Original article

Lymphatic filariasis in the foothill areas around Susunia of West Bengal in India

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Abstract

Objective: To investigate the filarial epidemiology in 16 foothill villages around Susunia hill, Bankura district, West Bengal, India. Indices studied were microfilaria rate, mean microfilarial density, filarial disease rate and endemicity rate. Other indices related to transmission were incrimination of vector species, man-hour density of the vector, vector infection and infectivity rates, human blood index of the vector etc. **Methods**: Examination of 20 μL night blood samples by finger prick and clinical examination for filarial diseases of 3 737 people (2 241 male and 1 496 female) was done randomly covering nearly 22 % population of the study area. Aspects related to vectors were dealt by regular collection and dissection of mosquitoes. **Results**: Overall microfilaria rate, mean microfilarial density, disease rate and endemicity rate were 6.10 %, 10.86 %, 20.20 % and 25.58 %, respectively. Causative parasite was identified as *Wuchereria bancrofti* and *Culex quinquefasciatus* was incriminated as the vector therein. Vector infection rate, infectivity rate and human blood index were assessed to be 6.31 %, 1.38 % and 77.33 %, respectively. **Conclusion**: Present study area is highly endemic for bancroftian filariasis. More than one fourth of the population under study were filarial victims indicating an overall alarming situation and immediate measure should be taken to rectify the situation.

Keywords: Lymphatic filariasis; Susunia; Foothills; Epidemiology; Vector

INTRODUCTION

Lymphatic filariasis is a major public health problem among WHO (TDR) target diseases. As many as 45.5 million people live in India out of 120 million filarial cases throughout the world [1]. As per recent estimates 1 307 million people in 83 countries/ territories endemic for lymphatic filariasis along with 553.7 million people of 243 districts in India are at risk of acquiring infection [2]. Information regarding filarial epidemiology and its related vectors from different areas of West Bengal, India, are available [3-14]. But there is no information from the foothill areas around Susunia hill of West Bengal. So a study was carried out to collect epidemiological information such as microfilaria rate (MR), mean microfilarial density (MMD), filarial disease rate (DR) etc. in 16 foothill villages around Susunia hill, West Bengal, India.

In addition, different entomological aspects like identification of the vector species among different species of mosquitoes, man-hour density (MHD) of the vector, vector infection and infectivity rates, human blood index (HBI) of the vector etc. were studied. All the data were subjected to statistical analysis for an accurate assessment of the situation that may help formulating appropriate control measures.

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MATERIALS AND METHODS

The present study was conducted in the foothill areas of Susunia hill, and the villages covered were Susunia, Hapania, Ramnathpur, Kustholia, Bankusthol, Chururi, Sagarya, Nutangram, Lachhmanpur, Rangametya, Rajamela, Kelai (= Udaymoni), Beldanga, Banashuria, Barkona and Lakshmanpur of Bankura district, West Bengal, India during the year 2001 – 2002 covering nearly 22 % population. The studied villages were situated within 15 km radiuses around Susunia Hill (1 442 m high) separated by fields, bushes or forests. Blood samples (20 μL) were collected (at random) by finger prick between 1 900 and 2 300 hrs [15]. Thick blood smears were prepared, dried in air, dehaemoglobinized, stained with Leishman's stain and examined for the presence of microfilariae, if any. Each subject was clinically examined for the signs of filariasis and interrogated. Physical examination of males included the genitals, legs, arms and the lymph glands in the groin and axillae. In case of females, examination was usually restricted to legs and arms. Age, sex, clinical history and socio-economic status of each subject were noted.

For collection of mosquitoes, 12 human habitations were selected in each village. So a total of 192 human habitations were fixed in 16 villages. Between 600 and 800 hrs, indoor-resting mosquitoes were captured for 10 mins from each human habitation by one insect collector using hand collection method[16]. Human habitations of each of 16 villages were searched serially (1st village in 1st week, 2nd village in 2nd week and so on) once in each season from March 2000 to February 2002. One year was divided into 3 seasons, namely summer (March – June), rainy (July – October) and winter (November – February). Thus, a total of 32 man-hours were employed in each season, i. e. and 192 man-hours during the study. The collected mosquitoes were identified [17,18] and all of them were dissected to search for different developing stages of filarial larvae including microfilariae [19]. Number of parasites detected in each infected mosquito (on 3 different sites like head, thorax and abdomen) was counted and noted.

The extent of man-vector contact was assessed by an indirect method, i. e. on the basis of anthropophilic index or HBI. To calculate HBI, blood meals of 300 blood-fed *Cx. quinquefasciatus*, collected from human habitations were analyzed by gel diffusion technique [20].

Available data were subjected to statistical analyses using normal deviate '*Z*' and student's '*t*' test[21].

RESULTS

According to the census report of India 2001, overall population of the villages under study was 17 271, of which 33.0 % belongs to Schedule Caste and 6.5 % to Schedule Tribes. Literacy rate was about 52.3 %. Major occupations of the people of the area were cultivation, agricultural labors and household industry (Table 1).

During the study, it appeared that, majority of the inhabitants of the area was very poor, work as low-income labourer (other than agricultural) or did not find any job for the major portion of the year. They sometimes move outside the native villages in search of job. Most of them are uneducated or went to school up to primary level with ill developed awareness of health, hygiene and sanitation.

From the 16 villages of the study area 3 737 people (2 241 male and 1 496 female) were brought into the study. Overall, village wise, age group wise and gender wise distributions of different parameters are presented in Table 2 & 3. Village wise analysis showed that, higher MR in Lakshmanpur (11.48 %), higher MMD in Banashuria (22.58 %) and higher DR Barkona (29.70 %) (Table 2).

MR was higher in the age group of 41 – 50 years (12.67 %) than the other age groups, MMD were higher the age group of 61 – 70 years (19.75 %) than the other age groups and filarial DR were higher in the age group of 31 – 40 years (30.67 %) than the other age groups (Table 3).

Different filarial diseases encountered during the study were adeno-lymphangitis, lymphoedema, elephantiasis, epididymo-orchitis and hydrocele. Most prevalent symptom was hydrocele (16.06 %) followed by epididymo-orchitis (4.28 %). Adeno-lymphangitis was higher in the age group of 31 – 40 years in both males (6.41 %) and females (9.74 %). Lymphoedema was higher in the age group of ≥71 years in males (4.76 %) and in the age group of 41 – 50 in females (12.23 %). Elephantiasis

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was higher in the age group of 51 – 60 years in both males (9.72 %) and females (17.50 %). Epididymo-orchitis was higher in the age group of 21 – 30 years (6.50 %) and hydrocele was higher in the age group of 41 – 50 years (24.11 %) (Table 4). More than one fourth of the populations of the area were filarial victims i. e. either detected as microfilaremic or with any type of filarial etiologies (Figure 1).

During the two-year period, altogether 7 272 mosquitoes of 8 species were collected from the study area. *Culex quinquefasciatus* (27.83 %) was the dominant species of mosquito with a MHD of 10.54. Other 7 species of mosquitoes were: *Culex vishnui* (group) (8.64 %), *Anopheles annularis* (25.62 %), *Anopheles barbirostris* (10.16 %), *Anopheles subpictus* (23.95 %), *Armigeres subalbatus* (3.25 %), *Mansonia annulifera* (0.48 %) and *Stegomyia aegypti* (0.07 %). During the study only *Culex. quinquefasciatus* was incriminated as the filarial vector and the parasites obtained were different stages of *Wuchereria bancrofti*. None of the other collected species of the mosquito was found to develop any larval stages of *Wuchereria bancrofti*. Overall, vector infection and infectivity rates among the vector collected from the human habitations of the study area were 6.31 % and 1.38 %, respectively. Highest vector infection and infectivity rates were found from the villages Lachhmanpur (9.84 %) and Banashuria (2.56 %), respectively (Table 2).

Among the *Culex. Quinquefasciatus* dissected, 49, 24, 16 and 25 were found to be positive for microfilaria, 1st stage, 2nd stage and 3rd stage larvae of *Wuchereria bancrofti* respectively and average load of respective immature parasites in those positive mosquito were 10.02, 7.50, 5.56 and 4.68 respectively. HBI of the vector collected from the study area were calculated as 77.33 %.

Table 1 Area and population data of the villages under study (data source Census of India, 2001).

Name of village	Area (km^2)	No. of house hold	Population			Schedule caste	Schedule tribe	Literate	Occupation			
			Total	Male	Female				Cultivation	Agri -labour	H. hold indus.	Others
Susunia	0.835	121	640	313	327	24	0	488	22	4	90	143
Hapania	2.364	65	332	153	179	38	277	138	157	10	24	47
Ramnathpur	1.871	141	802	389	413	147	521	312	151	109	52	48
Kustholia	5.743	287	1 579	779	800	705	0	916	130	243	70	154
Bankusthol	1.653	62	370	191	179	370	0	239	90	58	0	9
Chururi	1.455	122	698	354	344	198	0	295	52	88	11	46
Sagarya	6.796	99	467	241	226	148	0	221	49	71	0	55
Nutangram	1.387	161	791	394	397	325	0	381	111	140	10	82
Lachhmanpur	6.917	526	2 964	1 499	1 465	735	0	1 618	591	357	31	181
Rangametya	0.713	116	717	365	352	183	108	421	101	60	3	50
Rajamela	3.488	283	1 645	859	786	483	153	779	219	429	84	94
Kelai	0.987	93	511	268	243	427	0	184	109	147	21	4
Beldanga	2.019	157	1 010	525	485	141	0	464	277	90	16	78
Banashuria	3.764	383	1 938	990	948	809	4	1 046	194	261	62	187
Barkona	4.731	449	2 358	1 170	1 188	803	0	1 240	489	324	42	178
Lakshmanpur	1.708	86	449	225	224	166	55	296	113	29	12	59
Total	46.431	3 151	17 271	8 715	8 556	5 702 (33.0%)	1 118 (6.5%)	9 038 (52.3%)	2 855 (16.5%)	2 420 (14.0%)	528 (3.1%)	1 415 (8.2%)

Table 2 Village wise distribution of microfilaria rate, mean microfilarial density & disease rate among human population with vector infection rate & infectivity rate around foothill areas of Susunia, Bankura district, West Bengal, India.

Villages	Number examined			Microfilaria rate (%)			Mean microfilarial density			Disease rate (%)			Vector infection rate	Vector infectivity ratel
	M	F	T	M	F	O	M	F	O	M	F	O		
Susunia	223	80	303	5.38	11.25	6.93	6.50	20.44	12.48	12.11	15.00	12.87	4.55	1.14
Hapania	45	62	107	6.67	4.84	5.61	7.33	6.00	6.67	15.56	12.90	14.02	4.55	1.14
Ramnathpur	50	52	102	4.00	3.85	3.92	5.50	7.50	6.50	20.00	15.38	17.65	3.81	0.48
Kustholia	87	17	104	10.34	0.0	8.65	9.11	0.0	9.11	20.69	11.76	19.23	8.93	1.79
Bankusthol	112	96	208	7.14	4.17	5.77	15.63	7.50	12.92	26.79	14.58	21.15	6.80	1.94
Chururi	160	132	292	5.63	6.82	6.16	4.44	6.22	5.33	26.88	4.55	16.78	8.03	1.46
Sagarya	195	53	248	3.08	3.77	3.23	7.67	13.00	9.00	21.03	3.77	17.34	4.29	1.43
Nutangram	88	56	144	5.68	7.14	6.25	5.80	5.75	5.78	7.95	19.64	12.50	4.90	0.98
Lachhmanpur	231	57	288	9.09	3.51	7.99	5.24	3.00	5.04	28.14	7.02	23.96	9.84	2.46
Rangametya	51	80	131	5.88	5.00	5.34	6.00	3.25	4.43	21.57	8.75	13.74	6.67	1.11
Rajamela	128	182	310	7.03	2.20	4.91	9.67	8.00	9.15	31.25	2.20	14.19	4.12	1.03
Kelai	57	85	142	5.26	4.71	4.93	6.00	4.50	5.14	17.54	2.35	8.45	3.80	1.27
Beldanga	222	184	406	9.01	4.35	6.90	16.40	8.50	14.14	33.78	15.76	25.62	5.31	0.88
Banashuria	274	192	466	5.11	6.25	5.58	25.93	18.67	22.58	35.40	15.10	27.04	7.69	2.56
Barkona	203	100	303	4.43	7.00	5.28	8.22	6.00	7.25	39.41	10.00	29.70	8.08	1.01
Lakshmanpur	115	68	183	14.78	5.88	11.48	13.59	15.00	13.86	36.52	5.88	25.14	7.26	1.61
Total/ overall*	2 241	1 496	3 737	6.69*	5.21*	6.10*	11.08*	10.45*	10.86*	26.91*	10.16*	20.20*	6.31*	1.38*

M = Male, F = Female, O = Overall

Table 3 Age group wise distribution of microfilaria rate, mean microfilarial density and disease rate among human population of foothill areas of Susunia, Bankura district, West Bengal, India.

Age(Years)	Number examined			Microfilaria rate (%)			Mean microfilarial density			Disease rate (%)		
	M	F	T	M	F	O	M	F	O	M	F	O
≤ 10	326	307	633	0.31	0.00	0.16	5.00	0.00	5.00	4.60	0.65	2.69
11 – 20	605	351	956	7.60	1.71	5.44	13.28	6.83	12.54	17.85	6.84	13.81
21 – 30	508	292	800	6.69	2.40	5.13	9.65	4.86	8.83	35.43	11.99	26.88
31 – 40	359	267	626	8.36	13.11	10.38	14.83	9.20	11.80	42.62	14.61	30.67
41 – 50	224	139	363	12.95	12.23	12.67	7.21	10.06	8.26	34.38	23.02	30.03
51 – 60	144	80	224	4.17	11.25	6.70	8.50	11.33	10.20	34.03	20.00	29.02
61 – 70	54	45	99	7.41	8.89	8.08	3.25	36.25	19.75	29.63	8.89	20.20
≥ 71	21	15	36	0.00	0.00	0.00	0.00	0.00	0.00	23.81	0.00	13.89
Total/overall*	2 241	1 496	3 737	6.69*	5.21*	6.10*	11.08*	10.45*	10.86*	26.91*	10.16*	20.20*

Data on microfilaria rate are adopted from Chandra and Paramanik[25].

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Table 4 Age group wise distribution of percent of different diseases among human population of the study area.

Age(Years)	Adeno-lymphangitis (%)		Lymphoedema (%)		Elephantiasis (%)		Epididymo-orchitis(%)(M)	Hydrocele (%)(M)
	M	F	M	F	M	F		
≤ 10	2.76	0.65	1.84	0.00	0.00	0.00	0.00	0.00
11 – 20	1.32	3.70	1.32	3.13	0.00	0.00	3.80	11.40
21 – 30	2.56	5.14	3.15	3.42	1.18	3.42	6.50	22.05
31 – 40	6.41	9.74	4.18	2.62	2.51	2.25	5.85	23.68
41 – 50	3.13	4.32	0.45	12.23	1.79	6.47	4.91	24.11
51 – 60	1.39	0.00	0.00	2.50	9.72	17.50	5.56	17.36
61 – 70	0.00	0.00	0.00	2.22	9.26	6.67	0.00	20.37
≥ 71	0.00	0.00	4.76	0.00	0.00	0.00	0.00	19.05
Overall	2.77	4.14	2.10	3.21	1.70	2.81	4.28	16.06

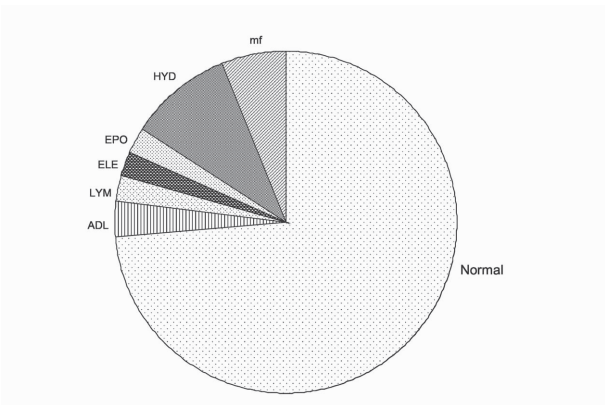

Figure 1 Comparison between different diseased (ADL = Adeno – lymphangitis, LYM = Lymphoedema, ELE = Elephantiasis, EPO = Epididymo – orchitis, HYD = Hydrocele), microfilariaemic (mf) & normal population in the area

DISCUSSION

The present study provides first-hand information regarding filarial endemicity and its vector from the foothill areas of Susunia hill, Bankura district, West Bengal, India. The studied villages were situated within 15 km radiuses around Susunia hill (1 442 m high) separated by fields, bushes or forests. All the studied villages were found to be endemic for bancroftian filariasis. Different parameters in male and females were high in different villages but general infection or endemicity pattern were more or less similar. Gender wise distribution shows that, overall, MR, MMD and DR were higher among males than females as reported in some other studies [9-12,14] [in case of MR and MMD differences between males and females were statistically not significant ($P > 0.05$; $Z = 0.429$, $Z = 0.136$) but DR were significantly higher among males than females ($P < 0.05$; $Z = 2.751$)]. This was probably because males of that area were more exposed to mosquito bites as they wear less cloth, travel in search of employment and sometimes sleep outside the house at night (as noted during the survey).

Age group wise distribution shows that, MR, MMD and DR were generally higher among the peoples of middle age group (31 – 40 & 41 – 50) except MMD, which was quite higher in older age group females (61 – 70). Peoples of middle or working age groups were more affected by the filarial parasites, which may seriously affect their efficiency and economy. Higher MMD among the older age group were possibly due to multiple infections. Among the aetiologies, hydrocele was significantly higher than all other diseases ($P < 0.05$; $Z = 2.612$ with nearest epididymo-orchitis). Different disease symptoms were distributed unevenly in different age groups and in both genders, indicating a steady state of transmission.

Prevalence of human house frequenting *Culex quinquefasciatus* was found to be moderate but it is sufficient to establish as a strong vector. Infected and infective vectors were available from all the 16 villages studied. Vector infection rate, infectivity rate and HBI were quite high in the present study area than some other areas of West Bengal [8,11,13,22].

Considerably higher load of parasite per infected mosquito was found in the study area than some other areas [8,10,13,14]. High infection rate combining with considerably high human blood index of the vector increases the potentiality of transmission. At the

same time, a natural control of the parasite transmission was observed. A significant fall in average load of microfilaria to 1st stage, 1st stage to 2nd stage and 2nd stage to 3rd stage larvae was noted ($P<0.05$; $t=10.951$, $t=7.056$, $t=3.289$), which is supported by some early studies [5,14,23,24].

Most of the people in the area belong to low-income group and they do not use any mosquito net or repellent. Poorly maintained drainage & sanitation and above all the tropical climatic condition probably favoured such endemic condition.

From the above discussion it could be concluded that the situation of the area is alarming. To rectify the situation employing various vector control methods, drug treatment of microfilaremics, developing awareness among the peoples about the disease and active community participation might be some effective steps.

To find out an effective drug treatment strategy in highly endemic area, a study was conducted by Chandra and Paramanik in the present study area[25]. Selected microfilaremic subjects were treated with single dose (6 mg/kg body weight) to triple dose of diethylcarbamazine (DEC) and followed up to 5 years (June 2002 - July 2007). Results show that single dose DEC treatment was not always sufficient to eliminate all the microfilaria (especially when MMD was high). Moreover the 5-year recurrence of microfilaremia was observed among 49 % of the treated subject. Therefore, the authors suggested a single course (6 mg/kg body weight for 3 days) DEC treatment. It was also established that DEC treatment should be continued for few consecutive years covering total population to stop any recurrence of microfilaremia[25].

REFERENCES

1 WHO. *Lymphatic filariasis infection and disease: Control strategies*. Malaysia: Universiti Sains Malaysia. 1994. TDR/CTD/FIL/PENANG/94.1.
2 WHO. Global programme to eliminate lymphatic filariasis. *Weekly Epidemiol Rec* 2006; 81:221-232.
3 **Rozeboom LE**, Bhattacharya NC, Gilotra SK. Observations on the transmission of filariasis in urban Calcutta. *Am J Epidemiol* 1968; 87: 616-632.
4 **Dondero Jr TJ**, Bhattacharya NC, Black HR. Clinical manifestations of bancroftian filariasis in a suburb of Calcutta, India. *Am J Trop Med Hyg* 1976; 25: 64-73.
5 **Hati AK**, Chandra G, Bhattacharya A, Biswas D, Chatterjee KK, Dwibedi HN. Annual transmission potential of bancroftian filariasis in an urban and a rural area of West Bengal, India. *Am J Trop Med Hyg* 1989; 40: 365-367.
6 **Chandra G**, Hati AK. Correlation between the preferred biting site of *Culex quinquefasciatus* and the region of the body affected by clinical filariasis. *Ann Trop Med Parasit* 1993; 87: 393-397.
7 **Chandra G**, Banerjee A, Hati AK. Current filariasis situation in some pockets of Calcutta. *Bull Calcutta Sch Trop Med* 1994; 42: 4-7.
8 **De SK**, Chandra G. Studies on the filariasis vector- *Culex quinquefasciatus* at Kanchrapara, West Bengal, India. *Indian J Med Res* 1994; 99: 255-258.
9 **Chandra G**, Hati AK. Filariasis survey in a rural area of West Bengal. *J Commun Dis* 1996; 28: 206-208.
10 **Chandra G**. Studies on transmission dynamics of lymphatic filariasis in rural areas of West Bengal. *Proc Zool Soc Cal* 1998; 51: 116-128.
11 **Rudra SK**, Chandra G. Bancroftian filariasis in tribal population of Bankura District, West Bengal, India. *Jpn J Trop Med Hyg* 1998; 26: 109-112.
12 **Rudra SK**, Chandra G. Comparative epidemiological studies on lymphatic filariasis between tribal and non-tribal populations of Bankura district, West Bengal, India. *Ann Trop Med Parasit* 2000; 94: 365-372.
13 **Das SK**, Ghosh A, Behera MK, Chandra G. Studies on Vector of Bancroftian filariasis at Katwa, West Bengal. *J Parasit Appl Anim Biol* 2003; 12 (1&2): 1-7.
14 **Chandra G**, Chatterjee SN, Das S, Sarkar N. Lymphatic filariasis in the coastal areas of Digha, West Bengal, India. *Tropical Doctor* 2007; 37(3): 136-139.
15 **Gubler DJ**, Inui TS, Black HR, Bhattacharya NC. Comparison of microfilaria density in blood sample by finger-prick, venipuncture and ingestion by mosquito. *Am J Trop Med Hyg* 1973; 22: 174-178.
16 WHO. Report of the WHO Expert Committee on Malaria. *Tech Rep Ser* 1964. 4-44.
17 **Christophers SR**. *Family Culicidae. Tribe Anophelini*. London: Taylor and Francis; 1933; 371:186.
18 **Barraud PJ**. *Family Culicidae. Tribe Megarhinini and Culicini*. London, Taylor and Francis; 1934. 463.
19 **Manson-Bahr PEC**, Bell DR. *Manson's tropical diseases*. London: ELBS Pub; 1991. 1365-1373.
20 **Ouchterlony O**, Nilson LA. Immunodiffusion and immuno-electrophoresis. In: *Hand book of experimental immunology*. Oxford: Blackwell Publication; 1973. 1-99.
21 **Zar JH**. *Biostatistical analysis*. 4th ed. New Delhi: Pearson Education (Singapore) Pte Ltd; 1999. 1-663.
22 **Chandra G**, Chatterjee SN, Hati AK. *Wuchereria* infection in the natural population of *Culex quinquefasciatus* in a rural area of West Bengal. *Environ Ecol* 1996; 14(4): 774-776.
23 **Symes CB**. Filarial infections in mosquitoes in Fiji. *Trans Roy Soc Trop Med Hyg* 1955; 49: 280-284.
24 **Chandra G**. Nature limits filarial transmission. *Parasites & Vectors* 2008; 1: 13.
25 **Chandra G**, Paramanik M. Effect of single to triple dose DEC on microfilaremics up to 5 years. *Parasitol Res* 2008; 103(6): 1279-1282.

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