Research article

Literature review and a preliminary study on leishmaniasis to inform community awareness campaigns in Sri Lanka

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Abstract

Background: Accurate knowledge about transmission and potential risk factors of leishmaniasis among residents in endemic areas is imperative. This paper presents a review of the existing literature on leishmaniasis risk factors in Sri Lanka and a preliminary study of the disease related awareness, attitudes and practices in an endemic area.

Methods: Publications on epidemiology of leishmaniasis in Sri Lanka were reviewed. Data were collected using an interviewer administered questionnaire from 120 inhabitants in Dickwella Divisional Secretariat in the District of Matara by a multistage cluster sampling method.

Results: Around 20 publications were reviewed, and potential risk factors identified. In the field survey, 21.7% (n=26/120) were aware of the name "leishmaniasis". Disease vector was identified by 68.1% (n=64/94) through the shown picture and description. Acne form was known as a type of early leishmanial skin lesion by 81.1% (n=73/90). Potential risk factors such as cracks of house walls (55.8%, n=67/120), damp areas in houses (60.0%, n=72/120), animal burrows (45%, n=54/120) and livestock pens (12.5%, n=15/120) were abundant in this area. Western medical treatment was preferred by 78.9% (n=71/90) as the treatment option. Around 58.9% (n=53/90) of respondents felt that disease prevention is a combined responsibility of community and the government.

Conclusions: Even though, potential environmental risk factors were abundant, this study found poor awareness regarding the salient aspects of leishmaniasis among the participants. They possessed positive attitudes towards curability of the disease, obtaining proper treatment and disease control.

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Introduction

Leishmaniasis is a neglected tropical disease caused by a sandfly-borne protozoan parasite of the genus *Leishmania.* This infection presents in three major clinical forms: cutaneous leishmaniasis (CL), the commonest form resulting in skin lesions, muco-cutaneous leishmaniasis (MCL) which affects mucosal tissues and visceral leishmaniasis (VL), the most serious form which invades internal organs.[1] As per the global estimates from the World Health Organization (WHO), there are 700,000 to 1,000,000 new cases of leishmaniasis and 26,000 to 65,000 deaths due to leishmaniasis occurring annually.[1]

The increase in the incidence of leishmaniasis is mainly attributed to domestic factors, peri-domestic factors, environmental conditions and human behavior. Many studies have found that characteristics of the domicile such as houses with cracked, mud or thatched plastered house walls, as well as dirt or damp earthen floors can enhance vector abundance.[2] Rearing animals like cattle, dogs, goats, pigs, hens and presence of rodents were identified as risk factors which enhance aggregation of sandflies.[3] Practices such as dumping animal dung near houses and sleeping outside the house near animal shelters, under trees and in farm fields at night were also associated with acquiring leishmaniasis.[3] Leishmaniasis tends to affect the poorest people and marginalized societies. Migration into villages can also increase cases of leishmaniasis.[4] In addition, natural disasters like earthquakes can create breeding places for sand flies.[5] Other environmental factors including elevation, forest coverage, proximity to woodland, new agricultural projects and irrigation lead to increase in the sand fly population.[6]

Sri Lanka is a recently established focus of leishmaniasis caused by a genetically modified variant of *Leishmania donovani*.[7] The main clinical form remains as CL in this focus.[8,9] Sri Lanka has two main foci for transmission of leishmaniasis in the north and south.[9] In 2008, leishmaniasis was made a notifiable disease in Sri Lanka.[10] Establishment of more dangerous forms (VL, MCL)[11], the presence of locally acquired mucosal leishmaniasis[12] and a humoral response associated with CL[13] have been reported recently. Furthermore, an array of problems are presented with the standard treatment, sodium stibogluconate.[14] The potential vector *Phlebotomus argentipes* is widely prevalent in the country.[15] Due to these potential threats, implementation of prevention and control strategies are vital. Understanding attitudes, practices and the nature of existing risk factors related to the disease in the affected community would be useful in formulating such programmes.

The aim of this preliminary study was to review the existing literature on risk factors for leishmaniasis in Sri Lanka, to study their prevalence and assess disease related community awareness, attitudes and practices**.**

Materials and Methods

Review of existing literature

Data bases including PUBMED and Google Scholar were searched with keywords "leishmaniasis", "risk factors", together with "Sri Lanka". Risk factors and other relevant information found during the literature survey were considered in favour of either outdoor or peri-domestic transmission in the relevant study areas.

Field Survey

Study setting: Sri Lanka consists of 25 districts. Each district has several Divisional Secretariat (DS) divisions which consist of smaller subunits called Grama Niladhari divisions (GNDs). Dickwella DS in the Matara district of southern Sri Lanka is "a notable hotspot for CL" as it has shown a concentration of CL cases.[16] This descriptive cross sectional study was conducted in the Dickwella DS division which consists of 48 GNDs.

Sampling method: The **s**tudy population consisted of inhabitants within 16 to 60 years of age and living in the Dickwella DS division for at least one year. This was to include those who have acquired infection from the same locality. A random three stage cluster sampling method was used to recruit 120 of households. In the first stage, four GNDs were randomly selected, following which one road was randomly selected from each chosen GND. At the third stage, 30 households were recruited from both sides of each selected road starting from the junction of the main road and the selected road. Only one occupant was interviewed from each house to overcome the effect of clustering and family association.

Data collection tool: An interviewer administered pretested questionnaire was used for data collection. Interviews were conducted in the preferred language of the participant (either Sinhala or Tamil). The questionnaire consisted of questions to collect information on demographic characteristics, knowledge of clinical manifestations and treatment options, attitudes and existing practices on prevention and treatment of CL and the presence of identified risk factors in the environment.

Data analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS) software, version 22. Associations were tested using Chi-Square test. The selected significant level was 5%.

Results

Review of existing literature on leishmaniasis risk factors in Sri Lanka

Risk factors associated with cutaneous leishmaniasis in Sri Lanka have been studied on a few occasions. Earlier publications speculated the presence of a local transmission cycle.[17] Both outdoor and peri-domestic transmission were subsequently described as reasons for the increase in newly identified cases.[8] The first formal study from northern Sri Lanka on leishmaniasis, indicated outdoor occupational behaviour, close proximity to jungles, lack of awareness and

inadequate use of preventive measures as associated risk factors.[18] The second study, also conducted in northern Sri Lanka identified male gender, spending a mean of >5 hours/day in outdoor work, and an age range of between 20 and 40 years as the most important risk factors.[8]

A study conducted using 938 subjects in the Hambantota district indicated possible peri-domestic transmission.[8] This study found an association of a twofold higher risk of acquiring leishmaniasis between the ages of 11and 40 years, five or more members in a household and the presence of cracks and crevices in the walls of the house. Household's ownership of animals, the presence of animal shelters in the home compound, the frequency of visits to animal sheds and the type of roof were not found to have any significant effect on the risk of CL.[8] Another study with a sample size of 2260 done in the Matara district[16] showed a higher number of affected females (60.5%, $p< 0.05$) than males. They identified un-plastered brick walled houses ($p<0.05$) and excessive time (>4 hours/day) spent outdoors ($P<0.05$) as significant factors for CL. Occupation, common water source as the mode of water supply and presence of animal shelters in their gardens within 200 m were not associated with the risk of acquiring the disease in this study.[16]

In a cross sectional study done with 834 participants in Thalawa MOH, Anuradhapura district [19], distance to paddy fields from the residencies of CL patients was significant ($p=0.01$) whereas distances to forest, marsh, scrub jungles, and water bodies were not. Contradictory findings were presented in another study conducted using 57 patients attending the Anuradhapura Teaching Hospital[20], in which existence of scrub jungles around the residence or occupational places ($p=0.003$), presence of sandflies ($p=0.021$) and working outside for more than 6 hours per day ($p=0.001$) were significant. Rearing animals, CL lesions in family members or neighbors and living in rural or urban areas were not reported as significant risk factors in this study.[20] A seasonal trend of leishmaniasis was found in a study which evaluated the data available from 2009 to 2016 and a peak was shown in the period between July to September in the north-central region and in October to December in the southern region.[21]

Field survey

The response rate was 100% (n=120). The majority of the sample consisted of females 69.2% (n =83), of whom 58.3% were housewives (n=70/83). All participants were between 35 to 60 years (mean age 45.42years). The mean monthly income was LKR 33,900.94. Most of the participants were educated up to GCE Ordinary Level (OL) or more (85%, n=102). The mean duration of residence in the Dickwella area was 32.98 years.

Knowledge on CL: Leishmaniasis was known to 90 (75%) participants who knew it either as leishmaniasis (n=26/120, 21.7%) or after seeing the picture of the vector and the description given by the interviewers (n=64/94, 68.1 %). Knowledge of CL was thereafter assessed only from the 90 participants who had knowledge of the disease. Acne or pimple was mentioned as a symptom of CL by 81.1% (n=73/90). Possibility of ulceration was known by 56.7% (n= 51/90) and 12.2% (n=11/90) knew that the lesions are slow healing while 8.9% (n=8/90) knew that they enlarge in size. Knowledge regarding the mode of transmission of the disease was inquired only from participants who knew the disease by its name (n=26/120), of whom 23 knew the disease was communicable, 12 knew that it was transmitted via sandflies and 7 identified the sand fly in the

shown images as “fruit fly”. The frequency distribution of knowledge on breeding sites, resting places and biting times of the sand flies is given in Table 1.

Only 42.2% (n=38/90) had some awareness of currently available and accepted treatment options. Cryotherapy treatment was known by 27 (71.1%) and intra-lesional drug administration by 17 (44.7%). Sources of the knowledge about the disease included other villagers (66.7%), healthcare workers (4.44%), family members (15.56%), relatives (3.33%) and no specific source (10%).

Attitudes of participants: The majority of participants (78.9%, n=71/90) considered leishmaniasis to be an important disease that affected their daily routine. Many participants (64.4% n=58/90) identified it as a disease on which a large expenditure needs to be incurred for treatment. Belief that the disease is completely curable was held by 72.2%. If a family member was infected, western medical treatment was the option of most participants (78.9%), with home care using traditional methods by 6.7% and no treatment option would be sought by 14.5%. Motivating fact is that, 58.9% thought both the community and health authorities should be held responsible in the prevention and control of leishmaniasis.

Practices of participants: The most adopted protective measure was ordinary bed nets (88.3%, n=106/120), while 47.5% (n=57/120) wore adequately covered clothes, 33.3% (n=40/120) used insecticide repellants and 40% (48/120) used mosquito coils.

Potential risk factors: The frequency distribution of potential risk factors is given in Table 2. Statistically significant association was found (p=0.006) between the monthly income and the number of preventive measures used. Associations between education level and the prevalent household risk factors (p=0.552), preventive measures and gender (p=0.29) and prevalent household risk factors and monthly income (p = 0.720) were not statistically significant.

Discussion

Since the detection of the first autochthonous case of CL in 1992, the incidence of CL has been continuing to rise along with several cases of VL and one case of MCL. This emphasizes the necessity of public awareness and control programmes on leishmaniasis. The current study was aimed to review potential risk factors and investigating their presence and to assess awareness, attitudes and practices related to leishmaniasis of permanent residents of the Dickwella DS division in Matara. The study sample consisted mostly of middle aged women (69.2%), the majority of whom were housewives. In contrast, a previous study[8] identified male gender as a risk factor. Generally, most outdoor environmental workers such as farmers and soldiers are males, and this was thought to be a reason for male preponderance in acquiring leishmaniasis. However, it is possible that in the current study, occupational categories and gender could have been influenced by the timing of data collection as it was done during the working day. It was noted in the present study that the majority of participants had an educational level of GCE OLs or above which is a favourable sign for awareness activities.

Table 1: Knowledge of vector behaviour

Characteristic** $	Number agreed	%
*__Breeding sites / Resting places__		
Cracks / crevices in:		
• **Moist ground**	37	41.1
• **Walls of houses**	15	16.7
• **Tree hollows**	3	3.3
• **Rocks**	3	3.3
• **Un-plastered brick walls**	10	11.1
Vegetation	34	37.8
Dampened areas in house	20	22.2
Livestock pens	10	11.1
Decaying organic matter (leaf litter, cow dung etc.)	10	11.1
Sand	8	8.8
Loose soil	6	6.7
Fruits	4	4.4
Animal burrows	3	3.3
Don't know	25	27.8
__**Biting times**__		
Morning (6am – 12noon)	7	7.8
Afternoon (12 noon to 3pm)	14	15.6
Evening (3pm – 6pm)	10	11.1
Night (6pm onwards)	3	3.3
Morning and Evening	20	22.2
Anytime	6	6.7
Don't know	30	33.3

$-Total respondents (n=90) were considered for percentages of each category in each question.
**** Multiple answers were accepted in both parts.**
*** Percentages didn't add up to 100% as participants gave more than one response for breeding sites.**

Table 2: Presence of potential risk factors for cutaneous leishmaniasis in the study area

Characteristic *$	Numbe	%
1. __Household risk factors__		
Rearing Animals		
Dogs	23	19.2
Cattle	3	2.5
Household clustering (Family members/No. of bedrooms)		
<2	106	88.3
= or >2	14	11.7
2. __Breeding/resting places present (inside or within10 m distance__		
Cracks / Crevices of:		
House walls	67	55.8
Moist ground	59	49.2
Rocks	14	11.7
Tree hollows	12	10.0
Others:		
Damp areas in houses	72	60.0
Un-plastered brick walls	55	45.8
Animal burrows	54	45.0
Loose soil	47	39.2
Livestock pens	15	12.5
3. __Risky behaviors of human host__		
Time spent outdoors (hours)		
<5	102	85.0
= or >5	18	15.0
Period of the day spent outdoors		
Morning (Before 12noon)	87	72.5
Evening (After 12 noon)	19	15.8
Both	14	11.7
Number of preventive methods used		
0	4	3.3
= or <3	63	52.5
>3	53	44.2
Sleeping outside/ on the ground		
Sleep outside	8	6.7
Sleep on the ground	14	11.7

* Multiple answers accepted.
$ Total respondents (n=120) was considered for percentages each category in each question

Inadequate knowledge in most aspects of leishmaniasis was identified in the current study. From the entire sample, only 21.7% knew the disease by its name 'leishmaniasis'. Nearly one fourth (n=30/120) were not aware of the vector borne nature of this disease, despite being inhabitants of a region endemic for leishmaniasis. The current findings are similar to that of the study conducted by Surendran *et al* in Delft Island in northern Sri Lanka[15] where none of the respondents were aware of a disease named 'leishmaniasis'. Of the 90 participants who knew about the disease, the majority (81.1%) identified the acne form of lesions as a symptom of CL, 42.2% were aware of the availability of treatment options in government hospitals and 30% knew that leishmaniasis is preventable. A study in Anuradhapura also showed that, nearly half the community did not know of the availability of treatment for leishmaniasis.[19]

Knowledge of initial symptoms is valuable in early case detection as a high parasite load at the early stage gives a higher probability of detecting parasites in contrast to patients with chronic lesions who have a lower parasite load. Early diagnosis will thereby reduce the delay in seeking treatment. The attitudes of the participants towards treatment seeking was generally positive. Early treatment minimizes the long course of illness, reduces the risk of recurrence, visceralization and transmission.

Fellow villagers were the source of information for 66.6% of participants who knew about leishmaniasis. This indicates that leishmaniasis has been a topic of discussion among the villagers providing a receptive background for awareness programmes. Interestingly, inputs received from primary healthcare workers was found to be quite low. Most participants (58.9%) felt that the community needs to play a role in preventing and controlling leishmaniasis in addition to health authorities. This also indicates that people will be receptive towards awareness campaigns. With regard to practices, a considerable proportion of participants used protective methods such as mosquito nets, repellants and use of proper clothing. Provision of impregnated nets will be a worthwhile disease controlling step in endemic areas.

Multiple potential sandfly breeding and resting conditions were found in the peridomestic environments of the study site. Information gathered from the literature review also was in favour of peridomestic transmission in the study area. Isolation of sandflies from different environmental conditions, identification of their behaviours and large scale case control studies are required to confirm this.

This is the first study on the awareness, attitudes and presence of environmental factors in leishmaniasis among the general public conducted in southern Sri Lanka. Some gaps and needs with regard to community perceptions, behaviour and existence of potential risk factors were identified. Limitations in available time and resources of this undergraduate study hindered collection of data from a larger sample. Study findings may not be fully generalized due to presence of micro differences in population perceptions, behaviour and environmental factors in the context of other affected areas within the island. Information found on awareness, practices and attitudes on cutaneous leishmaniasis in this community can be combined with findings of regional and country wide risk factor studies to formulate community awareness campaigns in more meaningful manner.

Conclusion

The majority of the study population had inadequate knowledge on most aspects of cutaneous leishmaniasis, despite living in an endemic area. Participants were shown to have practices that are likely to increase the chances of disease acquisition. The majority had a positive attitude towards seeking proper treatment and adopting vector control strategies. These findings highlight the importance of conducting awareness campaigns for endemic communities.

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Conflicts of interest: None

Ethical Considerations: Ethical approval for the study was obtained from the Ethics Review Committee (ERC) of the Faculty of Medicine, University of Colombo. Informed consent was taken from all participants prior to the study.

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