 44.8% were males and 55.2% were females. The youth between ages 10-19 years constituted 44.2% of the study sample. The mean age was 29.2 years with a median age of 24 years and standard deviation of 17.8 years. The age range was 10-89 years. The summary statistics for age suggests a positively skewed distribution of the variable in the sample (Table 1)

Table 1: Age and sex distribution of the sample

Age Group (years)	Sex				Total	
	Male		Female			
	No.	%	No.	%	No.	%
10 - 19	190	48.6	195	40.5	385	44.2
20 - 29	46	11.8	76	15.8	122	14.0
30 - 39	38	9.7	75	15.6	113	13.0
40 - 49	46	11.8	62	12.9	108	12.4
50 - 59	35	9.0	40	8.3	75	8.6
60 - 69	24	6.1	22	4.6	46	5.3
70+	12	3.0	11	2.3	23	2.6
Total	391		481		872	100.0

3.2 Prevalence of microfilaria in the study population

The overall prevalence of microfilaraemia was 12.1% (95% confidence intervals of 9.6% - 14.6%). Prevalence was lowest (9.5%) in the age group 10-19 years and highest (17.6%) in the age group 40-49 years. The differences observed in prevalence rates between the age groups were not statistically significant (chi-square = 7.16, p value = 0.41; Table 2).

One hundred and twenty eight people (128) not included in the study sample came on their own requesting to have their blood checked for microfilaria. In order to maintain good relations and also as an ethical consideration, they were examined. Although this was not part of the methodology, this information has been included as a matter of documentary interest. In this group, 18.75% (24) were microfilaria positive. This prevalence was 7% higher compared to that found in the study sample.

Wuchereria bancrofti was the only microfilaria species that was identified.

Table 2: Prevalence of microfilaria by age and sex.

Age group in years	MALE			FEMALE			TOTAL			
	No.Exam.	No.Pos.	Prevalence%	No.Exam.	No.Pos.	Prevalence%	No.Exam.	No.Pos.	Prevalence%	95% CI
10-19	148	12	8.1	147	16	10.9	295	28	9.5	6.1-12.9
20-19	32	5	15.6	58	6	11.1	90	11	12.5	5.5-19.5
30-39	27	6	22.2	66	5	3.4	93	11	11.8	5.5-18.5
40-49	36	5	13.9	55	11	20.0	91	16	17.6	9.6-25.6
50-59	24	6	25.0	33	2	6.1	57	8	14.0	4.8-23.2
60+	27	5	18.5	27	3	11.1	54	8	14.8	5.1-24.5
Total	294	39	13.3	386	43	11.1	680	82	12.1	9.6-14.6

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3.3 Prevalence of microfilaria by sex

Analysis was done to determine if there was any sex difference in the prevalence of microfilaraemia. Of 680 individuals examined, 13.3% (39) males were microfilaria positive compared to 11.1% (43) females. However, this difference was not statistically significant (chi square = 0.71, p value = 0.4).

3.4 Prevalence of microfilaraemia by level of education

Analysis was done to determine if there was any association between level of education and microfilaria prevalence. Based on 678 respondents, a microfilaria prevalence of 14.5% (23) was found in respondents with less than primary education compared to 11.4% (59) in those with primary and above education (chi square = 1.1; p value = 0.30). The quantitative difference observed was not statistically significant.

3.5 Prevalence of microfilaraemia by house screening

Analysis was done for 675 respondents to see if screening of house entrances against mosquitoes had any association with the prevalence of microfilaria.

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Microfilaria prevalence was 0% in those inhabiting houses which were well screened, 10.9% (29) in those with partially screened houses and 13.0% (51) in those living in unscreened houses. These differences, however, were not statistically significant (chi square = 2.90; p value = 0.23.) and could therefore have been due to chance.

3.6 Prevalence of microfilaria by use of mosquito net

Analysis was done for 510 of the respondents to determine if use of mosquito nets was associated with the prevalence of microfilaraemia.

The use of mosquito nets was found to be associated with a lower prevalence of microfilaraemia. It was found that the prevalence in 372 respondents who used nets was 11.0% (41) compared to 19.6% (27) in 138 respondents who were not using them. This difference was statistically significant (chi square = 6.36, p value = 0.012.).

3.7 Microfilaria density by sex

Further analysis was done to determine if there was a sex difference in microfilaria density levels. There was a slight difference between males and females at the levels of 6-50mf/100uL; where 9.2% (27) of the males were in this group

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compared to 6.2% (24) of the females. Nevertheless the quantitative difference observed between males and females were not statistically significant ($t = 0.45$, p value = 0.66; Table 3) .

Microfilaria counts showed that there were 83 microfilaria per positive slide with a median count of 36, a mode of 26 a range of 6-1172 and a standard deviation of 165.27. This was a highly skewed distribution. Therefore logarithmic transformation of microfilaria counts was done to get the mean counts. There were 3.67 microfilaria per positive slide in males and 3.60 in females.

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Table 3: Microfilaria density by sex

Microfilaria/ 100uL	Male		Female		Total	
	no	%	no	%	no	%
6 - 50	27	9.2	24	6.2	51	7.5
51+	12	4.1	22	4.9	31	4.5
Negative	225	86.7	343	88.9	598	88.0
Total	294	43.2	386	56.8	680	100.0

3.8 Prevalence of lymphatic pathology in the study population

3.8.1 Prevalence of hydrocele

A total of 370 men underwent genital examination to find out if they had hydrocele or elephantiasis of the scrotum or both (21 men declined to be examined). Age specific rates show that 48.1% (178) of those examined were young men aged between 10-19 years. Hydroceles were found in 13.5% (50) of the examined individuals and elephantiasis of the scrotum was found in 0.54% (2).

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The prevalence of hydrocele rose with age and was highest (41.2%) in the age group 60 years and above. There was a highly statistically significant association between increase in age and a rising prevalence of hydrocele (chi square = 59.35, p value < 0.0001; Table 4).

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Table 4: Prevalence of hydrocele by Age

Age Group	No. Examined	No positive	Prevalence	95% CI
10 - 19	178	3	1.7	0 - 3.6
20 - 29	43	5	11.6	1.8 - 21.5
30 - 39	36	8	22.2	8.7 - 36.5
40 - 49	45	9	20.0	8.1 - 31.9
50 - 59	34	11	32.4	16.3- 48.5
60+	34	14	41.2	24.3- 58.1
Total	370	50	13.5	9.9 - 17.1

3.8.2 Prevalence of limb elephantiasis

In the sample population of 872 people, the extremities were examined for oedema in order to detect elephantiasis. The results showed that 5.2% (45) of the respondents had elephantiasis. Among these, 20% (9) were males and 80% (36) were females. The number of affected females was four times that of males. Based on the sample population in which 391 were males and 481 were females, the prevalence in males was 2.3% while that in females was 7.5%.

In those affected, the legs were most commonly involved (88%) and the left was more frequently involved than the right (49% vs 39%). The upper extremities were affected in 12%.

3.9 Microfilaraemia and chronic pathology

Microfilaria are known to disappear from the blood circulation in chronic disease due to immunological clearance. This study investigated if the same phenomenon existed in the study population. The results show that, 8% (4) of the respondents with hydrocoele were found to harbour microfilaria as were 2.2% (1) of respondents with elephantiasis.

3.10.0 Perceptions of study population on the causes, transmission, treatment and prevention of filariasis

3.10.1 Disease awareness by the study population

Six hundred and twenty seven (627) people responded to the question on whether or not they had heard of elephantiasis and hydrocele. Six hundred and eighteen (98.6%) of the respondents had heard of elephantiasis while 94% (588) of them in fact knew of a person(s) with elephantiasis. For hydrocele, 98.6% (618) of the respondents also had heard of

this condition while 95.9% (601) of them knew someone with a hydrocele.

When asked if they thought these diseases constituted a problem in their area, 79.1% (496) of the respondents thought hydrocele was indeed a problem while 77.7% (487) thought so in the case of elephantiasis.

3.10.2 Mosquito and diseases

Six hundred and twenty six people (626) responded to the question on whether or not they regarded mosquitoes as dangerous insects.

Mosquitoes were regarded as dangerous insects by 94.9% (594) of the respondents. When these were asked what they thought mosquito dangers were, 95% (595) named disease transmission, 3.0% (19) said mosquito bite caused itchy skin and discomfort, while 0.3% (2) could not pinpoint the dangers and 1.6% (10) gave varied reasons.

Six hundred and twenty (620) individuals responded to the question on the role of the mosquito in disease transmission. Malaria was mentioned by 83.2% (516) of the respondents, elephantiasis by 42.4% (263), hydrocele by 26.8% (167) and

AIDS was mentioned by 10.4% (65) of the respondents. Malaria seemed to be well known as mosquito transmitted compared to hydrocoele and elephantiasis.

Six hundred twenty six (626) individuals responded to the question on anti-mosquito measures practiced at household level. Four hundred and seventy eight (76.3%) of the respondents said they were using some kind of measure like the mosquito-net, repellants and environmental cleaning, while 23.7% (148) said they never took any mosquito protective measure. The mosquito net was the most frequently used method, being applied by 60.5% (379) of the respondents.

3.10.3 Perceived causes of hydrocele by age and sex

Analysis of the data on perceptions of causation for 621 respondents indicated that the study population is generally ignorant of the causes of hydrocele. The beliefs of causation included will of God, 36.4% (226) of the respondents, and mosquito bite 26.8% (167) of the respondents. However, a significant proportion, 26.2% (163) of the respondents did not know the cause. A small proportion believed in witchcraft, promiscuity and other causes (Tables 5 and 6).

Further analysis on the association of age and beliefs of causation, showed that the belief in the will of God ranged from 33 to 35% with the exception of the older age group (60+years) in which 47.8% believed in the will of God. The belief in mosquito bite ranged from 19.4 to 31.5%. The lowest proportion being in those aged 60+ years, and the highest being in the age group 30 to 39 years. Those who did not know of the cause ranged from 18% in the 30 to 39 age group to 36.4% in the 10 to 19 age group. The youngest age group appeared to be more ignorant.

Comparing males and females, the results show that a slightly higher proportion of females (39.4%) believed in the will of God compared to 32.8% of the males. However this difference was not statistically significant (p value = 0.75). Mosquito bite was thought as a cause by 25.8% of the males in compared to 27.6% of the females (not a statistically significant difference - p value = 0.60). With regard to those who did not know the cause, the proportions in males and females were virtually the same (26.1% and 26.2% respectively).

Table 5: Perceived causes of hydrocele by age

Perceived cause of hydrocele	10 -19	20-29	30-39	40-49	50-59	60+	Total
Will of God	47(33.6%)	41(33.9%)	43(38.7%)	38(35.5%)	25(33.3%)	32(47.8%)	226(36.4%)
Mosquito bite	33(23.6%)	36(29.8%)	35(31.5%)	33(30.8%)	17(22.7%)	13(19.4%)	167(26.9%)
Coconut juice	2(1.4%)	1(0.8%)	1(0.9%)	2(1.9%)	0(0.0%)	0(0.0%)	6(1.0%)
Bewitchment	3(2.1%)	4(3.3%)	2(1.8%)	0(0.0%)	1(1.3%)	0(0.0%)	10(1.6%)
Promiscuity	3(2.1%)	8(6.6%)	7(6.3%)	9(8.4%)	7(9.3%)	7(10.4%)	41(6.6%)
Other reasons	1(0.7%)	0(0.0%)	3(2.7%)	1(0.9%)	2(2.7%)	1(1.5%)	8(1.3%)
Don't know	51(36.4)	31(25.6%)	20(18.0%)	24(22.4%)	23(30.7%)	14(20.9%)	163(26.2%)
Total	140(22.5)	121(19.4%)	111(17.8%)	107(17.2%)	75(12.0%)	67(10.8%)	621(100%)

Table 6: Perceived causes of hydrocele by sex

Perceived cause of hydrocele	Male		Female		Total	
	No.	%	No.	%	No.	%
Will of god	88	32.8	140	39.4	228	36.6
Mosquito bite	69	25.8	98	27.6	167	26.8
Coconut juice	3	1.1	3	0.9	6	0.9
Bewitchment	9	3.4	1	0.3	10	1.6
Promiscuity	25	9.3	16	4.5	41	6.6
Inter/menses	4	1.5	4	1.1	8	1.3
Don't know	70	26.1	93	26.2	163	26.2
TOTAL	268	43.0	355	57.0	623	100.0

3.10.4 Perceived causes of hydrocele by education

The association of level of education and the respondents'perceptions on causes of hydrocoele was also investigated. Generally, across all educational levels, 26.7% of the respondents thought that mosquitoes can cause hydrocele, 36.7% thought the will of God was responsible and 26.2% did not know the cause.

If the level of education is considered, 32.8% of those with primary education and above thought the mosquito was the cause compared to 13.3% of those with lower than primary education; the difference being highly significant (p value< 0.001). Of those with lower than primary education, 48.2% believed in the will of God as the cause of hydrocele compared to 31.4% of those with primary education and above. The difference was also statistically significant (p value = 0.0000). However, comparing the levels of education for respondents who did not know the cause of hydrocele, the differences in proportions of the two groups was not statistically significant (p value = 0.44; table 7).

Table 7: Perceived causes of hydrocele by education

Perceived cause of hydrocele	<Primary		≥Primary		Total	
	No.	%	No.	%	No.	%
Will of God	94	48.2	134	31.4	228	36.7
Mosquito bite	26	13.3	140	32.8	166	26.7
Coconut Juice	1	0.5	5	1.2	6	1.0
Bewitchment	3	1.5	7	1.6	10	1.6
Promiscuity	12	6.2	29	6.8	41	6.6
Other reasons	4	2.1	4	0.9	8	1.2
Don't know	55	28.2	108	25.3	163	26.2
Total	195	31.4	427	68.6	622	100.0

3.10.5 Perceived causes of elephantiasis by age and sex

Analysis of the data on the perceptions of the study population on the cause of elephantiasis indicated that overall, 31.1% of the respondents thought that it was the will of God, while 42.45 believed that the mosquito was the cause. A significant proportion of 21.4% did not know the cause and a smaller proportion believed in bewitchment, promiscuity, and other causes (Tables 8 and 9).

With regard to the association of age and beliefs of causation of elephantiasis there seemed to be a direct relationship between belief in the will of God and age; as the age increased, the proportion of the respondents who believed in this causation, increased. However, for the belief in mosquito causation, there was a decrease in the proportion of respondents with increasing age.

A significant proportion of the respondents did not know the cause of elephantiasis, ranging from 13.2% to 28% across all age groups. The lowest proportion was in the age group 40 to 49 and the highest in the age group of 10 to 19 years.

Further analysis indicate that a higher proportion of females (35.2%) believed in the will of God compared to 25.5% of the

males; this difference was significant (p value = 0.009; table 9). A higher proportion of males (46.0%) believed in the mosquito bite compared to females (39.7%); but there was virtually no difference in the proportions of those who did not know (21.7% in males and 21.1% in the females).

Table 8: Perceived Causes of Elephantiasis by age

Age in years.

Perceived cause of elephantiasis	10 -19	20-29	30-39	40-49	50-59	60+	TOTAL
Will of God	28(20.1%)	21(17.4%)	42(37.5%)	38(35.8%)	29(40.8%)	34(49.3%)	192(31.1%)
Mosquito bite	66(47.5%)	60(49.6%)	52(46.4%)	47(44.3%)	21(29.6%)	16(23.2%)	262(42.4%)
Bewitchment	1(0.7%)	6(5.0%)	1(0.9%)	2(1.9%)	1(1.4%)	0(0.0%)	11(1.8%)
Promiscuity	0(0.0%)	2(1.7%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	2(0.3%)
Dirty water	1(0.7%)	0(0.0%)	2(1.8%)	4(3.8%)	3(4.2%)	1(1.4%)	11(1.8%)
Don't know	39(28.1%)	32(26.4%)	15(13.4%)	14(13.2%)	16(22.5%)	16(23.2%)	132(21.4%)
Other reasons	4(2.9)	01(19.6%)	0(0.0%)	1(0.9%)	1(1.4%)	2(2.9%)	8(1.3%)
TOTAL	139(22.5)	121(19.4%)	112(18.1%)	106(17.2%)	71(11.5%)	69(11.2%)	618(100%)

Table 9: Perceived causes of elephantiasis by sex

Perceived cause of elephantiasis	Male	%	Female	%	Total	%
Will of god	67	25.5	125	35.2	192	31.0
Mosquito bite	121	46.0	141	39.7	262	42.4
Bewitchment	3	1.1	8	2.3	11	1.8
Promiscuity	1	0.4	1	0.3	2	0.3
Dirty water	8	3.0	3	0.8	11	1.8
Don't know	57	21.7	75	21.1	132	21.4
Other reasons	6	2.3	2	0.6	8	1.3
Total	263	42.6	355	57.4	618	100.0

3.10.6 Perceived causes of elephantiasis by education

Analysis was carried out to determine if the level of education had any influence on the perception of causation. The results show that the will of God as a cause was believed by 50.8% of respondents with less than primary education, compared to 22.3% of the respondents with primary and above education. The difference was statistically significant (P value <0.001). In contrast, 52.6% of the respondents with primary or more education thought of the mosquito aetiology compared to 19.4% of the respondents with less than primary education; the difference was also statistically significant (p value = 0.000). For those who did not know of the cause, there was little difference between the two educational categories; i.e 23.7% of those with less than primary education and 20.4% of those with primary or more education.

Education appeared to be an important factor in determining the correct perception of elephantiasis causation (Table 10).

Table 10: Perceived causes of elephantiasis by education

Perceived cause of elephantiasis	Education					
	<Pr Ed.		≥Pr.Ed		Total	
	No.	%	No.	%	No.	%
Will of God	97	50.8	95	22.3	192	31.1
Mosquito bite	37	19.4	224	52.6	261	42.3
Bewitchment	6	3.1	5	1.3	11	1.8
Promiscuity	0	0.0	2	0.4	2	0.3
Dirty water	3	1.5	8	1.9	11	1.8
Don't know	45	23.7	87	20.4	132	21.4
Other reasons	3	1.5	5	1.2	8	1.3
Total	191	31.0	426	69.0	617	100.0

Key:< pr.Ed. = Less than primary education.

≥ pr.Ed. = Greater than or equal to primary education

Table 10: Perceived causes of elephantiasis by education

Perceived cause of elephantiasis	Education					
	<Pr Ed.		≥Pr.Ed		Total	
	No.	%	No.	%	No.	%
Will of God	97	50.8	95	22.3	192	31.1
Mosquito bite	37	19.4	224	52.6	261	42.3
Bewitchment	6	3.1	5	1.3	11	1.8
Promiscuity	0	0.0	2	0.4	2	0.3
Dirty water	3	1.5	8	1.9	11	1.8
Don't know	45	23.7	87	20.4	132	21.4
Other reasons	3	1.5	5	1.2	8	1.3
Total	191	31.0	426	69.0	617	100.0

Key:< pr.Ed. = Less than primary education.

≥ pr.Ed. = Greater than or equal to primary education

3.10.7 Perceived causes of elephantiasis by occupation

Analysis was carried out to determine if there was any relationship between the respondents'perceptions on causes of elephantiasis and occupation. The belief in the will of God ranged from 12.7% among the students to 41.0% among the peasants. Therefore the peasants appeared to believe more in the will of God compared to other groups. The belief in mosquito bite ranged from 30.8% among the fishermen to 70.4% among government workers. The latter group seemed to be more aware of the medical explanation i.e mosquito bite. With regard to respondents who did not know, the range was 9.9% in government workers to 30.8% among the peasants; indicating that the peasants were least informed (Table 11).

Table 11: Perceived causes of elephantiasis by occupation

Perceived cause of elephantiasis	Peasant	Govt. employee	Involved in business	Fisherman	H/Wife	Student	Others	TOTAL
Will of God	128(41.0%)	13(16.0%)	16(43.2%)	3(23.0%)	10(23.2%)	13(12.7%)	9(31.0%)	192(31.1%)
Mosquito bite	102(32.7%)	57(70.4%)	15(40.6%)	4(30.8%)	19(44.2%)	55(53.9%)	10(34.5%)	262(42.5%)
Bewitchment	6(1.9%)	1(1.2%)	0(0.0%)	1(7.7%)	2(4.7%)	0(0.0%)	1(3.5%)	11(1.8%)
Promiscuity	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	1(2.3%)	1(1.0%)	0(0.0%)	2(0.3%)
Dirty water	5(1.6%)	2(2.5%)	1(2.7%)	1(7.7%)	0(0.0%)	1(1.0%)	1(3.5%)	11(1.8%)
Don't know	67(21.5%)	8(9.9%)	5(13.5%)	4(30.8%)	11(25.6%)	28(27.5%)	8(27.6%	131(21.2%)
Other reasons	4(1.3)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	4(3.9%)	0(0.0%)	8(1.3%)
TOTAL	312(50.6)	81(13.1%)	37(6.0%)	13(2.1%)	43(7.0%)	102(16.6%)	29(4.7%)	617(100%)

3.10.8 Perceptions on the prevention of hydrocoele.

According to age-specific responses, the proportions that believed hydrocele was preventable ranged from 32.2% in the 60+ years age group to 50.5% in the 40-49 years age group. There was little quantitative difference in those aged 20 to 49 years compared to the remaining age groups. In the age group 20 to 49 years a higher proportion of respondents thought that hydrocele could be prevented, in contrast to the higher age groups. However for the age group 50 to 59 a lower proportion of respondents believed that hydrocele was preventable.

With regard to those who did not believe that hydrocele was preventable, the range was 16.0% in the 20 to 29 years age group to 33.9% in the 60+ years age group. There was only a little variation across the age groups, however it appeared that the age group 20 to 29 years had the least proportion of respondents who believed that hydrocele was not preventable (Table 12).

Analysis of the association of sex and the perceptions of hydrocele prevention indicate that slightly more males (46.1%) compared to females (40.5%) believed that the condition is preventable but the difference was not statistically significant (p value = 0.12; Table 13).

Table:12 Perceptions on hydrocoele prevention by age.

Age	Perception on prevention						Total	
	Condition preventable		Condition not preventable		Don't know			
	No.	%	No.	%	No.	%	No.	%
10-19	48	37.2	40	31.0	41	31.8	129	22.6
20-29	48	45.3	17	16.0	41	38.7	106	18.6
30-39	54	50.0	22	20.4	32	26.9	108	18.9
40-49	51	50.5	19	18.8	31	30.7	101	77.7
50-59	24	36.9	18	27.7	23	35.4	65	11.4
60+	20	32.2	21	33.9	21	33.9	62	10.8
Total	245	42.9	137	24.0	189	33.1	571	100

Table: 13 Perceptions on hydrocele prevention by sex

Perception on Prevention	Male		Female		Total	
	No.	%	No.	%	No.	%
Yes	112	46.1	133	40.5	245	42.9
No	56	23.0	81	24.7	137	24.0
Don't know	75	30.9	114	34.8	189	33.1
Total	243	42.6	328	57.4	571	100

3.10.9 Perception on hydrocele prevention by education

The association of education and the perceptions on the prevention of hydrocele was investigated. Considering respondents across all levels of education, 42.8% thought that hydrocoele is preventable. However for those with primary education and above, 49.2% of the respondents thought that hydrocoele was preventable compared to 28.2% of those with less than primary education; the difference was statistically significant (p value = 0.000; Table 14). Of those with less than primary education, 32.2% thought hydrocele was not preventable compared to 20.5% of those with primary and above education; the difference was also

statistically significant (p value = 0.002). In the group with less than primary education 39.6% did not know, while 30.3% of those with primary and above education did not know whether or not hydrocele was preventable. The difference was statistically significant (p value = 0.02; Table 14). Education level therefore, appeared to be an important factor in the perception of hydrocoele prevention.

Table 14: Perceptions on hydrocele prevention by education

Level of Ed.	Perception						Total	
	Hydrocele preventable		Hydrocele not preventable		Don't know			
	No.	%	No.	%	No.	%	No.	%
<Pr.Ed.	49	28.2	56	32.2	69	39.6	174	30.5
≥Pr.Ed.	195	49.2	81	20.5	120	30.3	396	69.5
Total	244	42.8	137	24.0	189	33.2	570	100

Key: <Pr.Ed. = Less than primary education

≥Pr.Ed. = Primary education or above

3.10.10 Perceptions on hydrocele prevention by occupation

Analysis was carried out to determine if there was any relationship between respondents' occupations and perceptions on hydrocele prevention. In respondents who believed in prevention, the proportion ranged from 35.8% in the peasants to 74.0% in government employees. Government employees stood out as a group in which the majority of its respondents believed in hydrocele prevention. There was little quantitative difference in the remaining occupational groups in this category.

For those who believed that hydrocele is not preventable, the proportions ranged from 6.5% in government employees to 27.0% among the peasants. Government empolyees again, stood out as a group that least believed that hydrocele cannot be prevented; there was little quantitative difference in the remaining occupational groups. And in the group who "did not know" if hydrocele can be prevented, the range was 19.5% in the government workers to 37.2% among the peasants. So in general, government workers appeared to have better positive perception on hydrocele prevention while the peasants had least (Table 15).

Table 15: Perception on hydrocele prevention by occupation

Occupation	Perception						Total	
	Hydrocele preventable		Hydrocele not preventable		Don't know			
	No.	%	No.	%	No.	%	No	%
Peasant	105	35.8	77	27.0	106	37.2	285	50.0
Government employee	57	74.0	5	6.5	15	19.5	77	13.5
Involved in business	15	45.5	8	24.2	10	30.3	33	5.8
Fisherman	5	41.7	3	25.0	4	33.3	12	2.1
Housewife	14	36.8	10	26.4	14	36.8	38	6.7
Student	43	44.8	24	25.0	29	30.2	96	16.8
Others	9	31.0	10	34.5	10	34.5	29	5.1
Total	245	43	137	24.0	188	33.0	570	100

3.10.11 Perceptions on prevention of elephantiasis

Analysis was carried out to determine if there was a relationship between age, sex and perceptions on elephantiasis prevention.

With regard to age, 48.7% of the respondents across all age groups, thought that elephantiasis can be prevented while 33.6% did not think so and 17.7% did not know.

In the category "condition preventable" the proportions who believed in prevention ranged from 38.5% in the 50 to 59 age group to 55.6% in the 30 to 39 age group. Generally, there was little quantitative difference between the age groups. The only exception was the age group 50 to 59 years where comparatively less (38.5%) of respondents believed that elephantiasis is preventable. In the category "condition not preventable" the proportion ranged from 25% in the 25 to 29 age group to 44.6% in the 50 to 59 age group. Again, there was little quantiatative differences between the age groups but in the same age group (50 to 59 years) there were more respondents who believed the condition as unpreventable. And in the category "don't know", the proportions ranged from 10.4% in the 60+ age group to 22.4% in the 10 to 19 age group. A trend was evident in that generally, the younger the

age, the higher was the proportion of respondents who did not know (Table 16).

More males (52.8%) than females (45.7%) thought that elephantiasis was preventable but the difference was not statistically significant (p value = 0.09; table 17).

Table 16: Perceptions on elephantiasis prevention by age

Age	Perception on prevention						Total	
	Condition is preventable		Condition not preventable		Don't know			
	No.	%	No.	%	No.	%	No.	%
10-19	62	49.6	41	32.8	22	17.6	125	22.4
20-29	54	51.9	26	25.0	24	23.1	104	18.6
30-39	60	55.6	40	37.0	8	7.4	108	19.3
40-49	47	47.5	30	30.3	22	22.2	99	17.7
50-59	25	38.5	29	44.6	11	16.9	65	11.6
60+	24	41.4	22	37.9	12	20.7	58	10.4
Total	272	48.7	188	33.6	99	17.7	559	100

Table 17: Perception on elephantiasis prevention by sex

Perception on prevention	Male No.	Male %	Female No.	Female %	Total No.	Total %
Preventable	123	(52.8)	149	(45.7)	272	(48.7)
Not preventable	74	(31.8)	114	(35.0)	188	(33.6)
Don't know	36	(15.4)	63	(19.3)	99	(17.7)
Total	233	(41.7)	326	(58.3)	559	(100)

3.10.12 Perceptions on elephantiasis prevention by education

Analysis was done to see whether or not the level of education had any relationship with the perceptions on prevention of elephantiasis.

Respondents with primary education and above had a higher proportion (55.7%) with positive perception on prevention compared to those with lower than primary education (32.6%); the difference was statistically significant (p value = 0.000). Only 28.3% of respondents with primary and above education thought that the condition was not preventable compared to 45.9% of the respondents with less than primary education. This difference was statistically significant (p value = 0.003; Table 18).

Table 18: Perceptions on elephantiasis prevention by education

Level of education	Perception on elephantiasis						Total	
	Preventable		Not preventable		Don't know			
	No.	%	No.	%	No.	%	No.	%
< primary Ed.	56	32.6	79	45.9	37	21.5	172	30.8
≥primary Ed.	215	55.7	109	28.2	62	16.1	386	69.2
Total	271	48.6	188	33.7	99	17.7	558	100

Key: <Pr.Ed. = Less than primary education

≥Pr.Ed. = Primary education or above

3.10.13 Perceptions on hydrocele treatment by age and sex

Analysis was done to see if age and sex had any association with the perception on hydrocele treatment.

Those who thought hydrocele can be treated comprised 85.9% of respondents across all age groups. More than 84% of the respondents in each age group believed that hydrocele is treatable and the quantitative differences noted were of no statistical significance (p value = 0.40; Table 19). Those who thought hydrocoele could be treated comprised of 87.3% of all males and 84.9% of all females, the difference noted was not statistically significant (p value = 0.08). Less than 10% of the respondents believed that hydrocele cannot be treated.

Table 19: Perceptions on treatment of hydrocele by age

Perception	Age in years						
	10 -19	20-29	30-39	40-49	50-59	60+	Total
Treatable	118	99	96	91	65	62	531
	(84.3%)	(83.9%)	(85.7%)	(86.7%)	(87.8%)	(89.9%)	(85.9%)
Not treatable	13	9	12	10	3	5	52
	(9.3%)	(7.6%)	(10.7%)	(9.5%)	(4.1%)	(7.2%)	(8.4%)
Don't know	9	10	4	4	6	2	35
	(6.4%)	(8.5%)	(3.6%)	(3.8%)	(8.1%)	(2.9%)	(3.7%)
Total	140	118	112	105	74	69	618
	(22.6%)	(19.1%)	(18.1%)	(17.0%)	(12.0%)	(11.1%)	(100%)

3.10.14 Perceptions on hydrocele treatment by education

Analysis was done to find out if there existed a relationship between level of education and the perceptions on hydrocele treatability. Majority (85.9%) of the respondents across all educational groups thought that hydrocele can be treated. Between the two educational groups (less than primary education and primary education and above) there was literally no difference in proportions of respondents who believed in the treatability of hydrocele and those who did not (p value = 0.76; Table 20).

Table 20: Perceptions on hydrocele treatment by education

Level of education	Perception on hydrocele						Total	
	Treatable		Not Treatable		Don't know			
	No.	%	No.	%	No.	%	No.	%
<primary	162	85.2	14	7.4	14	7.4	190	30.8
≥primary	368	86.2	38	8.9	21	4.9	427	69.2
Total	530	86.2	52	8.4	35	5.7	617	100

Key: <Pr.Ed. = Less than primary education

≥Pr.Ed. = Primary education or above

3.11 SUMMARY OF THE RESULTS

The highlights of the study were as follows:

1. Hydrocele and elephantiasis were well known disease entities and that people reckoned that they are a problem; 98.6% of the respondents had heard of elephantiasis and 94% of them actually knew of a person(s) with the condition. This is supported by an elephantiasis prevalence of 5.2% (95% CI of 3.7% - 6.4%). In the case of hydrocele, 98.6% of the respondents had heard of the condition and 95.6% of them actually knew of a person with hydrocele. This is supported by a prevalence rate of 13.5% (95% CI 9.9% - 17.1%) of hydrocele in the community.

   With those prevalences, it is undoubted that 79.2% of the respondents in fact thought that hydrocele was a problem as 77.8% thought so for elephantiasis.

2. Although 98.6% of the respondents knew of hydrocele, only a small proportion (26.6%) were aware of the correct mode of transmission (mosquito bite). The majority (36.6%) believed the condition was due to the will of God, besides the 26.2% of the respondents who did not know of the cause.

It is interesting to note that for elephantiasis a greater proportion (42.4%) believed that the condition was mosquito transmitted compared to hydrocele (26.8%). However, 31.1% of the respondents thought the condition was due to the will of God and 21.4% did not know the cause.

3. In regard to preventability, majority (more than 50%) did not know that these two conditions were preventable. In the case of hydrocele, only 42.9% of the people believed the condition to be preventable, 24% did not think it was preventable, and 31.1% did not know. For elephantiasis, 48.7% believed the condition to be preventable, 33.6% did not think it was preventable and 17.7% did not know. These observations seem to support the hypothesis that many people are not aware of the causes and prevention of filariasis.

The level of education seemed to influence the belief of causation and prevention of filariasis. While 13.3% of those with less than primary education believed hydrocele is mosquito transmitted, 32.8% of the respondents with primary education and above thought so. With regard to prevention only 28.2% of the respondents with less than primary education believed that the

condition was preventable compared to 49.2% of those with primary education and above.

4. The prevalence of microfilaremia was 12.1% (95% CI 9.6% - 14.6%). The prevalence was lower in the younger age groups and rose with age. It was higher in males compared to females. The use of the mosquito-net was significantly associated with low prevalence. Thus the hypothesis that deployment of preventive measures lowered the transmission rate and hence microfilaria prevalence held true.

   Microfilaria were found to be very low in chronic disease.

5. Majority of the respondents (85.9%) knew that hydrocele can be cured surgically in a hospital.

6. Seventy six percent (76.2%) of the people took measures to protect themselves from mosquito bites and the mosquito-net was being used by 60.4% of the respondents.

7. 5.2% of the respondents had limb elephantiasis, 13.5% of the men had hydrocele and 0.5% of them had elephantiasis of the scrotum.

CHAPTER 4

DISCUSSION

The prevalence of Wuchereria bancrofti microfilaraemia in Lindi town was 12.1% (95% CI 9.9 - 14.3). This rate is considerably low when viewed in the context of the previous prevalences for the coastal strip (Hawking, 1940; Jordan, 1956a; Crans, 1970; Wegesa, 1979; Menu and Kilama, 1971) and in particular for the Lindi coast which all along has had a reputation of fourty two years of filarial hyperendemicity.

The study of Jordan (1954) indicated that the prevalence of microfilaria in the vicinity villages around Lindi township namely Mchinga, Rondo and Mtama were 54%, 21% and 56% respectively. Probably the rate for the town itself (Lindi-then very small), could not have been much different from the surrounding villages. For Kilwa village (now a small town) located 100km. to the North of Lindi town, the rate in men was 73%, the highest Jordan ever found in his territorial-wide survey.

The low microfilaria prevalence observed in the current study is surprising when other factors that would have been expected to favour an increased transmission of Bancroftian

filariasis in the area are taken into account. These factors include, an increase in the Lindi urban population which has occurred over the last fourty years (1988 National census), the reliance on the pit latrine as the main sanitary facility (1988 National census; and based on the present study which found that 90% of people use pit latrines); the absence of a control programme in the town and the general absence of diethylcarbamazine in health facilities as well as the prevailing little awareness among the population that hydrocele and elephantiasis are mosquito-borne.

The present microfilaria prevalence rate reflect the current situation in Lindi but in fact could also be a reflection of a prevalence of microfilaria that has declined. Minjas (1986) for example, found a prevalence of microfilaria of 12.9% in Dar-es-Salaam. This contrasts with 37% in adult males and 20% in adult females which Jordan (1956a) found in Dar-es-Salaam. Other prevalences along the coast were 21-52% in rural Tanga and 40% in urban Tanga (Crans, 1970), 41% in Tanga coastal villages (Wegesa et.al, 1979) and 29.1% in Bagamoyo (Menu and Kilama, 1971).

A possible explanation to this observed difference may lie in the increased use of the mosquito net by the indigenous

population that has occurred over the last fourty years. Although there are no available data to show the proportion of the indigenous population which was using the net, Hawking (1940) and Jordan (1956a) both remarked that the prevalence of microfilaria in Arabs and Indians residing in same areas as Africans was lower. They attributed this difference to the anti-vector measures that the former were known to be deploying compared to the latter, rather than to racial differences.

In the current study the use of the mosquito net was associated with a reduction in the prevalence of microfilaraemia. Those without nets had a prevalence of 19.6% compared to 11% in those using nets. These results were statistically significant. The other factors that may have contributed to lower the prevalence of microfilaria are education and housing improvements that are thought to have taken place over the last fourty years. Although in this study both the higher level of education and the screening of houses were each associated with a reduction in the prevalence of microfilaraemia, statistical testing did not support these facts. Further research on these aspects may be needed.

It is also possible that the observed low rate of microfilaria is in fact due to differing methodologies of investigation. Jordan (1954), for instance, in his territorial surveys investigated volunteers. Volunteers may give biased results as it happened in the current study in which the volunteer microfilaria prevalence was 7% higher at 19% compared to 12.1% in the random sample. Similarly, Hawking (1940) investigated patients and relied on hospital records. Those kinds of populations are expected to give different results.

The study also confirmed a well known worldwide pattern summarized by Sasa (1976) of a rise of microfilaria prevalence rate, with increasing age. In this study the relationship of microfilaria was not steadily linear with age as Minjas (1986) had noted in Dar-es-Salaam. The highest prevalence (17.6%) was found in the age group 40-49. This is in contrast to what Wegesa et.al, (1979) found in some Pangani district villages where the 70+ age group had the highest prevalence (90%).

In the current study, the prevalence of microfilaria in males was 13.3% compared to 11.1% in females. Menu and Kilama (1971), in Bagamoyo, found a microfilaria prevalence of 36%

in males and 27% in females. The Bagamoyo findings indicate higher prevalences despite the fact that a less sensitive method (the blood slide - Denham et.al 1971) was used. However, in the present study, statistical analysis indicate that the difference between males and females could have resulted by chance.

Hydrocele has been the predominant complication of filariasis in East Africa (Hawking 1940; Jordan 1955; Wegesa et al, 1979; Minjas 1986). The prevalence of hydrocele has also been noted to rise with age. The results in this study corroborate this well documented pattern. The prevalence of hydrocele was 1.7% in the 10-19 years age group, it rose steadily reaching 41.2% in those aged 60 years and above. However, Wegesa et.al (1979) found hydrocele prevalences that reached 90% in those aged 70 years and above in Pangani district. The rate of the same age group in Lindi was slightly below half of that for Pangani. Possible explanations to this difference include increased access to surgical operations in Lindi urban compared to rural Pangani and increased use of anti-mosquito measures in the urban setting compared to the rural setting.

In Lindi, 13.5% (95% CI 10% - 17%) of males had hydrocoeles. This was not much different from a prevalence of 12% that Menu and Kilama (1971) found in Bagamoyo or a prevalence of 12.1% that Minjas (1986) reported in Dar es Salaam. It was not surprising therefore, that in a community where 20% or more of the middle aged males had hydrocoeles; 98.6% of the respondents had heard of the condition and that 95.6% of them actually knew of a person(s) with a hydrocele. These figures, nevertheless, suggest a falling hydrocele prevalence in the respective areas. Fourty two years back, Jordan (1954) got higher hydrocele prevalences in the Lindi villages. The prevalences were 38%, 37%, 23%, and 20% for the respective villages of Likawage, Nanjirinji, Mchinga and Mtama. It is tempting to state that hydrocele prevalence may have gone down. However same reservations as put forward for the prevalence of microfilaria earlier also hold true.

Even though hydrocele rates may seem to be falling, this condition in any community constitute a social-economic and medical problem. Wegesa et.al, (1979) noted that in 1976, 15% of the major surgical operations in Tanga regional hospital were due to hydrocele. The experience of the author in Lindi is similar, although hard data is not available. The costs for such operations are mainly borne by the government

(ultimately the tax payer) and are an economic burden for a condition which could be better prevented. Muhondwa (1983) noted that people with big hydroceles felt embarrassed of their condition and hence found it difficult to socialize. Also the physical incapacitation associated with big swellings make farming, an economic activity employing the majority of the rural people difficult. Hydrocele, therefore, may have negative economic implications on the economy of a country besides the economic and social embarrassment of the person with the condition.

The current study, found the prevalence of limb elephantiasis to be 5.2% (95% CI 3.7 - 6.7%) and scrotal elephantiasis was 0.5% (95% CI 0-1.3%; 10). Jordan (1955,1956 a,b,c) found limb elephantiasis prevalences of 0-4% in the territory. Wegesa et. al, (1979) in Tanga villages got limb elephantiasis prevalence of between 0.5-3.3%. Hawking (1940) recorded elephantiasis prevalences of between 0-3.75% from the Mainland hospital statistics. The current rate of elephantiasis seem to be higher compared to those reported in earlier studies. Since elephantiasis is not curable surgically like hydrocele, its relative prevalence in a community may appear constant or even rising.

In this study, of those affected with limb elephantiasis 80% (36) were females and 20% (9)were males (male/female ratio 1:4). This is in contrast to the 1:1 male/female ratio that Wegesa at.al (1979) found in Tanga. Jordan (1954) did not indicate the prevalence rate of elephantiasis from the southern province though he found 3 males and 13 females to have limb elephantiasis. Whether the current proportions reflect the data of Jordan or not, it is difficult to conclude - there is no explanation to this sex difference in the current study.

In the current study, legs were affected in 88%; and the arms in 12% of the affected individuals. Chandra and Hati (1993), noted that Culex quinquefasciatus preferred to bite the lower parts of the body. They argued that this biting habit correlated well to the development of clinical filariasis in the lower extremeties. This theory may explain why the lower extremities are usually more affected than the upper extremities.

Menu and Kilama (1971) in Bagamoyo, found 12.0% of males had hydroceles, 0.6% had elephantiasis of limbs and 0.8% had elephantiasis of the scrotum. These figures are quite comparable to the current study for hydrocele and

elephantiasis of the scrotum where respective rates were 13.5% and 0.5%. However, for limb elephantiasis, Lindi had a higher prevalence in men compared to Bagamoyo (2.3% vs.0.6%). For females, the prevalence of elephantiasis in Bagamoyo was lower (2.2%) compared to that of Lindi (7.5%). It seems, elephantiasis in males and females was more prevalent in Lindi as compared to Bagamoyo.

More females than males, in the current study, were affected with limb elephantiasis. But if limb and scrotal affection are taken togher, more males than females were affected (15.9% vs 7.5%). Although no reason was advanced to account for the sex difference in Bagamoyo, it is possible that the survey which was carried out during the night ruled out many females from participating due to cultural inhibitions. In the present study, however, more females than males were actually studied. The gender difference in the clinical manifestations according to Pani et.al, (1991) may be due to occurence of hydrocele in the males that makes them have more sequelae of filariasis than females.

In this study, with regard to perceptions, nearly all respondents (98.6%) knew of hydrocele and elephantiasis and more than 75% of them appreciated that the conditions were a

problem in their community. Unfortunately few correctly knew of their cause. Muhondwa (1983) found that even in a place where there had been a project for filariasis control, 56% of the people interviewed still thought hydrocele and elephantiasis could not be prevented and that only 40% of the respondents believed that these sequelae were caused by mosquitoes. Possible explanations to this anomaly include education level of the respondents and the myths and misconceptions related to the chronic sequelae of Bancroftian filariasis. In the current study, however, ignorance about the cause and the age old divine attribution to anything difficult to understand seemed to have had the upper role. It is thought that the role of education as a factor in determining correct perceptions was very important.

Concerning the belief in the mosquito aetiology, it was noted that the higher the level of education, the more was the proportion of people who believed in the mosquito related aetiology. And conversely, the lower the level of education the more was the proportion of people who believed in the will of God. Taking the example of hydrocele, the will of God as a cause for hydrocele was believed by 48.2% of the people with below primary education compared to 31.4% of those with primary education and above; this difference was

highly statistically significant. On the other hand the mosquito cause was believed by 32.8% of those with primary education and above compared to 13.3% of those with less than primary education; the difference was again, very significant.

Carme et.al, (1979) in French Polynesia, found that the main beliefs of the causes of elephantiasis were foot injury (40.6%), mosquito bite (12.5%) and heredity (11.7%). In Lindi, the main beliefs of causation included Will of God (31.1%) and mosquito transmission (42.4%). It is interesting to note that although the study in Polynesia was carried out at a time when a filariasis control programme was in place, the majority of the population did not believe that the mosquito had any role in filariasis transmission.

Despite the positive role of education, it may not be easy in the context of this study to explain why the mosquito aetiology as a cause of hydrocele and elephantiasis ranked low when compared to malaria. For malaria transmission, 83% of the respondents correctly implicated the mosquito. Malaria was probably better understood in the community than filariasis not only because of formal education, but also informal education. There has been a lot of malaria health

education campaigns over the radio in this country, so more people may have been aware of it. Possibly targeted health education campaigns against certain diseases may be important in influencing perceptions.

The majority of the respondents did not know that the conditions were preventable. It is quite possible that this is due to the general lack of health education on filariasis in this country. Taking the example of hydrocele, the education level seemed to influence the respondents' perceptions. Of the people with less than primary education 28.2%, compared to 49.2% of those with primary or more education believed that hydrocele is a preventable condition; this difference was significant.

With regard to occupation it was evident that in the case of hydrocele, a lower proportion of the peasants (35.8%), compared to government employees (74%) thought the condition is preventable. However, this may be linked to a person's education. Government workers were more likely to be better educated and hence more informed than the peasants.

Most respondents, irrespective of their gender, age, education or occupation agreed on the hospital treatability

of hydrocele. This may be because hydrocelectomy is commonly done in hospitals in filarial endemic areas.

It is concluded that filariasis in Lindi urban is a health problem of a magnitude of public health importance. Nevertheless, as it has been clearly demonstrated, misconceptions about the cause and transmission of the disease abound.

It is recommended that a local and nationwide strategy be devised to correct the misconceptions and to control the disease.

CHAPTER 5

CONLUSIONS AND RECOMMENDATIONS

Bancroftian filariasis is essentially a neglected disease in Tanzania. For a long time it has been under the interest of the researchers whose reports end up in journals or dissertations without further action on the part of the Government. The main reason for this neglect may be because the disease is hardly fatal, so does not attract the attention it deserves.

Unfortunately this neglect is shortsighted because the disease has a lot of hidden economic and social costs to the nation and to the individual. For instance, there are many people in endemic areas who seek for surgical relief of their hydroceles. Operations are costly not only to the individual but to the nation as well. Moreover, individuals with big hydroceles are physically handicapped and hence less productive for themselves, their families and may actually be a burden to the nation.

The short term measures that are recommended are:

1. Health education to the community to counter the misconceptions and also to inform the people on ways of

prevention of filariasis, for example the use of the mosquito-net, should be started by the local and central authorities.

2. Since the pit latrine is the main sanitary facility in Tanzania, and is often the source of the vector (C.quinquefasciatus), there is a need of promoting wider use of the expanded polystyrene beads technology which has been proven to work.

3. As a long term measure, the country should embark on a filarial control programme aimed at reduction of infection in the community.

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