I

INTRODUCTION

Lymphatic filariasis, also known as elephantiasis is a parasitic disease, caused by filarial nematode, the adult worms of which are present in the lymphatic vessels, lymph nodes also in the connective tissues, sub-cutaneous tissues and body cavities of the host while the microfilariae are found in the peripheral blood of human. Occasionally, these microfilariae are found in Chylous urine or Hydrocele fluid. The adult worms obstruct the flow of lymphatic fluid because of which lymph get accumulated at only one site resulting the organ to swell up; usually affecting one or both legs, genital organ causing hydrocele, breast enlargement, swollen clitoris and vulva, grotesque enlargement of male scortum, and penis. Infection also causes acute fever, inflammation of lymphatic system and branchial asthmatic condition known as "Tropical Eosinophilia" (WHO, 1995).

There are eight main species of filarial nematodes infecting human beings viz: *Wuchereria bancrofti, Brugia malayi, Brugia timori, Onchocera volvulus, Dipetalonema perstans, Dipetalonema streptocereum, Mansonella ozzardi* and *Loa loa*. Among above, the first three, *W. bancrofti, B. malayi* and *B. timori* cause lymphatic filariasis and are responsible for the morbidity. *W. bancrofti* is the main cause of lymphatic filariasis in Nepal (Thakur, 2000) and it is the only reported species from Nepal. The other five species cause non-lymphatic filariasis.

Initially lymphatic filariasis does not show any sign and symptoms until the adult worm die. The disease is not usually life threatening but can permanently damage lymphatic system and kidneys. It is the second leading cause of permanent and long-term disability in the world. The worms block the lymph vessels; fluid is accumulated thus resulting swelling in breasts, legs, scortum and genital organs. Thus attained condition is known as “lymphoedema”. The swelling may be up to the several time of its normal size. Skin becomes hard and thick after swelling which is now called as “elephantiasis”. Acute manifestation of lymphatic filariasis involves episodic attacks of adenolymphangitic (inflammed lymph nodes) associated with fever and malaise. Each attack may lasts for several days. Such attacks are the significant cause of morbidity.

Other complications of filarial disease include Chyluria (milky urine), which is painless but results in weight loss and lethargy and tropical pulmonary eosinophilia (asthma and cough) which results in chronic pulmonary fibrosis.

Lymphatic filariasis is well established disease in tropics and sub-tropics. The rapid and unplanned growth of cities creates numerous breeding sites for mosquitoes which are the main vector or agent for the transmission of disease. It is a significant cause of acute and chronic illness in both sexes mainly affecting the poorer community of the society.

Lymphatic filariasis is endemic in 80 countries and more than 1.1 billion people worldwide are estimated to be at the risk (WHO, Geneva, 2000). Approximately 120 million people in tropical and sub-tropical regions of the world are infected, of these 90% are caused by *W. bancrofti* and 10% by *Brugia malayi*, limited to Asia and some parts of Pacific (WHO, 1997). Almost 27 million men suffer from genital disease (hydrocele), more than 15 millions suffer from lymphoedema or elephantiasis of leg, 83 million people from lymphatic functional disability and 30 million from renal pathology (WHO, 1997). This parasitic disease is a major socio-economic burden globally in tropics and sub-tropics. Approximately one-third of the population at risk live in the Indian sub-continent with an estimated 45 million infected individuals. In South-East Asian region, about 600 million people live in the endemic areas constituting about 60% of the global burden.

Emphasis on the vector control measures is being given for controlling the transmission of the disease. Diethylcarbamazine (DEC) is being used from more than 40 years for the treatment of filariasis as a chemotherapic mean. Repeated treatment with DEC results significant reduction in the incidence of acute and chronic attacks and the risk of developing chronic disease. Control with DEC involves either mass treatment of all population of endemic community or selective treatment of those who are diagnosed as microfilarial positive during night blood surveys. Nowadays treatment with single dose of DEC is of great practical interest.

By the end of 2001, a total of 25,479,136 people had received mass drug administration in 22 countries participating in the program to eliminate lymphatic filariasis (PELF). This is marked increase compared to the year 2000 when only 20 countries participated and 3 million people at risk were covered (WHO, 1999).

In most of the world's endemic areas, there are no effective filarial control measures. This is mainly because filariasis has not been regarded as a major public health problem and also most of the control strategies are too complicated and expensive to be sustained. In the past, parasitic control on transmission have eradicated filariasis in several endemic areas, however eradication is very difficult to achieve in most places. It will be appropriate to focus first on the development and implementation of simple, cost effective and sustainable strategies for morbidity control (Ramachandran, 1993).

Thus control of lymphatic filariasis for its elimination can be done by controlling the transmission of the parasite and this can be done by the application of the vector control measures.

In Nepal, out of total population (23.2 millions approximately), 13.9 millions (60%) are estimated to be at the risk of infection and filariasis is endemic in different regions of Nepal. Here, a very few surveys on lymphatic filariasis have been undertaken so far. Jung (1973), in a cross-sectional survey, found the prevalence ranging from 0-17.8% in nine different sites of central Nepal. Pradhan *et al.,* (1998), in a study in Gokarna VDC of Kathmandu, found an

endemicity rate of 24.6%. Bista *et al.*, in a situation analysis study during 1995-1999, recorded lymphatic filariasis at 13.2-23.4% in different regions of Nepal. Recently, Sherchand (2001/02), on epidemiological mapping of lymphatic filariasis in 37 districts, found 11 districts above 20%, 15 districts with 6-19% and seven districts with 1-5% antigenaemia. The disease is more prevalent in Terai areas than in the hills. Thus, based on the public health importance of lymphatic filariasis, WHO has made a global call for the elimination of LF by 2020, following which government of Nepal has also expressed commitment towards it and has put forward its effort for lymphatic filariasis elimination by 2015. The Government of Nepal has expressed a commitment to work for the LFE following WHO's Global and Regional calls of LFE by the year 2020. A tentative plan of action for the elimination of LF in Nepal is in place. To action this, and to prioritize the districts for the implementation of LFE, it becomes crucial to know the exact prevalence of LF for the entire country through WHO recommended standard techniques (Ghimire, 2002).

The present study has been done with the project work accomplished by "PARASED" Nepal, which was a joint collaboration of WHO and the Government of Nepal. The prevalence rate of LF recorded in Salyantar district may be helpful for the implementation of the lymphatic filariasis eradication program which may be a part for the global elimination of LF as called by WHO.

II

OBJECTIVES

General Objectives:

To determine the human filarial situation in the Salyantar VDC of Dhading district, Nepal and to provide the data essential to the planning, implementation and evaluation of services for the prevention, control and treatment of lymphatic filariasis

Specific Objectives:

- To determine the age and sex-wise prevalence of filariasis
- To determine the Endemicity Rate (ER) of the disease
- To study the knowledge, attitude and practices of people towards the disease in relation to the education
- To determine the asymptomatic and symptomatic filariasis cases among the people of surveyed area
- To determine the filarial prevalence in relation to education and occupation of the surveyed area

III

LITERATURE REVIEW

Filariasis in Global Context

The symptoms of Bancroftian filariasis have been mentioned as “elephantiasis arabicum” in the ancient Hindu literature, viz: Susratha (600B.C.). The term “Malabar leg” was applied to the condition by Clark in Cochin in 1709A.D. Our present knowledge of filariasis owes much to the investigators carried out towards the end of nineteen and the beginning of the twentieth centuries. Microfilariae (first stage larvae) were first demonstrated by Demarquay in 1863 in the hydrocele fluid of a patient from Cuba. In 1868 Otto Wucherer in Brazil found microfilariae in the urine of patient with haematochyluria. Lewis (1872) in India demonstrated the same in the peripheral blood. Adult worms were found by Bancroft in Brisbane in 1876 and named *Filaria bancrofti* by Cobbold in 1877. In 1921, this species was included in the genus *Wuchereria* (Arora and Arora, 2001).

Sir Patrick Manson, working in China in 1878, observed the development of *W. bancrofti* in the mosquito *Culex quinquifasciatus* and established the essential role of vector. This was the first demonstration that female *Culex* mosquito could harbour an infective agent of a parasite. A year earlier he confirmed that these nematodes were the cause of elephantiasis (Cheng, 1986). In 1881, he described nocturnal periodicity of *W. bancrofti*, the microfilariae being present in greatest number in the peripheral blood during night hours.

Recent Data on Lymphatic Filariasis

Dixit *et al.*, (2005) conducted the study on the rhythmic behaviour of *Wuchereria bancrofti* microfilaraemia in human population at Raipur, by studying the tempered behaviour of microfilaria in human blood and biting activity and mf density in the vector. A statistically validated ciradius rhythm was detected in mf density 86% of the microfilaraemic subjects and the peak biting periodicity appeared at 02:37 with the range between 00:39 and 03:22.

Gupta *et al.*, (2005) studied on biochemical targets on filarial worms for selective antifilarial drug design. They highlighted the research and developed the rational antifilarial agents and discuss the pitfalls since the discovery of Diethylcarbamazine, the only drug of choice for controlling filariasis despite of its adverse effect.

Mishra *et al.*, (2005) studied on the combine detection of *Brugia malayi* and *Wuchereria bancrofti* using single PCR at low level of infection. They isolated the parasites DNA from filarial positive blood samples. The primers used were Hha1 and Ssp1 which amplified the DNA fragments of 322bp and 188bp specific to *Brugia malayi* and *Wuchereria bancrofti* respectively. The sensitivity of this assay was tested with blood and mosquito samples having one *Wuchereria bancrofti* on a pool of 10 *Brugia malayi*.

Onapa *et al.*, (2005) conducted a study on rapid assessment of the geographical distribution of lymphatic filariasis in Uganda by screening of school children for circulating antigens (CFA), by using the process called

rapid immunochromatographic card test which reveals that CFA prevalence generally decreases with increasing altitude and no CFA-positive cases were found at sites that were >1300m above sea level.

Rajkumar *et al.*, (2005) conducted a study on *Wuchereria bancrofti and Onchocerca volvulus* co-infection in a refugee from Sierra Leone. The diagnosis was done by using direct blood smear (*W. bancrofti*) and serology (*O. volvulus*). They have commented briefly on the therapeutic implication of the co-infection.

Mathieu *et al.*, (2005) while studying on the factors associated with participation in the campaign of mass drug treatment against lymphatic filariasis in Leogane district, Haiti, found that absenteeism during the drug distribution (12%), use of contraceptives (12%) and pregnancy (11%) to be the primary factors for failing to take drugs while people who knew filariasis to be the mosquito transmitted disease and having learnt about the mass drug administration through posters and banners were found to be positively associated with taking the drugs.

Bregani *et al.*, (2005) studied the effects of thiabendazole in *Mansonella perstans* filariasis and found out that the parasitic density, eosinophilia and symptoms significantly reduced after one and two step therapy in most patients.

El Setouhy *et al.*, (2004) used a randomized clinical trial comparing singe and multi-dose combination therapy with Diethylcarbamazine (DEC) and

Albendazole (Alb) for the treatment of bancroftian filariasis in the endemic population outside Sub-Saharan African. The result revealed that multi-dose DEC/Alb was significantly more effective than single dose therapy for reducing and clearing microfilaraemia but neither of the process result the complete clearance of filarial antigemia.

Yahathugodia *et al.*, (2004) while studying on the knowledge about lymphatic filariasis in two communities (Unawatuna, a coastal community and Baddegama, an inland community of the Galle district, reported that the people of Unawatuna had greater awareness towards clinical and parasitological features of the disease (P=0.0003) and drug treatment (P=0.00380) than that of Baddegama.

Koyadun *et al.*, (2004) conducted a study on bancroftian antigaemia clearance and Myanmar migrants after biannual mass treatment with DEC 300mg oral dose FILDEC tablets in southern Thailand. They found that out of 34 antigaemic Myanmar index cases of varying initial CFA level who were initially screened out with ICT filariasis, 13 index cases were followed up, treated and monitored at the DEC post treatment 6, 12 and 18months with high antigens titers (99.7-181.6$\times 10^3$Au/ml) and found 54.44%, 33.58% and 9.97 significant decrease of the CFA levels (P<0.007).

Anosike *et al.*, (2004) conducted a study on human filariasis in Dass local government area of Bauchi state, Nigeria. The infection rates, intensity and clinical manifestations of human filarial infections were studied. 215 (20.3%)

of 1059 males and 99 (19.1%) of 569 females examined were infected. Microfilariae if *Onchocerca volvulus, Wuchereria bancrofti, Mansonella streptocerca, Loa loa* and *Mansonella oerstans* were encountered. Sexwise, agewise, community wise and occupation wise ($P<0.05$) prevalence of the parasites were also studied.

Keylem *et al.*, (2004) determined the impact of long-term ivermectin on *Wuchereria bancrofti* and *Mansonella perstans* infection. The study was conducted in 11 communities of Burkin Faso and the drug was given under community directed treatment strategies. The implication of this study were discussed in relation to the old Onchocerciasis Control Programme (OCP) and to the ongoing African Program for Onchocerciasis (APOC).

Jiang Jung *et al.*, (2004) found six cases of filarial chyluria in the hospital admitted from November 2001 to June 2002. Of these cases, 4 were men and 2 were women with age of 32-52 years (mean 42years). Operative time ranged from 69-120minutes (mean 95minutes). Interpretative blood loss was 50-80ml (mean 85ml). Chyluria disappeared in all patients immediately after operation. Mild haematuria occurred in 4 cases within 12 hours and disappeared at 24 hours.

Hammad *et al.*, (2003) studied the impact of DEC on vector competence of *Culex pipens* L. to *Wuchereria bancrofti* Cobbold and found out that an annual single dose of DEC has greater potential to mediate sustained microfilaria

reductions thereby reducing but not eliminating transmission and killing the filarial parasites within the mosquito.

Alves *et al.*, (2003) studied on immunocytochemical localization of antigens recognized by tropical pulmonary eosinophilia and individuals with intestinal helminthes antisera in microfilaria of *Wuchereria bancrofti* which suggest that sera from people of non-endemic area for filariasis harboring intestinal helminthes also share antifilarial antibodies that recognize antigens of microfilaria of *W. bancrofti*.

Rajendran *et al.*, (2003) studied on the influence of the mass drug administration of diethylcarbamazine alone or with albendazole on the prevalence of filarial antigaemia; which concluded that the use of DEC alone produced a slightly greater reduction in the prevalence of antigaemia than the use of both DEC and albendazole and to maximize the benefits of Mass Drug Administration (MDA), greater efforts should be made to increase treatment coverage among young children.

Figueredo *et al.*, (2003) studied the histopathology of bancroftian filariasis and the role of adult worm in the lymphatic vessel disease with the clinical, ultrasonographic and surgical characteristics. The protean spectrum of alteration seen in the host's lymphatic vessels was discussed and the changes caused by live and dead worms were highlighted as independent events. Evidence of a remodeling process, in which the lymphatic endothelial cells appeared to have a key role, was also provided for the first time.

Tobian *et al.*, (2003) studied the sensitivity and specificity of ultrasound detection and risk factors for filarial associated hydrocele. For this 342 men above 15 years of age in endemic areas in Papua New Guinea were evaluated. The observations suggested that filarial pathology of the male genitalia is under reported when evaluated by physical examination alone. The duration and the intensity of infection are the risk factors for hydrocele.

Pacella *et al.*, (2003) studied a case report of a 23 years old man immigrant from Sri-Lanka suffering from an acute painful volume increase of the right scortum without fever. Clinical examination suggested a diagnosis of testes torsion. An inflammatory spermatic cord and epididymis with a purple nodule of the middle portion were found which was diagnosed as filarial infection.

Chadee *et al.*, (2003) studied on filariasis in Georgetown South America. They conducted a one year survey of febrile patients attending filariasis (Night) clinic. Out of 769 thick blood smears collected, 103 were positive for *W. bancrofti*; also the age group and sex of infected persons were described.

Chandrasena *et al.*, (2002) estimated the sensitivity, specificity and cost effectiveness of an immunochromatographic test (ICT, AMRAO) for the diagnosis of Lymphatic filariasis against two standard parasitological techniques; thick blood film (TBF) and Nucleopore Membrane Filtration (NMF) for which blood was collected from the individual of endemic areas in the western part of Sri-Lanka, which shows the ICT to be more effective than TBF or NMF in diagnosing infection in lymphatic filariasis.

Weerasoriya *et al.*, (2001) reported 4.4% prevalence of microfilaraemia in three suburban area of Matara, in Sri-Lanka. Prevalence was significantly lower in female than in male and in males aged < 20 yrs than in older males. Overall 9.5% of the subjects had the clinical manifestation, 6.4% had filarial fever, 3.0% had elephantiasis and 6.2% had hydrocele. There was linear increase in prevalence after the age of 40 years.

Wickremanayake *et al.*, (2001) developed a dot-ELISA for detection of microfilaria of *W bancrofti* in an endemic area. The test can differentiate the endemic normals from the microfilaraemic symptomatic individuals. Antigens of molecular weight 130kDa and 50kDa of the cattle filarial worm *Setaria digitata* were used for this test. It was observed that these two antigens were also present in the serum of asymptomatic microfilaraemic individuals.

Tritee-raprapab *et al.*, (2000) conducted a study on transmission of the nocturnal periodic strain of *W. bancrofti* by *Culex quinquefasciatus* in Thailand. The prevalence of *W. bancrofti* infection in the immigrants (2.5%) promoted concern in the public health community for the re-emergence of Lymphatic filariasis. It was concluded that *W. bancrofti* infective with third stage larva got the potential for establishing an urban cycle of transmission in Thailand.

Massage *et al.*, (2000) reported the prevalence of *W. bancrofti* in 31.8% of 1025 inhabitants with 32.1% infection in female and 31.5% in male; studied in the Hale area of Northeast Tanzania. Clinically 6-9% of examined individuals

had elephantiasis and 28.5% males of aged 15years and above had hydrocele. Both the clinical manifestation and microfilaria prevalence were found to increase with age.

Bhumiratna *et al.*, (1999) assessed the efficiency of the ICT card test by using clinical recall techniques and microscopy (thick smear and capillary tube technique) in the sera of 225 subjects living in *W. bancrofti* endemic village of Tak prorince, Thailand. The ICT card test gave a 20% antigen positive rate of the same, 5.8% by thick smear and 5.3% by capillary tube technique respectively. The ICT card test had a specificity of 100% when sera from microfilaraemic subjects were positive. When it was done in *W. bancrofti* microfilaraemia sera, the ICT card test had a sensitivity of 100% using microscopy as reference and 84.6% when using clinical and recall technique. However the card test was more positive than the other when done in endemic normal sera (14% positive).

WHO (1997) carried out a study in Northern Ghana in a rural community, where filariasis is highly endemic (14% of the population age over 10years were microfilaraemic with *W.bancrofti* and 3% was chronic disease), showed that Lymphatic filariasis can be a major social and economic burden on poor communities and also indirect economic loss associated with adenolymphagitis (ADL). Another study carried out in rural community in Southern India showed that the productivity by male weavers with chronic Lymphatic filariasis was reduced by an average of 27.4% in comparison with matched controls.

WHO (1997) conducted a study in India to determine the prevalence of filariasis. In India filariasis is major public health problem next to malaria. At present WHO estimates about 428 million people with 28 million of mf carriers and 21 million clinical cases that spread in 13 states and five union territories. India contributed about 74% of endemic population and 81% of disease burden in the region. *W. bancrofti* was the most predominant infection comprising 99.4% of the problem in the country, while *Brugia malayi* was confined to the western coast of Kerala and a few areas of the six other states. Both the infections were nocturnally periodic. In the Nicobar group of Island, diurnally sub- periodic infections were transmitted by *Aedes niveus* group was detected about three decades back.

Filariasis in Nepal

Sherchand *et al.*, (2003) studied the prevalence of infection by *W. bancrofti* in 37 districts of Nepal from July to December (2001). The study populations were selected above 15 years age of respondents and the immunochromatographic test (ICT-filariasis test) was used to screen for circulating filarial antigen (CFA). The overall prevalence of lymphatic filariasis from a 4,488 sample population was 13% and 33/37 districts were found to be endemic. On the basis of geographical data, the highest numbers of cases were found at altitudes between 500-700 meters however a substantial no. of infected individuals were found in the highly populated Kathmandu valley at altitudes between 900-1500m. Prevalence rates above 20% were found in 11

districts (with the highest rate of 40%), 6-19% in 15 districts and 0.1-5% in 7 districts.

Ghimire *et al.*, (2003) conducted a survey to study the prevalence of lymphatic filariasis in the endemic areas, Mahendranagar and Nagrain VDCs of Dhannusa district in Terai plain region of Nepal, from June –July 2002. The result showed that the prevalence of microfilaraemia in Mahendranagar was higher than in Nagrain VDC. A total of 1085 finger prick thick blood smear samples were collected from volunteers at two sentinal sites, 468 from Mahendranagar and 612 from Nagrain VDC, from 22:00-2:00hr. 25/468 (5.3%) of Mahendranagar and 14/617 (2.3%) from Nagrain VDC were found to be positive for *W. bancrofti*. The prevalence was found to be higher in female although the participation of both the sexes was almost equal.

Sherchand (2002) conducted an epidemiological survey to determine the prevalence of disease due to lymphatic filariasis in Magaragadi VDC, Bardia district of Nepal. The study population selected was above 15 years of age and the process used was Immunochromatographic card test (ICT-test) to screen the circulating filarial antigens (CFA). Out of 500 samples collected 141 were infected with larvae of *W. bancrofti*. The vector for this parasite was found to be the mosquito of genus *Culex quinquefasciatus*.

Tuladhar and Sherchand (2001) conducted an epidemiological study in three different geographical regions, viz; Terai (Sipwa VDC of Rupendehi district), inner Terai (Dovan VDC of Palpa district) and Hill (Katunje, Golmadi, Ittachen

and Byasi of Bhaktapur district) of Nepal. A total of 53 blood samples (10.35%) was found ICT-filariasis positive in the study, 39 blood smears from buffy coat. Out of a total 410 blood samples, 27 thick blood smears were found positive in Bhaktapur. Among three different methods in the detection of mf, smear from buffy coat was found best. ICT card technique in antigen detection was still better for field survey in diagnosis of filariasis if all techniques.

Manandhar (2001) conducted an epidemiological study of microfilaria in three different regions of Nepal. The study reported 19.9% crude disease rate with highest rate of crude disease infection (38%) in 70 and above age group.

Bhusal *et.al.*, (2000) studied the prevalence of *W. bancrofti* infections in Tokha Chandeswori VDC of Kathmandu in 1998. A survey of 978 nocturnal blood samples were collected in the VDC which indicated an overall prevalence of 5.8% for microfilaraemia and the crude disease rate of *W. bancrofti* was recorded to be 13%. The highest microfilaraemia infection rate was recorded as 11.8% among the group of 40-49 years and the highest crude disease rate was recorded as 36.4% in the age group of 70 and above.

Bista *et al.*, (2000) while studying the situation analysis during 1995-1999, recorded the prevalence of lymphatic filariasis at 13.2-23.4% in different regions of Nepal, in out patient clinics of different health institutions and through the HMIS during the fiscal year 1995/96 to 1998/99.

Pradhan *et al.*, (1997) reported 24.6% endemicity rate, 12.75% microfilarial infection (15.09% in male and 8.9% in female) and 11.95% crude disease rate (8.49% in male and 16.59% in female) of *Wuchereria bancrofti* in Gokarna VDC of Kathmandu valley and identified 12 sps of mosquitoes (*Anopheles nigerrimus, Anopheles vagus, Anopheles willmori, Anopheles kessele, Culex fescocophela, Cules gelidus, Culex pseudovishui, Culex whitmori* and *Cuex tritaeniorhynchus)* from the study area. Among these species *C. quinquifasciatus* was found to be more prominent.

Jung *et al.*, (1973) studied all together 9 sites which showed 4.99% to 6.15% *W. bancrofti* in all age groups and both sexes in the urban population, 6.6%-10.3% in the semi urban population and 1.2%-17.8% in the rural population. Similarly 7.1%-9.16% microfilariae rate was found in the urban population, 10.03-11.3% in the semi-urban population and 0.8%-17.69% in the rural population.

The following table provides information about National and Region-wise distribution of lymphatic filariasis, which is based on the annual reports DoHS, MoH and HMG, Nepal from 1995/96 to 2004/05.

Table 1: National and Region-wise Number of filarial cases in Nepal Fiscal Year 1995/96 to 2004/05:

Year	National	Eastern Region	Central Region	Western Region	Mid-Western Region	Far-western Region
1995/96	3100	493	849	789	662	317
1996/97	2694	257	981	736	303	418
1997/98	2371	328	605	976	317	155
1998/99	1744	165	671	913	281	14
1999/00	1797	209	718	632	195	43
2000/01	1632	262	546	692	123	9
2001/02	1183	142	173	733	79	56
2002/03	809	63	302	334	64	46
2003/04	550	47	246	221	20	16
2004/05	549	25	274	180	50	20

Table 2: Distribution of filarial cases according to the geography of Nepal of the Fiscal Year 2004/2005:

Year	Total cases	Mountain	Hill	Terai
2004/2005	549	4	192	353

IV

MATERIALS AND METHODS

MATERIALS REQUIRED:

- Slides, sterile lancets, cotton, gloves, mask, measuring cylinder, dropper, slide box, compound microscope, toothpick
- Reagents: methanol, giemsa stain 5%, distilled water
- A set of questionnaire

STUDY AREA:

Nepal is an underdeveloped country surrounded by China at the North and India at the East, West and South. It is located from 80^{o} 4' in the East to 88^{o}12' in West longitude and from 22^{o} 22' in North to 30^{o} 27' in South latitude. It is administratively divided into five developmental regions, 14 zones and 75 districts. There are 20 districts in the Terai region, 38 districts in the hill region and remaining 17 in the mountainous region. The Dhading district where the present study was carried out, is a hilly district located in Bagmati Zone and included in the Central Development Region.

Dhading is situated West to the Kathmandu valley, at the height of 488m to 7409m from sea level. This district is surrounded by Nuwakot and Kathmandu in the East, Rasuwa in the North-East, Makwanpur in South-East, Chitwan in the South-West and Gorkha in the West. It has the total area of 1,926 sq. km (Central Bureau of Statistics, HMG, 2001) with 50 VDCS and 3 constituencies, and Dhading Bessi is the district headquarter. The total population of this

district is 338,658 (male=165,864, female=172,794) i.e. 1.46% of total country's population with the sex ratio of 0.96 and annual growth rate of 1.97% (1991-2001). There are 62,759 households with the average household size of 5.40. This district has the human developmental index of 0.258. The ethnic groups include Chhetri, Brahmin, Magar, Tharu, Tamang, Newar, Darai, Sanyasi, Chepang (Praja) and others. There are 52 healthposts in this district. 84.85% of the people living there accept agriculture as their main occupation while rest 15.15% depends on other works rather than agriculture.

According to the annual report published by Epidemiological Department and Control Division, HMG, 2004/05, the total number of lymphatic filarial cases reported in Outpatient Department in the health institutions of Dhading district during the fiscal year 2004/05 was reported to be 21.

The single VDC, Salyantar, situated in the North West of the district was selected for the study purpose. It is a plateau area surrounded by rivers at all sides, Netrawati in South and East while Gandaki in North and West. It is attached to Gorkha in the West part. It has the total population of 7,658 (male= 3,579 and female=4,079) with 1,458 number of households and 5.25 average household size. The VDC is dominated by Chhetri, Brahmin, Kumal, Darai, Bika, Pariyar, Sanyasi and others.

People are mostly farmers and human habitation was surrounded by poor sanitation. Almost each and every household has a large pit dug for accumulating the cattle dung for using as organic fertilizer. During Monsoons,

these pits get filled up with water which becomes the main area for mosquito breeding, the main vector for the transmission of filariasis. There is still no any facility of electricity, transportation, communication and irrigation. So people in Salyantar are still away from developmental facilities.

STUDY POPULATION:

On consulting with the local health personals, population from highly filariasis affected areas (ward no. 1, 2 and 3,) of Salyantar VDC were chosen for cross sectional sampling. The blood samples were collected from the family members of age above 2 years.

STUDY DESIGN:

Epidemiological cross sectional study was applied as the research design in the study.

SAMPLING TECHNIQUE AND SAMPLE SIZE:

A total of 516 blood samples collection and questionnaire filling of the same population were conducted from community of Salyantar VDC at ward no. 1, 2 and 3 of Dhading district. Questionnaires were filled every time and blood samples were collected at night from 10pm to 2:30am when people were in relax condition in their beds.

INSTRUMENTATION: Tools used in this study were as follows:

⁾ Mass orientation program:

Mass orientation program was held before blood collection in the study area to inform all the respondents about the disease filariasis and its effects so as to motivate them for participating in the program. Everyone was informed about the purpose of the study. They were informed that blood samples will be collected from the family members above 2 years of age and it will be collected during the night hour. During the sampling if some respondents were not in their house, they were not included in the target sample collection. Only those respondents who were present in their houses during the collection period were included.

⁾ Questionnaire:

The questionnaire contained name, age, sex, occupation, education, marital status, relationship with the head of the family, surrounding environment and their probable effects against disease, their current health status, clinical symptoms of filariasis. A structured questionnaire was prepared, pre-tested and piloted before administrating in the community.

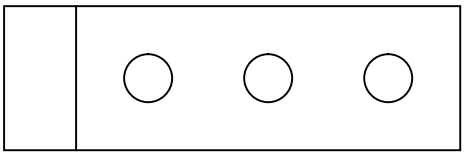
⁾ Human Blood Sampling:

Human blood samples were drawn by pricking the ear lobe.

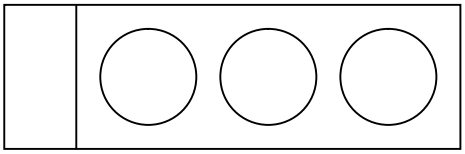
Procedure for blood sample collection:

After pricking the ear lobe of the respondents, three blood smears were prepared on a slide. The blood smears were then allowed to dry for 8-10

minutes and were kept properly inside the slide box during the collection period. Each smear of the blood contains approximately 20ml of blood. The blood smears were stained with Giemsa stain.



Blood drops on the slide



Thick blood smear

The preparation of stained blood smears for microscopical observation was as follows:

i. Dehaemoglobination of thick blood smear: The thick blood smears were dehaemoglobinised using distilled water and dried at room temperature.

ii. Fixing of blood smear: Blood smears were fixed in methanol by just dipping for about 5 seconds and dried at room temperature. Methanol helps to fix the nematodes if present in the blood smears.

iii. Staining of blood smear: The dehaemoglobinised blood smears were stained in Giemsa stain at 1:10 dilution for 30 minutes and air dried.

iv. Observation: The stained blood smears were examined under 5X, 10X, 40X and 100X objective lenses of the compound microscope. The microfilariae were identified as *Wuchereria bancrofti* on the basis of following characters:

Stained sheath, discrete nuclei, empty space between the nuclei and body wall, cephalic space, absence of nuclei at tip of tail, bent tail tip underneath the body.

Data Processing and Analysis:

The collected raw data were firstly edited to detect errors and omissions and to make them accurate, uniform and well arranged, then they were coded for easy classification and tabulation. Thus classified and tabulated data were analyzed by means of table and bar diagrams.

Validity and Reliability of the Study:

- All reagents, equipments and laboratory methods were standardized.
- Quality control on sample collection, processing and confirmation of *Wuchereria bancrofti* was maintained throughout the test.
- Questionnaires were filled as instructed by the supervisor.
- The study was properly instructed and guided by the supervisor.

V

RESULTS

The study was carried out among the filarial suspected and unsuspected people of ward no. 1, 2 and 3 of Salyantar VDC of Dhading district. Altogether 516 blood samples from 203 households were taken as the sample size. The information regarding the participants was collected with the questionnaire survey and blood samples were collected from the same population. Blood samples from both sexes and from different age groups, above 2 years were collected and subjected for microscopical examination to detect the human filarial infection.

Different results obtained from microscopical examination and questionnaire analysis can be categorized as follows:

) GENERAL PREVALENCE OF MICROFILARIAEMIA:

The microscopical observations revealed that out of 516 respondents, 117 (22.67%) were infected with the microfilarial parasites (Table 3).

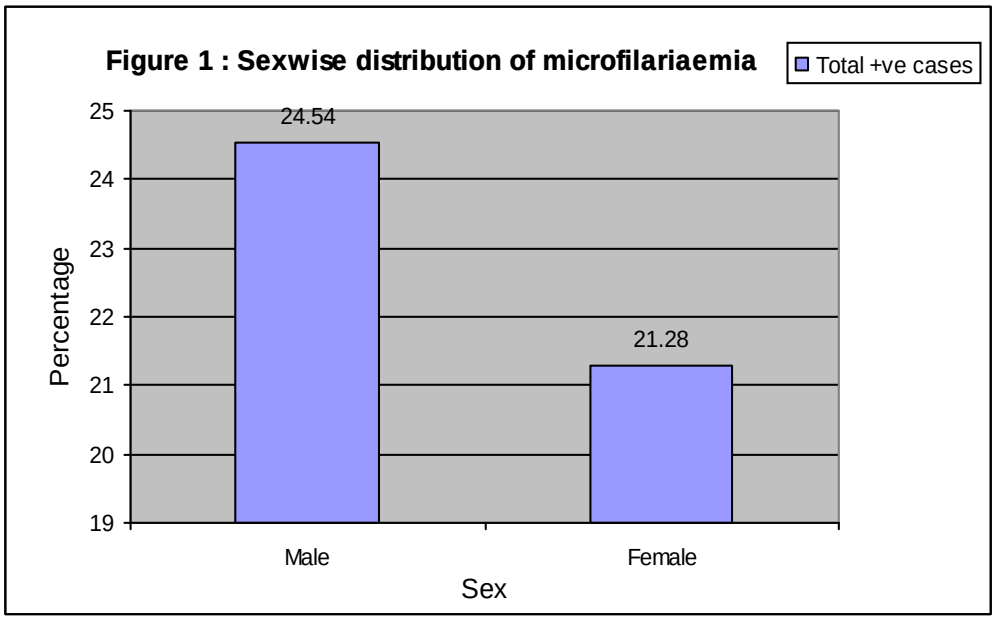
) SEX-WISE PREVALENCE OF MICROFILARIAEMIA:

Table 3 shows the total number of respondents included in the study and the distribution of microfilariaemia in relation to sex. 42.64% of males and 57.36% of females were included in the survey, out of which 24.54% of males and 21.28% of females were infected with the microfilarial parasites which showed that males were more infected than females. A total of 22.67% were the microfilarial positive cases.

Statistically, the difference between male and female prevalence rate of microfilariaemia was found to be insignificant ($\chi^2 = 0.75$, $P < 0.05$, 3 d.f.).

Table 3: Sex-wise distribution of microfilariaemia:

Sex	Examined Samples		Positive Samples	
	No.	%	No.	%
Male	220	42.64	54	24.54
Female	296	57.36	63	21.28
Total	516	100.00	117	22.67



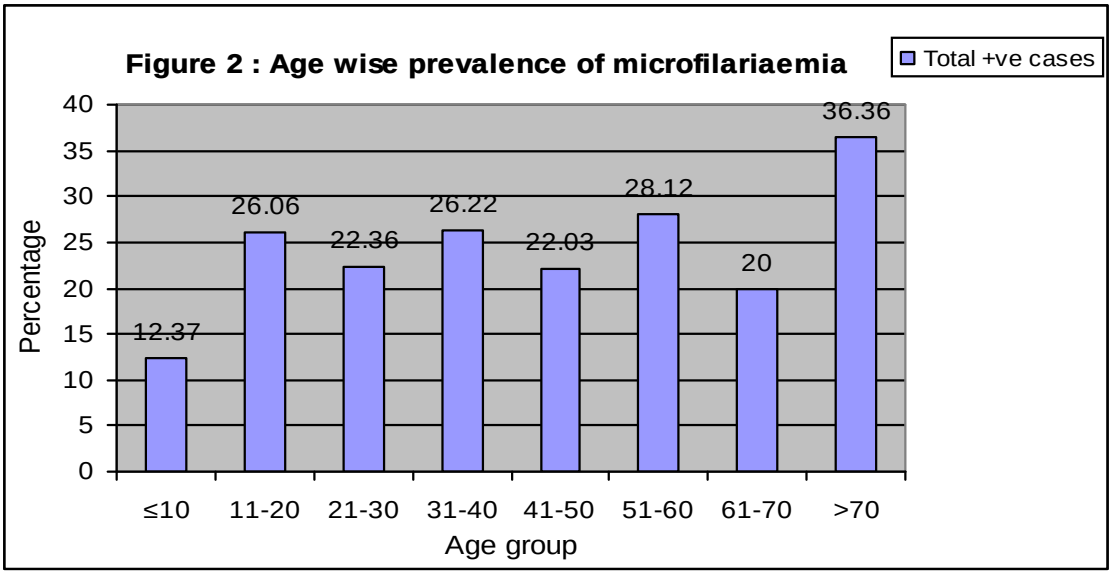
AGE WISE PREVALENCE OF MICROFILARIAEMIA:

Table 4 shows that maximum and minimum number of respondents included in the survey were from the age groups 11-20 years (31.97%) and >70 years (2.13%) respectively and also shows the age wise prevalence of filarial parasites among the population studied. High prevalence was recorded in the age group >70 years i.e. 36.36% while least in the age group ≤10 years i.e. 12.37%. Similarly infection rate of 28.12%, 26.22%, 26.06%, 22.36%, 22.03% and 20.00% were recorded in the age groups, 51-60 years, 31-40 years, 11-20 years, 21-30 years, 41-50 years and 61-70 years respectively.

Statistically, the difference between age wise prevalence of MF was found to be insignificant ($\chi^2 = 9.191$, $P < 0.05$, 15 d.f.).

Table 4: Age wise prevalence of microfilariaemia:

Age group	Examined Samples		Positive Cases	
	No.	%	No.	%
≤10	97	18.79	12	12.37
11-20	165	31.97	43	26.06
21-30	76	14.72	17	22.36
31-40	61	11.82	16	26.22
41-50	59	11.43	13	22.03
51-60	32	6.20	9	28.12
61-70	15	2.90	3	20.00
>70	11	2.13	4	36.36
Total	516	100.00	117	22.67

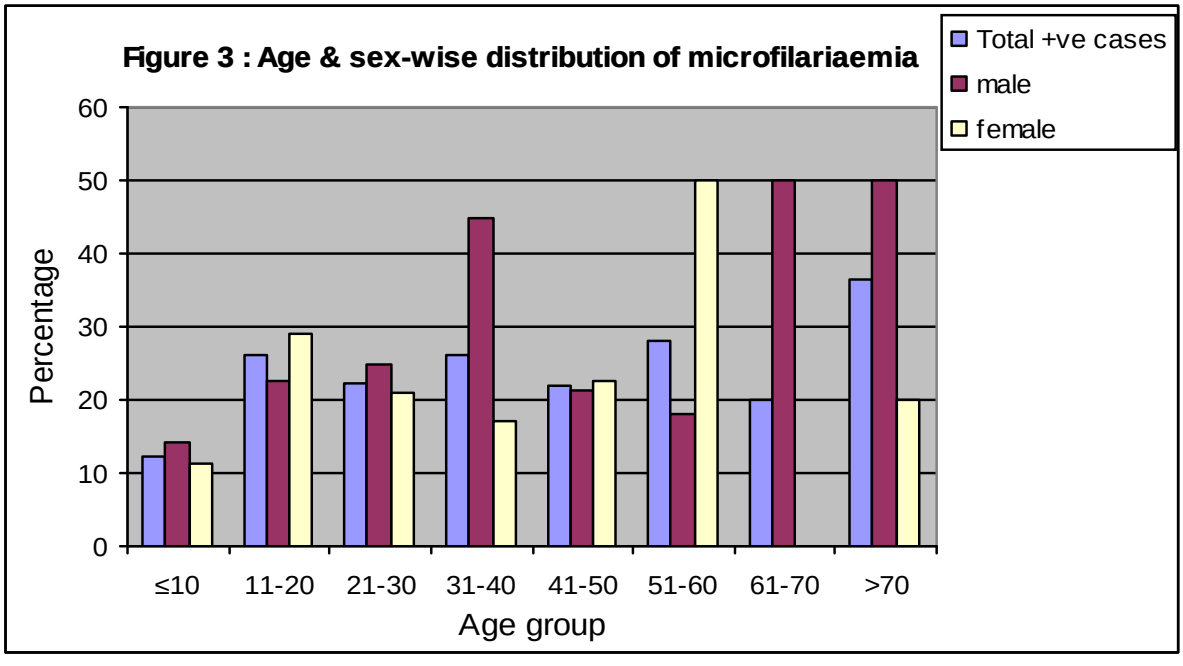


AGE AND SEX WISE DISTRIBUTION OF MICROFILARIAEMIA:

Fifty percent infection rate was recorded in the age groups 61-70 years (3/6) and >70 years (3/6) of male and also in the age group between 51-60 years (5/10) of female while no infection was seen in the female of age group 61-70 years. Many number of samples were collected from the age group 11-20 years of both sexes, infective cases were also seen in more numbers of them i.e. 22.67% (17/75) in males and 28.89% (26/90) in females (Table 5).

Table 5: Age and Sex wise distribution of microfilariaemia:

Age Group (years)	Total samples	Total +ve cases	Total +ve cases (%)	Male			Female		
				Total samples	+ve cases	%	Total samples	+ve cases	%
≤10	97	12	12.37	35	05	14.29	62	07	11.29
11-20	165	43	26.06	75	17	22.67	90	26	28.89
21-30	76	17	22.36	28	07	25.00	48	10	20.83
31-40	61	16	26.22	20	09	45.00	41	07	17.07
41-50	59	13	22.03	28	06	21.43	31	07	22.58
51-60	32	09	28.12	22	04	18.18	10	05	50.00
61-70	15	03	20.00	06	03	50.00	09	00	00.00
>70	11	04	36.36	06	03	50.00	05	01	20.00
Total	516	117	22.67	220	54	24.54	296	63	21.28



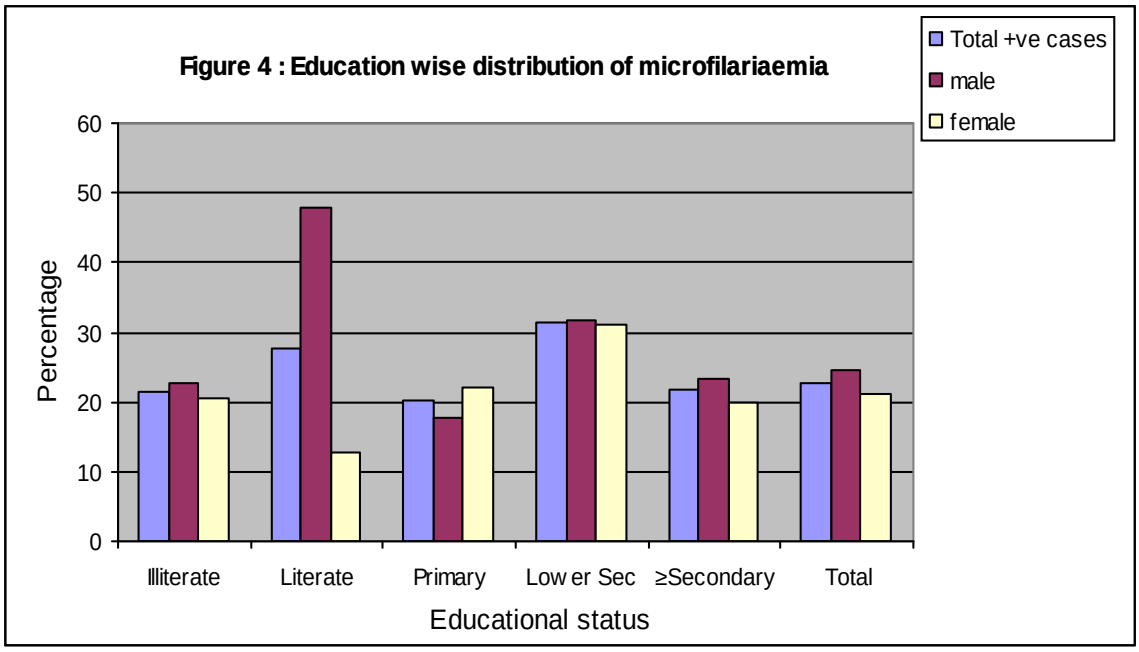
) EDUCATION WISE DISTRIBUTION OF MICROFILARIAEMIA:

Table 6 gives the distribution of microfilarial parasites in the study population in relation to education. Maximum prevalence was seen in the respondents with the education up to lower secondary i.e. 31.25% (15/48) and minimum prevalence in the respondents up to primary level education i.e. 20.13% (31/154). Regarding sex-wise, literate males and females with the education up to lower secondary were more infected with 47.83% and 31.03% infection rate respectively while primary level educated males (17.81%) and literate females (12.90%) were the least infected than the others.

Statistically, the difference between education wise prevalence of microfilarial parasites was found to be insignificant (χ^2=3.579, P < 0.05, 9 d.f.)

Table 6: Education wise distribution of microfilariaemia:

Education level	Total samples	+ve samples		Male			Female		
		No.	%	Total samples	+ve samples		Total samples	+ve samples	
					No.	%		No.	%
Illiterate	196	42	21.43	75	17	22.67	121	25	20.66
Literate	54	15	27.78	23	11	47.83	31	04	12.90
Primary	154	31	20.13	73	13	17.81	81	18	22.22
Lower Sec	48	15	31.25	19	06	31.58	29	09	31.03
≥Secondary	64	14	21.87	30	07	23.33	34	07	20.03
Total	516	117	22.67	220	54	24.54	296	63	21.28



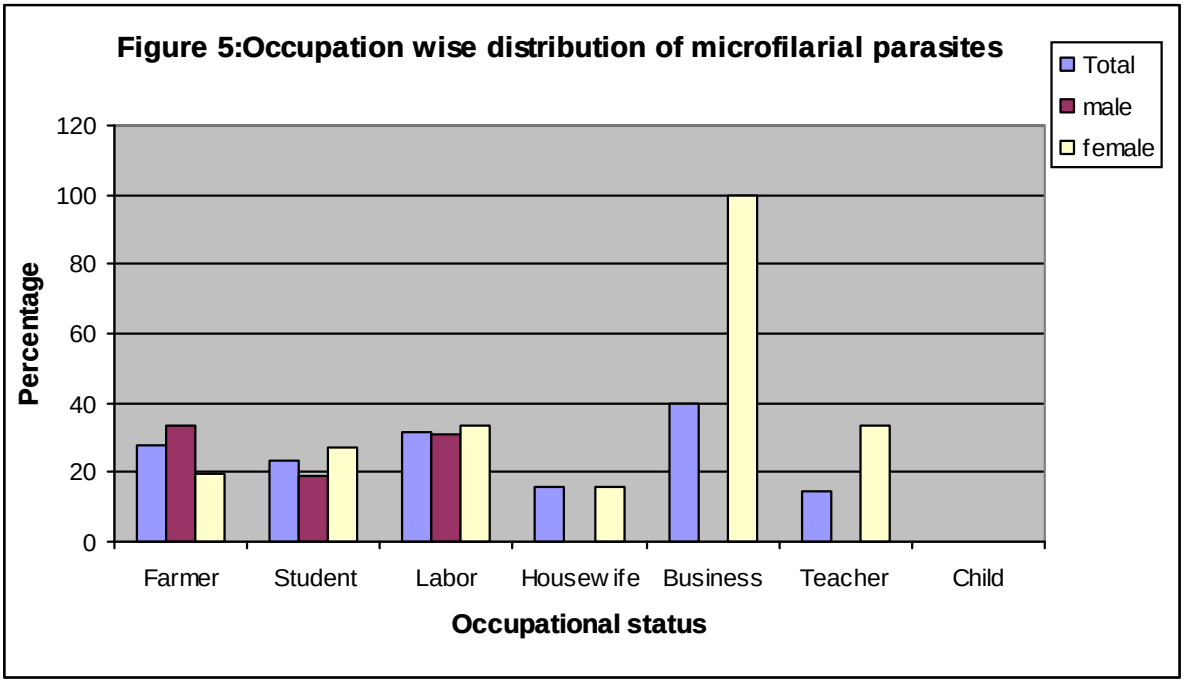
OCCUPATION WISE PREVALENCE OF MICROFILARIAL PARASITES:

Maximum infection was recorded in the respondents with business as occupation i.e. 40% and no infection was found in children while 27.56% of farmers, 23.28% of students, 31.58% of labors, 15.73% of housewives, 40% of business holders and 14.28% of the teachers were also infected (Table 7).

Statistically, the difference between occupation wise prevalence was found to be insignificant (χ^2=12.641, P < 0.05, 13 d.f.).

Table 7: Occupation wise distribution of filariasis:

Occupation	Total samples	+ve samples		Male			Female		
		No.	%	Total samples	+ve samples		Total samples	+ve samples	
					No.	%		No.	%
Farmer	156	43	27.56	90	30	33.33	66	13	19.69
Student	219	51	23.28	105	20	19.05	114	31	27.19
Labor	19	06	31.58	13	04	30.77	06	02	33.33
Housewife	89	14	15.73	00	00	00.00	89	14	15.73
Business	05	02	40.00	03	00	00.00	02	02	100.0
Teacher	07	01	14.28	04	00	00.00	03	01	33.33
Child	21	00	00.00	05	00	00.00	16	00	00.00
Total	516	117	22.67	220	54	24.54	296	63	21.28



) CLINICALLY MANIFESTED CASES IN RELATION TO AGE AND SEX:

Overall clinical manifestation in the present study showed the presence of 23 hydrocele cases, 5 chylurial cases and 92 elephantiasis cases. The hydrocele cases were more prevalent in the age group 41-50 years i.e. 42.86% (12 cases). Leg elephantiasis was prevalent more in males than in females with 20.09% and 15.54% respectively while chylurial cases recorded in males and females were 0.9% and 1.01% respectively (Table 8).

Table 8: Clinically Manifested cases in relation to age and sex:

Age group (years)	Total samples	Male				Female		
		Total	Hydrocele (%)	Chyluria (%)	Elephantiasis (%)	Total	Chyluria (%)	Elephanti-asis(%)
≤10	97	35	00 (00.00)	0 (0.00)	06 (17.14)	62	0 (0.00)	11 (17.74)
11-20	165	75	02 (02.67)	1 (1.33)	11 (14.66)	90	1 (1.11)	09 (10.00)
21-30	76	28	00 (00.00)	0 (0.00)	09 (32.14)	48	0 (0.00)	06 (12.50)
31-40	61	20	03 (15.00)	0 (0.00)	06 (30.00)	41	1 (2.44)	07 (17.07)
41-50	59	28	12 (42.86)	1 (3.57)	05 (17.86)	31	1 (3.23)	09 (29.03)
51-60	32	22	04 (18.18)	0 (0.00)	07 (31.82)	10	0 (0.00)	04 (40.00)
61-70	15	06	01 (16.66)	0 (0.00)	02 (33.33)	09	0 (0.00)	00 (00.00)
>70	11	06	01(16.66)	0 (0.00)	00 (00.00)	05	0 (0.00)	00 (00.00)
Total	516	220	23 (11.5)	02 (0.9)	46 (20.09)	296	3 (1.01)	46 (15.54)

J TOTAL ENDEMICITY RATE OF FILARIASIS:

The total endemicity rate of filariasis in the study population was found to be 44.76% with 22.67% microfilariaemia (MF) and 22.09% crude disease rate (CDR). Out of 22.67% microfilarial infection, 15.31% were with the presence of microfilarial parasites but without any symptoms while 7.36% showed the presence of microfilarial parasites with filarial symptoms (Table 9).

Table 9: Total endemicity rate of filariasis:

Total samples	MF (%)	CDR (%)	(MF+CDR) (%)	ER (%)
516	79 (15.31)	114 (22.09)	38 (07.36)	231(44.76)

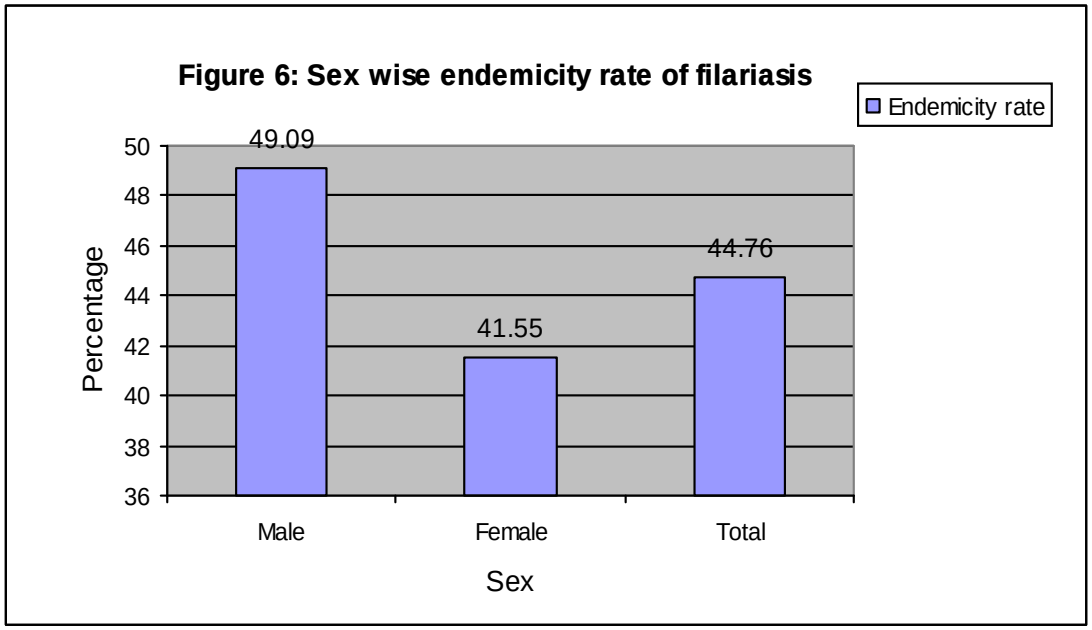
) SEX WISE ENDEMICITY RATE OF FILARIASIS:

Table 10 shows the endemicity rate of filariasis in relation to sex which was found to be the highest in males i.e. 49.09% than in females i.e. 41.55%.

However the difference between sex-wise endemicity rate was found to be satistically insignificant (χ^2=2.9, P < 0.05, 3 d.f).

Table 10: Sex wise endemicity rate of filariasis:

Sex	MF		CDR		(MF+CDR)		ER	
	No.	%	No.	%	No.	%	No.	%
Male	29	36.71	54	47.37	25	65.79	108	49.09
Female	50	63.29	60	52.63	13	34.21	123	41.55
Total	79	15.31	114	22.09	38	7.36	231	44.76



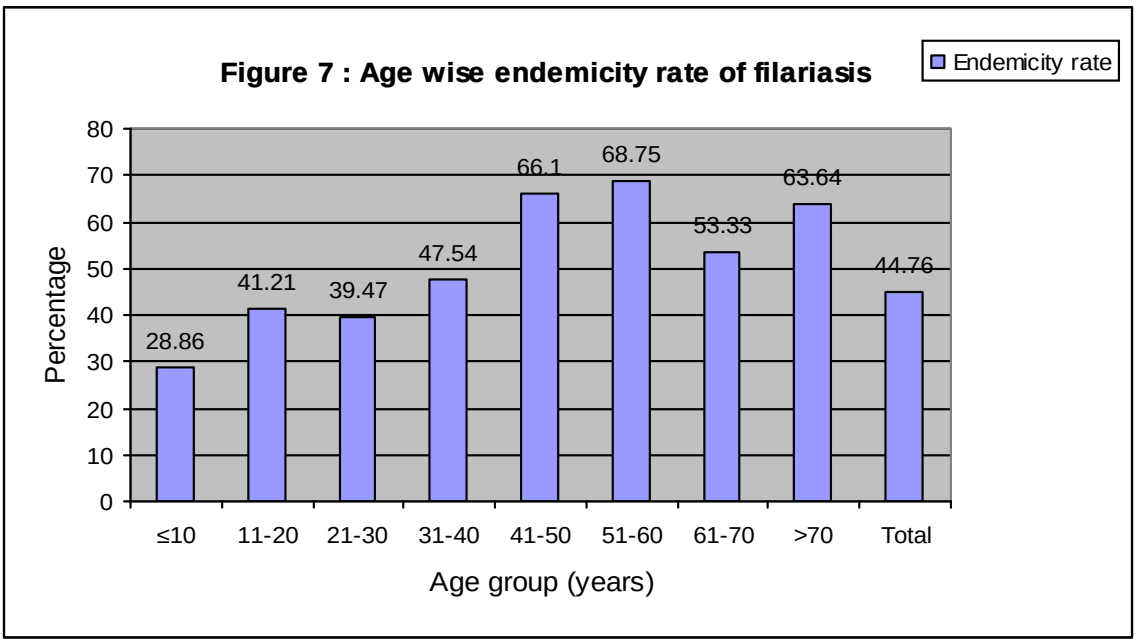
) AGE WISE ENDEMICITY RATE OF FILARIASIS:

Table 11 shows the endemicity rate of filariasis in relation to age. The increased endemicity rate was seen in the age group 51-60 years i.e. with 68.75% while low in the age group ≤ 10 years i.e. 28.86%. The endemicity rate of 66.10%, 63.64%, 53.33%, 47.54%, 41.21 % and 39.47% were found in the age groups 41-50 years, >70 years, 61-70 years, 31-40 years, 11-20 years and 21-30 years respectively.

The difference between age wise endemicity rate was found to be statistically significant (χ^2 =32.414, P > 0.05, 15 d.f.).

Table 11: Age wise endemicity rate of filariasis:

Age group	Total samples	MF (No.)	CDR (No.)	(MF+CDR) (No.)	ER	
					No.	%
≤10	97	07	16	05	28	28.86
11-20	165	37	25	06	68	41.21
21-30	76	10	13	07	30	39.47
31-40	61	08	13	08	29	47.54
41-50	59	08	26	05	39	66.10
51-60	32	05	13	04	22	68.75
61-70	15	01	05	02	08	53.33
>70	11	03	03	01	07	63.64
Total	516	79	114	38	231	44.76



) DISTRIBUTION OF MICROFILARIAL PARASITES IN RELATION TO THE USE OF MOSQUITO NETS:

Table 12 provides the data about the use of mosquito nets by the respondents and also the distribution of microfilarial parasites in relation to the use of mosquito nets. 36.24% of the respondents were found to use nets while sleeping but 63.76% did not use net. Very few respondents who did not use mosquito nets were found to use mosquito mats (2.13%), mosquito coils (23.40%), smoke (12.06%) or spray (10.40%) as preventive measures against mosquitoes. 20.86% of the mosquito net users and 23.71% of the non-users were found to be infected with the microfilarial parasites

Table 12: Prevalence of Microfilarial parasites in relation to the use of Mosquito nets:

S.N.	Use of Mosquito nets	Total People		Positive Samples	
		No.	%	No.	%
1	Yes	187	36.24	39	20.86
2	No	329	63.76	78	23.71
	Total	516	100.00	117	22.67

) DISTRIBUTION OF MICROFILARIAL PARASITES IN RELATION TO THE KNOWLEDGE ABOUT LYMPHATIC FILARIASIS

74.61% of the respondents were without any knowledge about the disease while only 25.39% of the respondents know about it. It was found that 25.95% of the respondents with the knowledge about filariasis and 21.56% of the people without any knowledge about it were infected with microfilarial parasites (Table 13).

Table 13: Distribution of Microfilarial parasites in relation to the Knowledge about lymphatic filariasis:

S.N.	Knowledge status	Total People		Positive Samples	
		No.	%	No.	%
1	Yes	131	25.39	34	25.95
2	No	385	74.61	83	21.56
	Total	516	100	117	22.67

VI

DISCUSSION AND CONCLUSION

Lymphatic filariasis has been estimated to be endemic in some 80 countries including 120 millions of people (WHO, 2000). It has global distribution with serious endemicity in Asia and Africa. Filariasis has been known to be endemic in Nepal since a long time (EDCD, 2000) and reported from different areas. The present study revealed the endemicity rate of 44.76% with overall microfilariaemia of 22.67% and crude disease of 22.09%. Jung (1973) reported 4.99% to 6.15% crude disease rate in all age groups and both the sexes in the urban population, 6.6 to10.3% in the semi urban population and 1.2% to 17.8% in the rural population. Similarly, the study showed 7.1% to 9.16% microfilariaemia in the urban population, 10.03% to 11.3% in semi urban population and 0.8 to 17.69% in the rural population survey carried out in Central Nepal. Pradhan *et al*., (1997) in Gokarna VDC of Kathmandu valley reported 24.6% endemicity rate with the overall 11.95% microfilariaemia and 12.64% crude disease. Bhusal *et al.*, (2000) reported 5.8% prevalence of microfilariaema and 13% crude disease rate of *W. bancrofti* in Tokha-Chandeshwori VDC. The results found out by Jung (1973), Pradhan *et al*., (1997) and Bhusal *et al.*, (2000) are relatively less than that of the present study in comparison to the endemicity rate, microfilariaemia and crude disease. While the crude disease (19.9%) reported by Manandhar (2001) from Sipwa, Dhovan and Bhaktapur is approximately similar to the present crude disease

rate. Sherchand *et al.,* (2000) surveyed 37 districts of Nepal and reported 13% prevalence of microfilaria which is also less in comparision with the present prevalence rate in Salyantar VDC.

Among 117 positive microfilarial cases, 54/220 (24.54%) were of males and 63/296 (21.28%) were of females. Males and females were infected in the ratio of 1.2:1. This is supported by Weerasooriya *et al.,* (2001) Srilanka. This may be due to the fact that during the summer, which is the optimum breeding season of mosquito, males usually sleep outdoor without using net and hence are more exposed to mosquito biting and also their usual dressing style, only vest and pant lead maximum biting by mosquito in the exposed parts of the body. While females are less susceptible to mosquito biting because they sleep indoor with their children using mosquito nets hence, are less exposed to mosquito biting.

All the age groups are susceptible to filariasis. The present study reveals high infection rate in the age group >70 years i.e. 36.36% while least in the age group ≤ 10 years i.e. 12.37%. The highest prevalence of MF in the age group >70 years may be because of high exposure towards outer environment, lack of awareness and carelessness towards using nets, about health and hygiene while the lowest prevalence in the age group below 10 years is because of their indoor sleeping habit using mosquito nets. Age wise distribution of filariasis is equivalent to the length of the exposure; this is also supported by WHO, 2001. According to Witt (2001) although LF is first acquired in childhood, clinical

features occur only after puberty and hence increase with age. Massage *et al.,* (2000) also supported that clinical manifestation and microfilaria prevalence increases with age.

The maximum prevalence rate was reported in the children with the education up to lower secondary i.e. 31.25% (15/48). Since collected samples consisted of more illiterate people (because the illiteracy rate was high), many positive cases were recorded in them i.e. 21.43% (75/196). Similar type of result has also been obtained by Chhetri (2005). Regarding the knowledge, most of the people i.e. 74.61% were still unaware about the disease and only 25.39% knew about it.

Females, students and people of the age group 11-20 years were found to be relatively higher in the study. In most of the houses, males were out of village for working and earning purpose, thus only females and children were found to stay at home and also the mass orientation program held in the school resulted the greater participation of children and females.

During the field survey, it was found that the environmental condition and sanitation around the house play a major role to spread filariasis. Similar result had been obtained by Chhetri (2005) and Jha (2003). In the surveyed area, it was observed that the surrounding environment of most of the households were dirty. People also domesticated animals near their settlements. They either use their own house as the cattle shed or construct it close to their residence. Also each and every household has a large pit dug for accumulating the cattle dung

for using as manure. During rainy seasons, these pits get filled up with water, which become an important site for mosquito breeding. The presence of bushy area around the house also supports the growth of mosquito. Not only this, the people worked in the morning and evening time which is suitable time for mosquito biting Such conditions increase the chance of mosquito breeding and biting hence increasing the spread of vector borne diseases.. These are the major risk factors for acquiring the vector borne disease filariasis.

By performing the survey on filariasis in the Salyantar VDC of Dhading district, it can be concluded that illiteracy which is responsible for lack of awareness towards the vector borne diseases, poor sanitary conditions around the house, carelessness towards health and hygiene and also carelessness towards the use of mosquito nets are the major contributing factors for the epidemicity of filariasis. Hence extensive study should be undertaken to determine the epidemiological and etiological factors that causes the high prevalence of filarial parasites.

VII

RECOMMENDATIONS

The following recommendations are forwarded to minimize the filariasis after conducting the cross sectional survey in Salyantar VDC of Dhading district:

- Many people are still unknown about the disease lymphatic filariasis. Thus to make them familiar about filariasis, awareness should be spread through mass media, radio, television, distributing posters and pamphlets, booklets, brochures, organizing different stage programs, training programs and also conducting household awareness, group awareness programs for protecting people from vector borne lymphatic filarial disease and to improve health and hygiene. Thus first priority should be given to spread awareness among the people.
- People should be made conscious of using mosquito nets, mosquito coils, mosquito mats, fumigants, ointments etc. for protection against mosquito bites.
- Mass drug administration and control program must be regularized along with the monitoring of the same study population of the site throughout the elimination program in order to assess the success of program.
- Public health education should necessarily be included from primary level education and also the teachers should be trained about the control of filarial disease. Along with that organizing drawings/ essays/ health songs/ dramas competitions among the school children will be helpful in bringing awareness

in the society because school children are one of the best ways to bring changes in the society.

- Concerned authority should make strict rules for introducing larvicides and insecticides or filling up the ditches and pits where the deposition of water is probable during monsoons and also in other seasons, which is the suitable site for breeding of mosquito.
- Regular health check up is needed in the study area and if someone is infected with MF, he/she should be immediately treated.
- Salyantar still lacks the electricity facilities because of which local people are compelled to live in the darkness of light of awareness, education and mass media, the very important reason for the spread of disease. So concerned authority should take an urgent step to facilitate the local people with electricity.

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