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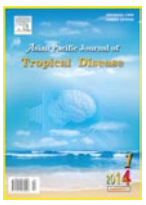

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Need for a differential criteria to stop mass drug administration, based on an epidemiological perspective of lymphatic filariasis in Thiruvananthapuram, Kerala, India

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PEER REVIEW

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Comments

This is a good study in which the authors have succeeded in obtaining a snapshot of the epidemiological situation of filariasis in the capital district of Kerala with an insight into the vector density and the knowledge of the common man towards filariasis and its elimination.
Details on Page S192

ABSTRACT

Objective: To determine the prevalence of any of the clinical manifestations of lymphatic filariasis, parasitological and entomological indices in Thiruvananthapuram district, Kerala, India, prior to launching mass drug administration (MDA) in the district in 2005.
Methods: A cross sectional survey was conducted in 7 endemic wards of the district, in a sample of 2472 individuals above the age of one year. The study consisted of data collection using questionnaire, night blood smear examination and mosquito collection followed by identification and dissection.
Results: The prevalence of any of the clinical manifestations of filariasis in this endemic area was 3% (73/2472) (95% *CI* between 2.3% to 3.7%). The microfilaria rate was found to be 0.38%. *Culex quinquefasciatus* formed the predominant mosquito species. The vector infection rate was 1.4% and infectivity rate was 0.47%. Half of the population had satisfactory knowledge regarding the disease. In almost an equal number, the knowledge was poor and only about 10% had good knowledge. Most of the people had not heard about the MDA program.
Conclusions: The prevalence of filariasis even in an area considered to be endemic in Kerala, was low. Microfilaraemia was much lower than the clinical manifestations. However, the potential risk of transmission of disease continues. For such areas which had a pre-MDA mf rate less than 1%, there needs to be more stringent criteria for evaluating the effectiveness of the programme, doing transmission assessment surveys and stopping MDA.

KEYWORDS

Mass drug administration, Lymphatic filariasis, Microfilaria rate, Prevalence, India, Kerala, Thiruvananthapuram

1. Introduction

World over there are 83 countries endemic for filariasis. Approximately 120 million individuals are already affected and 1.2 billion are at risk of infection[1]. India alone contributes to 40% of the global filariasis burden and harboures 50% of the global population at risk[2]. *Wucheraria bancrofti* is endemic in 17 states and 6 union territories, *Brugia malayi* is limited to some areas in Kerala and in 7 other states. A total of 257 districts in India are endemic for the disease[3]. India has a total of 31.26 million micro filaraemics; 7.44 million have lymphoedema and 12.88 million suffer from hydrocele. It is estimated that a total of 40.65 million episodes of adeno lymphangitis occur in a

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year[4]. The total disability adjusted life years lost in India due to this disease are around 2.06 million, resulting in an annual wage loss of USD 811 million[5].

In Kerala, about 6 million people are exposed to the risk of filariasis. The entire coastal area is endemic for the disease and there are certain inland pockets of filariasis in Kerala. In Kerala filariasis is endemic in 11 out of the 14 districts[6,7].

Filariasis is targeted for elimination globally as a public health problem by 2020 and half the time line is over[8]. This program for elimination of lymphatic filariasis (PELF) is based on a dual approach consisting of interruption of transmission to prevent the disease by mass drug administration (MDA) and alleviation of the disability in those who already have the disease[9]. Worldwide filariasis elimination efforts are in progress. Lymphatic filariasis has already been eliminated in countries like Japan, Taiwan, South Korea and Solomon Islands and markedly reduced filarial infection in China[3]. India also started elimination efforts in 1997. In Kerala MDA was launched in 1997 in 2 districts. Later on when there were discussions on the launch of MDA in all the eleven endemic districts in 2004, there were controversies both among the lay public and medical communities on the need of the programme. The most important step to develop a global elimination program is to define accurately where the infection exists and to what extent. This poses an operational challenge to the public health persons. In Thiruvananthapuram district, a few endemic pockets have been identified by the National Filaria Control Programme (NFCP) unit based on the reporting of cases and their periodic surveys. One such endemic pocket was selected to study the epidemiology of the disease and to contribute to a better understanding on the need of MDA in the district. This knowledge would also benchmark the extent of the problem before launch of MDA in the district, so as to evaluate the effectiveness of the programme. The study attempted to determine the prevalence of any of the clinical manifestations of filariasis and the parasitological indices in the study area. The entomological indices were also estimated to understand the dynamics of transmission. We also tried to assess the knowledge, attitude and beliefs regarding filariasis and mass drug administration in the study population.

2. Materials and methods

2.1. Study design and setting

A cross sectional survey was conducted in 7 endemic wards of Thiruvananthapuram corporation area (Figure 1).

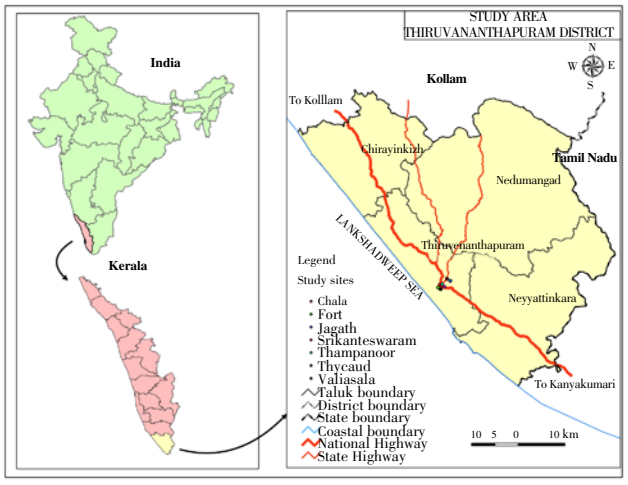


Figure 1. Study area map.

2.2. Study population

2.2.1. Inclusion criteria

All persons above the age of one year, residing in this area for the past 6 months and willing to participate. For assessing the knowledge, attitude and beliefs regarding the disease and MDA, one adult member from each house was selected.

2.2.2. Exclusion criteria

For assessing the knowledge, attitude and beliefs regarding the disease and MDA, if the respondent happened to be a case or a medical professional, they were excluded.

2.3. Sample size and sampling technique

According to the recommendation of NFCP for a routine survey, 5% of the population has to be covered. The total population of this area is 47 752. Hence a sample size of 2 400 was decided upon. About 48 clusters with 50 in each of the clusters were selected. Two stage cluster sampling using the probability proportionate to size sampling technique (PPS) was followed. The first stage was the wards. The second stage consisted of households belonging to one residents association. The number of clusters to be taken from each ward was decided by PPS. From each residents association, number of houses were selected consecutively after identification of the first house using the method employed in universal immunization programme coverage evaluation, till the desired number was achieved.

2.4. Data collection

2.4.1. Tools

A pre-tested semi-structured questionnaire and clinical examination were conducted to find the prevalence of clinical manifestations. The important study variables are

defined as follows:

2.4.1.1. Adeno lymphangitis/Acute dermato lymphangio adenitis (ADL/ADLA)

ADL/ADLA is characterised by a plaque like area of relatively diffuse (sub)cutaneous inflammation with or without lymphangitis and/or satellite adenitis with associated entry lesion, distal oedema and severe systemic manifestations like fever, chills.

2.4.1.2. Acute filarial lymphangitis

Acute filarial lymphangitis is characterised by a circumscribed isolate nodule or cord like lesion of the legs arms or breast with inflammation confined to lymphatic vessel and/or lymph node with associated descending lymphangitis. Satellite adenopathy, entry lesion and distal oedema are rare. Systemic manifestations are none or mild[10].

2.4.1.3. Filarial lymphoedema

Operational definition of filarial lymphoedema: Unilateral or bilateral but asymmetrical swelling of the limb, which is of long duration and associated thickening of the skin, along with history of repeated episodes of fever and pain in the affected part[10].

2.4.1.4. Hydrocoele

Hydrocoele in an area endemic for bancroftian filariasis is considered to be due to filariasis unless proved otherwise. Operational definition of filarial hydrocoele: A soft cystic transluminent swelling of the scrotum which we can get above, but not reducible and with no impulse on coughing.

2.4.1.5. The formula used in this study

Microfilaria (mf) rate, mean mf density, disease rate, vector density, vector infection rate and vector infectivity rate are calculated in the following formulas:

$$\text{mf rate (percent)} = \frac{\text{Total no of persons found to harbour mf}}{\text{Total no of persons examined for mf}} \times 100$$

$$\text{Mean mf density} = \frac{\text{Total no of mf}}{\text{Total no of persons positive for mf}}$$

$$\text{Disease rate (D.R) (\%)} = \frac{\text{No of persons showing signs and symptoms of filarial disease manifestation}}{\text{No of persons examined for filarial disease}} \times 100$$

$$\text{Vector Density (V.D) per 10 MHC} = \frac{\text{No of quinquefasciatus collected}}{\text{Time (in hours) spent on mosquito collection}} \times 10$$

$$\text{Vector infection rate (\%)} = \frac{\text{No of female vector mosquito found to contain developing and developed stages of parasite (Stage I, II, III)}}{\text{No of dissected female vector mosquito}} \times 100$$

$$\text{Vector infectivity rate (\%)} = \frac{\text{No of female vector mosquito found to contain developed stages of parasite (Stage III alone)}}{\text{No of dissected female vector mosquito}} \times 100$$

2.4.2. Techniques

During the day time house to house visit was done to find those with clinical manifestations of the disease, using a pre-tested, semi-structured questionnaire and the suspected cases were clinically examined. First 25 from each cluster, who were willing to participate, excluding infants were blood filmed the same night. Approximately 20 mm^3 (3 drops) of blood was collected on a glass slide and spread into an oblong thick smear (3×2 cm). The smears were dried, numbered and stained with JSB I stain. Smear examination was done later. Mosquito collection was done from 3 houses by random selection, spending 15 min each in indoor and outdoor catching station. The time of collection was between 6.00 am and 8.00 am. Mosquito collection was done by aspirator tube and torchlight method. Aspirator tube, 30-45 cm long with internal diameter, 8-12 mm and made up of glass or plastic tubing was used. After immobilization, the wings and the legs were removed, put on to the slide, dissected and examined.

2.5. Ethical considerations

Permission from the local authorities and institutional heads were obtained. Informed written consent was taken from the participants. In case of children, <18 years, the consent of either parent was taken.

2.6. Statistical analysis

The point estimates are described in percentages and the parameter estimates obtained from the 95 % *CI*. Associations have been tested using *Chi*-square test.

3. Results

3.1. General description of study population

The study was conducted in a sample population of 2472 people in the study area (Figure 1). About 19% of the population belonged to the fourth decade of life, which formed the largest group. The sex ratio was 1041 which is comparable with that of Kerala and Thiruvananthapuram[11].

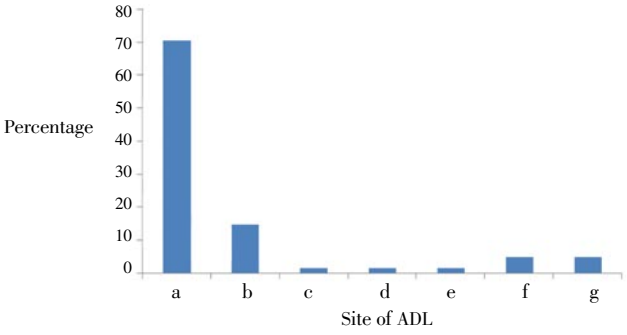
The prevalence of any of the clinical manifestations of filariasis in this endemic area was 3% (73/2472) (95% *CI* between 2.3% to 3.7%). There were a total of 61 people (2.5%) with history of ADL, 13 (0.6%) with hydrocoele and 44 (1.8%) with lymphoedema (Table 1).

Table 1
Clinical manifestations of lymphatic filariasis in the study area.

Disease status	Frequency	Percent	Fleiss quadratic 95% *CI*
ADL	16	0.6%	0.30-1.30
ADL and hydrocele	4	0.2%	0.02-0.70
ADL and Lymphoedema	41	1.7%	1.00-2.60
Hydrocele	9	0.4%	0.10-0.90
Lymphoedema	3	0.1%	0.01-0.60
No disease	2399	97.0%	95.90-97.90
Total	2472	100.0%	

3.2. Adenolymphangitis

ADL was the most common manifestation and 83.5% of filariasis cases gave a history of ADL. Out of the 61 with ADL, 16 (26.2%) had ADL alone, 4 (6.55%) had ADL and hydrocoele and majority had ADL and lymphoedema (67.2%). Five (0.18%) had ADL episodes at the time of study. Two (0.08%) of them were newly diagnosed cases. About 25% developed ADL before the age of 25 years, 50% developed it before 37 years and for 75% before 44 years. The lowest age of onset was 7 years. The periodicity of ADL episodes ranged from less than one episode per year (31%) to greater than five per year (20.7%). About 28 (48.2%) had one to 4 episodes per year. Nearly half of them (44.8%) had only one or less episodes per year. There were 16 people in this study with history of episodes of adenolymphangitis but no lymphoedema. The sites were ADL was found is shown in Figure 2.

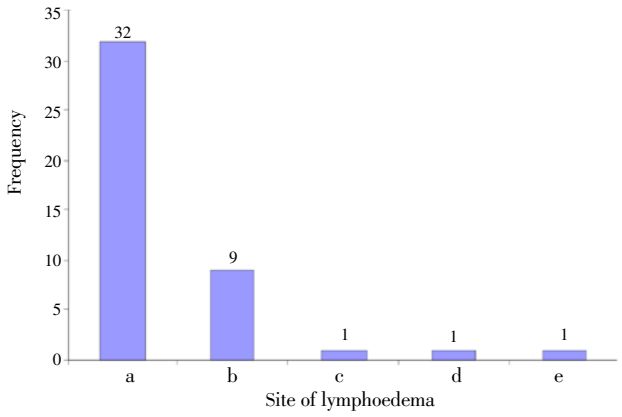


a:Right/Left Lower limb b: Both lower limbs
c: Both lower limbs and right upper limb
d: Right upper limb e: Axillary f: Inguinal
g: Inguinal and scrotum

Figure 2. Site of ADL.

3.3. Lymphoedema

First and second grades were more prevalent amongst those with lymphoedema with respective counts of 36.4% (16/44) and 29.5% (13/44). Grade 3 was seen in 15.9% (7/44) and grade 4 in 18.2% (8/44). Lower limbs were the most commonly affected (see Figure 3). The youngest person with lymphoedema was 29 years old and the eldest was 95.



a: Right/Left lower limb b: Both lower limbs c: Both lower limbs and breast
d: Both lower limbs and right upper limb e: Right upper limb

Figure 3. Site of lymphoedema.

3.4. Factors associated with clinical disease

When the disease rate was considered, it was seen that as age increases, the disease rate also increases (Figure 4). Age was found to be significantly associated with disease (Table 2). Similar to the scenario in total population, females were more in the diseased population also, but this difference was not statistically significant. Education, occupation and income were significantly associated with clinical manifestations (Tables 2 and 3). Hence it can be concluded that there is an association between socio economic status and the occurrence of disease.

Table 2

Association of clinical manifestations with age, sex and education.

Variable	Categories	Clinical features of filariasis		
		Absent	Present	
Age group	<10	301 (12.5)	0 (0.0)	
	11-20	420 (17.5)	1 (1.4)	
	21-30	432 (18.0)	7 (9.6)	
	31-40	463 (19.3)	7 (9.6)	*Chi*-square-87.34
	41-50	338 (14.1)	20 (27.4)	*df*-8
	51-60	229 (9.5)	14 (19.2)	*P* value<0.001
	61-70	147 (6.1)	16 (21.9)	
	71-80	55 (2.3)	5 (6.8)	
	Above 80	14 (0.6)	3 (4.1)	
Sex	Female	1219 (50.8)	42 (57.5)	*Chi*-square- 1.02
	Male	1180 (49.2)	31 (42.5)	*df*-1, *P* value-0.311
	Illiterate	72 (3.0)	8 (11.0)	
	Primary	748 (31.2)	33 (45.2)	
	High school	788 (32.8)	23 (31.5)	*Chi*-square-28.19
Education	HS* and diploma	258 (10.8)	3 (4.1)	*df*-6, *P* value<0.001
	Degree	301 (12.5)	4 (5.5)	
	PG** and professional	130 (5.4)	2 (2.7)	
	Under 5	102 (4.3)	0 (0.0)	

*HS-highersecondary, **PG-postgraduate.

Table 3

Association of clinical manifestations with occupation and income.

Variable	Categories	No Filariasis	Filariasis	
Occupation	Business\Shop\Others	68 (2.8)	4 (5.6)	
	Clerical	113 (4.7)	2 (1.7)	
	Officer\Teacher	71 (3.0)	2 (2.7)	
	Under 5	102 (4.3)	0 (0.0)	*Chi*-square-31.39
	Professional	49 (2.0)	1 (1.4)	*df*-9
	Retired from service	73 (3.0)	3 (4.1)	*P* value<0.001
	Skilled\Semiskilled worker	104 (4.3)	4 (5.5)	
	Student	572 (23.8)	1 (1.4)	
	Unemployed	844 (35.2)	34 (46.6)	
	Unskilled worker	403 (16.8)	22 (30.1)	
Income	Upto 3000	329 (13.7)	20 (27.4)	*Chi*-squared-12.739
	3001-6000	832 (34.7)	26 (35.6)	*df*-4
	6001-9000	927 (38.6)	21 (28.8)	*P* value-0.013
	9001-12000	290 (12.1)	6 (8.2)	
	Above 12000	21 (0.9)	0 (0.0)	

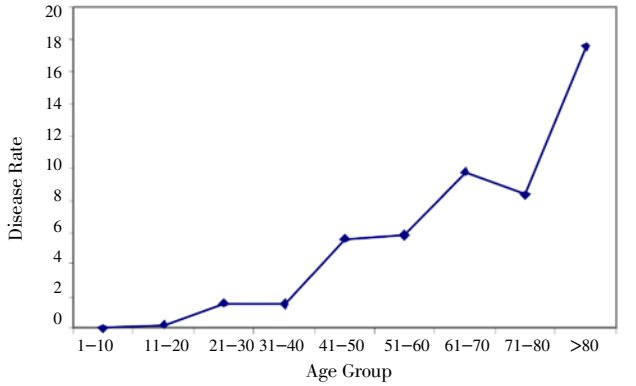


Figure 4. Trend of disease rate with age.

3.5. Parasitological and entomological indices

About 1 300 blood smears were examined, out of which only 5 were positive. The mf rate in the area is found to be 0.38%. The mean mf density was 5.4 per 20 mm^3 of blood. A total 346 mosquitoes were collected from the study area. This consisted of 222 from indoor and 122 from outdoor. These mosquitoes belonged to 4 genera and 6 species (Table 4). *Culex quinquefasciatus* (*C. quinquefasciatus*) formed the predominant species constituting 94.14% of the total indoor collection and 55.64% of the outdoor collection. The indoor density of *C. quinquefasciatus* in the study area was 398/10MHC. The outdoor density of *C. quinquefasciatus* was 131/10MHC. The indoor and outdoor vector density of all mosquitoes together was 423 and 236/10MHC respectively. A total of 215 mosquitoes were dissected, out of which, 3 mosquitoes contained developing stages of the larvae. The vector infection rate was 1.4% and infectivity rate was 0.47%.

Table 4
Mosquitoes identified from the study area.

Ward	Species	Indoor PMHD*	Outdoor PMHD	Total PMHD
Fort	*C. quinquefasciatus*	12.0	1.3	6.7
	Aedes aegypti	2.7	5.3	4.0
	Aedes albopictus	0.0	2.7	1.3
Chala	*C. quinquefasciatus*	41.3	6.7	24.0
	Aedes albopictus	1.3	9.3	5.3
	Armigerus	0.0	8.0	4.0
	Mansonia annulifera	0.0	1.3	0.7
Srikanteswaram	*C. quinquefasciatus*	64.0	22.7	43.3
	Armigerus	0.0	2.7	1.3
Valiasala	*Culex gelidus*	0.0	5.3	2.7
	Armigerus	2.7	4.0	3.3
	Aedes albopictus	0.0	1.3	0.7
Thycaud	*C. quinquefasciatus*	24.0	0.0	12.0
	Aedes albopictus	2.7	0.0	1.3
	Armigerus	1.3	9.3	5.3
Jagathy	*C. quinquefasciatus*	52.0	1.3	26.7
	Aedes albopictus	0.0	2.7	1.3
	Armigerus	6.7	21.3	14.0
Thampanoor	*C. quinquefasciatus*	58.7	50.7	54.7

*PMHD-Per man hour density.

3.6. Knowledge, attitude and beliefs

Half of the population had satisfactory knowledge regarding the disease. Only about 10% had good knowledge. 58.9% of the respondents attributed filariasis to mosquito bite, 2.5% even knew that the disease is caused by a worm. 19.4% thought that the disease is not infective. Out of the 243, 50.2% said that filariasis is transmitted by mosquitoes. Most of the respondents (73.7%) did not know whether there is any relation between filariasis and hydrocoele. Most of the people had not heard about the MDA program. Of the 108 who heard about MDA, nearly half (41.7%) read about it in a newspaper and 30.6% heard of it through visual media. 73.1% thought that the program is required and a still lesser number 67.6% agreed to participate.

Some of the beliefs regarding filariais reveal man's excellent reasoning ability. Many attributed the illness to having bathed in the temple pond. Some believe that walking in dirty water, unhygienic practices *etc*. are the cause of disease, and all of them have an association with mosquito breeding. There was also a belief that if you happened to stamp on the sands of Cherthala, where pine apple grows, due to the extreme heat, you are likely to get the disease. A few attributed the disease to causes like indigestion and climatic change. Some had a strong belief that the disease is hereditary and runs in families. There is also the belief that elephantiasis brings fortune and the affected one is likely to get money. There was also another belief related to money according to which, landlords, who do not give their labourers adequate wages will get elephantiasis. Adenolymphangitis is well known among the people as "vaathappani" and lymph node enlargement is often referred to as "pathakkalam". Many believed that filariasis is not an infectious disease, as stated by one "filariasis and leprosy does not spread".

4. Discussion

In a study by Jain *et al.* in a semi-urban community of Kerala, the disease prevalence was 3.6 percent[12]. The reported mf positive cases to the state for the year 2012 (upto September) is 414 (mf prevalence=0.001) and the prevalence of the disease manifestation is still lesser. This means that the disease prevalence is decreasing over the years. Contrary to this, there are studies which show an increasing prevalence in the state over the years as well[13]. The most common manifestation of filariasis in our study was ADL. There is a consensus that hydrocele is the most common manifestation of bancroftian filariasis[14,15]. The study however shows only 0.6% of the population have hydrocoele. This may be due to the fact that many find it difficult to disclose. The lowest age of onset of 7 years obtained in this study is comparable to other studies done in Kerala[12]. The annual incidence of ADL in a 10 years long study in Tanzania was 3.3%[16]. This was 8.5% in another Indian study[17]. The fact that in our study only 0.08% was found to have first episode of ADL can be explained by the cross-sectional nature of the study. The periodicity of ADL episodes obtained in the study is higher than that in other studies. In a study by Ramiah *et al.*, more than half (63.5%) of the affected individuals suffered only one episode, a few experienced as many as 8 over the one-year period. In another study from India, the average number of episodes of ADL per year was 1.57 (1.15 SD) per affected person, and it was found to be gender dependent. Duration of the episode varied from 1 to 11 d with mean duration of 3.93 (1.94 SD) d[17].

Studies in India have not found any seasonal pattern in the occurrence of the ADL episodes[18]. Acute attacks have been known to recur at irregular intervals from once a month to less than once a year and may continue to do so, often until

the end of life. Literature indicates that, as obtained in this study, in some endemic countries, there are individuals who do not develop obvious chronic disease but may have had a history of long standing recurrent acute attacks[1,19,20]. The most commonly affected sites of lymphoedema are legs, scrotum, arms, penis, vulva and breast in that order of frequency[21]. The usual sites affected by lymphoedema obtained in this study also were lower limb, followed by inguinal/scrotal.

Age was found to be significantly associated with disease in our study. In a study by Jain *et al.* in a semi-urban community of Kerala in 1983, clinical disease showed a significant association with age[13]. Clinical manifestations and microfilarial prevalence are seen to be increasing with age in other studies as well[15,22]. In a study by Pani *et al.*, the prevalence of chronic signs was clearly age-dependent in both sexes, while that of acute signs was independent of age. The clinical manifestations are more in male due to the high prevalence of hydrocoele. Microfilaraemia is also higher in males[23,24]. Among those aged 9 to 16 years, the analysis of gender and filariasis by age showed that boys from 15 to 16 years old had a higher risk of infection than girls[25]. Although in our study, sex was not significantly associated with clinical manifestations of filariasis, it shows a significant association with sex in many other studies. As obtained in this study, the occurrence of filariasis is associated with socio-economic status. In a study by Jain *et al.* in a semi-urban community of Kerala, a significant relationship of educational status and family size was observed with disease. With the increase in per capita income of the individuals, a significant decrease in number of persons with disease was noted. The knowledge of the disease and MDA was poor in our study. This shows that the campaigns for MDA have not been of the required intensity even in an endemic area. The mode of transmission of the disease was known in a good number of respondents. Contrary to this finding, another study from the same state shows specific knowledge on the transmission is lacking as many believed that the disease is inherited[26].

The mf rate obtained in the study agrees with the data from filariasis bureau, in Thiruvananthapuram district which was 0.24% (including urban and rural areas), during the same period. According to the National Vector Borne Disease Control Programme, the mf rate in the state is also decreasing. Mf rate in the state was 0.68 in 2004 and it has come down to 0.14 in 2011. The mf rate in this survey is low when compared to the prevalence of clinical manifestations, which may be due to the practice in the local hospitals to give DEC to the least suspected cases also. Kumar had postulated that mf rate has a good positive correlation with disease rate[26]. However the present study and many others[27-29] do not support this hypothesis. The mf rate reflects current status of parasite circulating in the community and may not be directly related to disease rate, which reflects a cumulative outcome of past infection. The mean mf rate obtained in the study is lesser than previous studies in the state and similar states in India[12,30]. Almost all the outdoor and about half of the indoor collections were *C. quinquifasciatus*. The indoor density of *C. quinquifasciatus* obtained in the study area is more than 3 times the vector density of Kerala (106 per 10MHC). This may be because the study was conducted in the month of September, when peak vector density is reported by others[12]. As per the NFCP guidelines, this area has a high vector density favouring mosquito transmission. This vector density is higher compared to that obtained in other parts of India[31]. The vector infection and infectivity rate indicates that the potential for transmission continues to exist. Earlier studies in Kerala showed that the vector was prevalent throughout the period of observation with highest density in September. Vector infection and infectivity rates ranged from 0 to 4.4 percent and 0 to 2.2 percent respectively[12]. This indicates that the disease transmission is reducing. Since this study gives an independent assessment of the pre-MDA situation in an area other than an implementation unit, it can be used to assess the effectiveness of MDA. The study site is a hotspot for lymphatic filariasis and therefore the epidemiological pattern obtained represents the worst case scenario in the district.

According the revised WHO guidelines[32], the criteria for conducting a transmission assessment survey (TAS) include a microfilaraemia prevalence of <1% and a coverage of MDA above 65%. Microfilaraemia prevalence of less than 1% may be indicative of interruption of transmission, but it may not reflect the effectiveness of MDA, in areas where the pre-MDA mf prevalence was less than 1%. In such areas the criteria of coverage of MDA may also be difficult to achieve, because people do not perceive it as a felt need[33]. This can become a major constraint to the implementers of the programme to implement TAS and consequently MDA should continue until the criterion on compliance is met[34]. Therefore there is a need to develop differential criteria for stopping MDA based on the varied epidemiological situations in areas where MDA has been implemented.

The prevalence of filariasis in Kerala, even in an area considered to be endemic is low. Microfilaraemia is much lower than the clinical manifestations. However the potential risk of transmission of disease continues, as evidenced from the high vector density and presence of infected and infective mosquitoes. MDA was rightly implemented in the state and the district. The knowledge of the disease and MDA in the community is low. Therefore health education, especially through the media needs to be strengthened. It is time for an evaluation of the outcome of the programme, since it was launched in Kerala and Thiruvananthapuram in 1997 and 2005 respectively. This study can be replicated in the same area for this purpose. For an area which had a pre-MDA microfilaraemia less than 1%, there needs to be more stringent criteria for evaluating the effectiveness of the programme. Control efforts including MDA, vector control

and health education needs to be continued with the best possible rigour, until we have clear evidence that the disease has been made a history. Generating this evidence through transmission assessment surveys is currently not possible, because of the constraints in the guidelines and therefore it needs to be reconsidered, based on the differential epidemiological situations in areas where MDA has been implemented.

Conflict of interest statement

We declare that we have no conflict of interest.

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Comments

Background

India being one among the filaria endemic countries, contributes to 40% of the global filariasis burden. A total of 257 districts in India are endemic for the disease. As far as the state of Kerala is concerned, the entire coastal area is endemic for the disease and there are certain inland pockets of filariasis with 11 out of the 14 districts being endemic. There is a need to better understand the necessity of MDA in the district of Thiruvananthapuram. This study would delineate the extent of the problem and later on help in assessment of MDA in the district.

Research frontiers

Filariasis is targeted for elimination globally as a public health problem by 2020 and more than half the time line is over. Elimation efforts are on in many countries. The key to developing a global elimination program is to define accurately where the infection exists and to what extent. In this context, this study would help the administrators decide on the need of MDA programme in the district of Thiruvananthapuram.

Related reports

The findings of this study are in concordance with the state level filariasis statistics. It confirms the decreasing trend of mf rate in Kerala state as reported in the NVBDCP report. The indoor density of *C. quinquefasciatus* obtained in the study area is more than 3 times the vector density of Kerala. This may be because the study was conducted in September, when peak vector density has been reported by other studies.

Innovations & breakthroughs

Studies to assess the filariasis burden is lacking in Kerala. Besides, the MDA programme does not seem to have a good uptake by the public in Kerala, hence the need to assess the epidemiological situation and redefine the criteria for continuation of MDA in the state. Misconceptions regarding the disease and the MDA programme also need to identified.

Applications

The low prevalence of filariasis in Thiruvananthapuram district is an eye-opener for the health authorities to look at stringent criteria to assess the effectiveness of the MDA programme. At the same time, the potential risk of transmission of disease continues, as evidenced from the high vector density and presence of infected and infective mosquitoes. Lack of awareness regarding MDA programme, reluctance of the public to participate in it, the misconceptions about filariasis and MDA, harboured by the common man all need to be addressed for the successful leap towards elimination.

Peer review

This is a good study in which the authors have succeeded in obtaining a snapshot of the epidemiological situation of filariasis in the capital district of Kerala with an insight into the vector density and the knowledge of the common man towards filariasis and its elimination.

References

[1] Ottesen EA, Hooper PJ, Bradley M, Biswas G. The global programme to eliminate lymphatic filariasis: health impact after 8 years. *PLoS Negl Trop Dis* 2008; doi: 10.1371/journal.pntd.0000317.

[2] Vasuki V, Hoti SL, Patra KP. RT-PCR assay for the detection of infective (L3) larvae of lymphatic filarial parasite, *Wuchereria bancrofti*, in vector mosquito *Culex quinquefasciatus*. *J Vector Borne Dis* 2008; **45**: 207-216.

[3] Sabesan S, Palaniyandi M, Das PK, Michael E. Mapping of lymphatic filariasis in India. *Ann Trop Med Parasitol* 2000; **94**(6): 591-606.

[4] World Health Organization. The global programme to eliminate lymphatic filariasis. Geneva: WHO; 2012. [Online] Available from: http://www.who.int/lymphatic_filariasis/disease/en/. [Accessed on June 21st 2013]

[5] Ramaiah KD, Das PK, Michael E, Guyatt H. The economic burden of lymphatic filariasis in India. *Parasitol Today* 2000; **16**: 251-253.

[6] Regu K, Ali MKS, Rajendran R, Koya SM, Ganesh B, Dhariwal AC, et al. Mass drug administration against lymphatic filariasis: experiences from Kozhikode district of Kerala State. *J Commun Dis* 2006; **38**(4): 333-338.

[7] Raju K, Jambulingam P, Sabesan S, Vanamail P. Lymphatic filariasis in India: epidemiology and control measures. *J Postgrad Med* 2010; **56**(3): 232-238.

[8] Addiss D; Global Alliance to Eliminate Lymphatic Filariasis. The 6th Meeting of the Global Alliance to Eliminate Lymphatic Filariasis: A half-time review of lymphatic filariasis elimination and its integration with the control of other neglected tropical diseases. *Parasit Vectors* 2010; **3**: 100.

[9] Dreyer G, Medeiros Z, Netto MJ, Leal NC, de Castro LG, Piessens WF. Acute attacks in the extremities of persons living in an endemic area for bancroftian filariasis: differentiation of two syndromes. *Trans R Soc Trop Med Hyg* 1999; **93**(94): 413-417

[10] Shenoy RK. Clinical and pathological aspects of filarial lymphedema and its management. *Korean J Parasitol* 2008; **46**(3): 119-125.

[11] Chandramouli C. *Provisional population totals paper 1 of 2011 India*. New Delhi, India: Office of the Registrar General & Census Commissioner; 2011.

[12] Jain DC, Menon PK, Sethumadhavan KV, Johney VM, Ghosh TK. Epidemiology of bancroftian filariasis in a semi-urban community of Kerala State. *J Commun Dis* 1989; **21**(4): 265-271.

[13] Krishna S. Morbidity trends in lymphatic filariasis: analysis from a tertiary care center in Kerala, Southern India. *Glob J Med Public Health* 2012; **1**(2): 3-5.,

[14] Noroes J, Addiss D, Cedenho A, Figueredo-Silva J, Lima G, Dreyer G. Pathogenesis of filarial hydrocele: risk associated with intrascrotal nodules caused by death of adult *Wuchereria bancrofti*. *Trans R Soc Trop Med Hyg* 2003; **97**(5): 561-566.

[15] Massaga JJ, Salum FM, Savael ZX. Clinical and parasitological aspects of *Bancroftian filariasis* in Hale, northeast Tanzania. *Cent Afr J Med* 2000; **46**(9): 237-241.

[16] Gasarasi DB, Premji ZG, Mujinja PG, Mpembeni R. Acute adenolymphangitis due to bancroftian filariasis in Rufiji district, south east Tanzania. *Acta Trop* 2000; **75**(1): 19-28.

[17] Babu BV, Nayak AN, Dhal K. Epidemiology of episodic adenolymphangitis: a longitudinal prospective surveillance among a rural community endemic for bancroftian filariasis in coastal Orissa, India. *BMC Public Health* 2005; **5**: 50.

[18] Ramaiah KD, Ramu K, Kumar KN, Guyatt H. Epidemiology of acute filarial episodes caused by *Wuchereria bancrofti* infection in two rural villages in Tamil Nadu, south India. *Trans R Soc Trop Med Hyg* 1996; **90**: 639-643.

[19] Gyapong JO, Gyapong M, Adjei S. The epidemiology of acute adenolymphangitis due to lymphatic filariasis in northern Ghana. *Am J Trop Med Hyg* 1996; **54**: 591-595.

[20] Indian Council of Medical Research. Prospects of eliminating lymphatic filariasis in India. *ICMR Bulletin* 2002; **32**: 1-14.

[21] Park K. *Park's textbook of preventive and social medicine*. 21st ed. Jabalpur, India: Banarsidas Bhanot Publishers; 2011.

[22] Okon OE, Iboh CI, Opara KN. *Bancroftian filariasis* among the Mbembe people of Cross River state, Nigeria. *J Vector Borne Dis* 2010; **47**: 91-96.

[23] World Health Organization. Lymphatic filariasis. Clinical manifestations. Geneva: WHO; 2012. [Online] Available from: http://www.who.int/lymphatic_filariasis/epidemiology/epidemiology_manifestations/en/. [Accessed on June 26th 2013]

[24] Ojurongbe O, Akinbo JA, Ogiogwa IJ, Bolaji OS, Adeyeba OA. Lymphatic filariasis in a rural community in Nigeria: a challenge ahead. *Afr J Med Med Sci* 2010; **39**: 179-183.

[25] Braga C, Dourado I, Ximenes R, Miranda J, Alexander N. *Bancroftian filariasis* in an endemic area of Brazil: differences between genders during puberty. *Rev Soc Bras Med Trop* 2005; **38**(3): 224-228.

[26] Suma TK, Shenoy RK, Kumaraswami V. A qualitative study of the perceptions, practices and socio-pyschological suffering related to chronic brugian filariasis in Kerala, southern India. *Ann Trop Med Parasitol* 2003; **97**: 839-845.

[27] Singh S, Bora D, Dhariwal AC, Singh R, Lal S. Lymphatic filariasis in rural areas of Patna District, Bihar. A challenge ahead. *J Commun Dis* 2006; **38**(2): 160-163.

[28] Dissanayake S. In *Wuchereria bancrofti* filariasis, asymptomatic microfilaraemia does not progress to amicrofilaraemic lymphatic disease. *Int J Epidemiol* 2001; **30**(2): 394-399.

[29] Singh S, Bora D, Sharma RC, Datta KK. *Bancroftian filariasis* in Bagdogra town, district Darjeeling (West Bengal). *J Commun Dis* 2002; **34**(2): 110-117.

[30] Dixit V, Baghel P, Gupta AK, Bisen PS, Prasad GB. Impact of season on filarial vector density and infection in Raipur City of Chhattisgarh, India. *J Vector Borne Dis* 2009; **46**: 212-218.

[31] Kaliwal MB, Kumar A, Shanbhag AB, Dash AP, Javali SB. Spatio-temporal variations in adult density, abdominal status & indoor resting pattern of *Culex quinquefasciatus* Say in Panaji, Goa, India. *Indian J Med Res* 2010; **131**: 711-719.

[32] World Health Organization. *Monitoring and epidemiological assessment of mass drug administration in the global programme to eliminate lymphatic filariasis: a manual for national elimination programmes*. Geneva: WHO; 2011, p. 1-79.

[33] Nujum ZT. Coverage and compliance to mass drug administration for lymphatic filariasis elimination in a district of Kerala, India. *Int Health* 2011; **3**: 22-26.

[34] Swaminathan S, Perumal V, Adinarayanan S, Kaliannagounder K, Rengachari R, Purushothaman J. Epidemiological assessment of eight rounds of mass drug administration for lymphatic filariasis in India: implications for monitoring and evaluation. *PLoS Negl Trop Dis* 2012; doi: 10.1371/journal.pntd.0001926.