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**Research Article**

# ANALYSIS OF POSSIBLE LIFE STYLE FACTORS RELEVANT TO CUTANEOUS LEISHMANIASIS INFECTIONS USING A PROFILE OF CUTANEOUS LEISHMANIASIS PATIENTS IN HAMBANTOTA DISTRICT, SRI LANKA

**Sudarshani, K.A.M[1]*., Eswaramohan, T[2]., Murugananthan, A[3] and Wegiriya, H.C.E[1]**

[1]Department of Zoology, Faculty of Science, University of Ruhuna, Matara
[2]Department of Zoology, Faculty of Science, University of Jaffna, Jaffna
[3]Department of Parasitology, Faculty of Medicine, University of Jaffna, Jaffna

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**A B S T R A C T**

The first Cutaneous Leishmaniasis (CL) patient in Sri Lanka was recorded from Hambantota district in 1992 and now Hambantota is considered as a CL endemic district with large number of CL patients. By interviewing CL positive patients (n= 185) attended to the Dermatology clinic in Tangalle Hospital, Hambantota district from June 2016 to January 2017, present study was aimed to identify possible life-style factors which exposed them to leishmaniasis infections. Information was collected using a structured questionnaire and analyzed using SPSS version 16.0. Majority of patients had protective measures namely, sleeping indoor (98.66%), on beds (85.9%) using non impregnated bed nets (75.50%), closing windows (92.1%) and covering windows with protective wire mesh or screens (99.35%) during the night. However during the day time all CL positive patients (100%) had outdoor occupational activities. Among them 27.6% dealt with soil, 21.1% used shrub jungles to collect firewood, 10.8% reared animals and 13.42% had decaying organic matter in the vicinity. Further 80% of CL patients had animals in their domestic (5.96%) and peri-domestic (44.37%) areas and 26.83% houses had rats. Present findings indicate day time activities, presence of animals and organic matters in peri-domestic area could be considered as possible factors for CL infections in Hambantota district.



## INTRODUCTION

Leishmaniasis which is caused by a protozoan haemoflagellate named *Leishmania* spp. is one of the neglected diseases especially in Asian countries. Leishmaniasis is endemic in 98 countries and globally 1.5 million new cases are reported per year (Alvar *et al*, 2012). It is transmitted by a sand fly, *Phlebotomus argentipes* (Diptera: Psychodidae). Leishmaniasis has mainly three clinical forms which are important to humans named, cutaneous leishmaniasis (CL), muco-cutaneous leishmaniasis (MCU) and visceral leishmaniasis (VL). The fatal one is the VL. First case of Leishmaniasis in Sri Lanka, an autochthonous CL patient was recorded in 1992 from Hambantota district (Atukorale *et al*, 1992). Localized CL cases are prevalent in Sri Lanka and the causative organism is *Leishmania donovani* which causes VL in Indian subcontinent. Before 2004, a few CL cases were reported from southern part of the country. In 2014 and 2016 the numbers of CL patients had increased in southern province and Hambantota district is recognized as a CL endemic area of the country (Rajapakse *et al*, 2007; Sudarshani *et al*, 2017).

**Corresponding author:* **Sudarshani, K.A.M**
Department of Zoology, Faculty of Science, University of Ruhuna, Matara

Control methods to decrease sand fly abundance and biting rates in domestic and peri-domestic transmission of parasites may reduce CL outbreak in the region. Some reports have indicated that CL in Afghanistan is associated with sex (Rethinger *et al*, 2003), age and domestic animals (Brooker *et al,* 2004). Yet, information on household risk factors associated with the disease is little in Asian region. Yadon *et al* (2003) indicated that working or helping in agricultural lands or water collection may be increased risk of CL. However, the disease transmission cycle in southern province is not fully investigated. Therefore, it is needed to identify not only the vector and reservoir hosts but the risk factors which are associated with the transmission of the disease in this area. Therefore, the present study was designed to identify the possible lifestyle factors which could be responsible for CL transmission in Hambantota district using CL patients' profile. The findings of the current study can be used to design effective methods for controlling the disease in Hambantota district, Sri Lanka.

## MATERIALS AND METHODS

### *Study area*

Southern province of Sri Lanka is consisted of three districts such as Galle, Matara and Hambantota which has 662,619 individuals and 96% of them are living in rural areas. The land

area of Hambantota district is 2,609km². Its' annual average temperature is $30^0$ C and annual average rainfall is 1000-1250mm. For the administrative purposes Hambantota district has been divided in to 12 District Secretary Divisions (Fig. 01) (District Secretary Division-Hambantota, 2016).

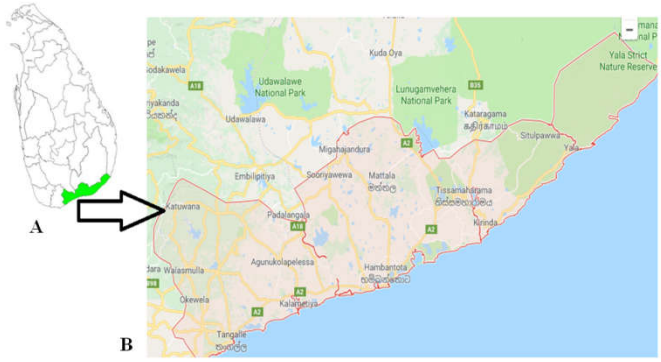


**Figure 1** Location of Hambantota district in Sri Lanka. **A**: Sri Lanka and shading area is Hambantota district. **B:** Hambantota District (The map was adopted from google maps).

### *Patients' Profile*

Current study was conducted during the period from June, 2016 to January, 2017. The patients with suspected CL lesions were attended to the Dermatology clinic in Tangalle Base Hospital. Diagnosis of CL was carried out by examining slit-skin smears of lesions. With the written consent from each patient, slit- skin smears were taken from the most indurated margin of the lesion under aseptic conditions on the day of enrolled to the Tangalle Base hospital during this study period. Prepared lesion smears were air dried, stained with Giemsa and examined under a light microscope using an oil immersion to detect *Leishmania* amastigotes at the Department of Zoology, University of Ruhuna, Sri Lanka. Patients who were positive for *Leishmania* amastigotes were selected for the study.

### *Collection of information*

After clinical examination, each positive patient was interviewed using a structured questionnaire.

**Table 1** Indoor and outdoor activities of CL patients' profile in Hambantota district during the study period

| Activity | Percentage (%) | Chi value | df | P value |
|---|---|---|---|---|
| 1. Outdoor sleeping | | | | |
| Yes | 1.34 | | | |
| No | 98.66 | 141.107 | 1 | 0.000 |
| 2. Sleep on | | | | |
| Floor | 10.01 | | | |
| On elevation (bed) | 85.90 | | | |
| Both | 4.09 | 297.094 | 3 | 0.000 |
| 3. Sleep under | | | | |
| Impregnated bed nets | 0.66 | | | |
| Non impregnated bed nets | 75.50 | | | |
| No bed nets used | 23.84 | 132.967 | 2 | 0.000 |
| 4. Windows have protective wire mesh/screen | | | | |
| Yes | 99.35 | | | |
| No | 0.65 | 149.026 | 1 | 0.000 |
| 5.Windows kept | | | | |
| Opened | 4.58 | | | |
| Closed | 92.1 | | | |
| Opened/Closed | 3.27 | 238.275 | 2 | 0.000 |
| 6.Insecticide spraying | | | | |
| Inside the house | | | | |
| Yes | 10.37 | | | |
| No | 89.63 | 84.807 | 1 | 0.000 |
| Outside and vicinity | | | | |
| Yes | 1.48 | | | |
| No | 98.52 | 127.119 | 1 | 0.000 |
| 7. Presence of organic matter near house | | | | |
| Yes | 13.42 | | | |
| No | 86.58 | 79.738 | 1 | 0.000 |
| 8.Storage of food inside the house | | | | |
| Yes | 20.13 | | | |
| No | 79.87 | 53.161 | 1 | 0.000 |
| 9. Animal rearing in | | | | |
| Domestic areas | 5.96 | | | |
| Peri-domestic areas | 44.37 | | | |
| Both areas | 29.80 | | | |
| No | 19.87 | 47.543 | 3 | 0.000 |
| 10. Presence of Rats at night (No. of houses recorded) | 26.83 (44) | - | - | - |

df: degree of freedom

Information on indoor and outdoor activities related to sleeping such as sleeping under mosquito nets, sleeping on floor, sleeping in outdoors, sleeping with the window open, combating insects (indoor and outdoor), animal rearing and outdoor occupational and leisure activities were recorded from each patient.

### *Ethical approval*

Ethical approval for this study was obtained from the Ethical Review Committee of the Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka.

### *Statistical analysis*

Data was entered into an Excel worksheet and SPSS version 16.0 statistical software was used for statistical analysis and significant differences were tested with a chi-square test at 0.05 level.

## RESULTS

Totally 312 CL suspected patients were attended to the Dermatology clinic in Tangalle Base Hospital. Among them slit-skin smears of 185 patients had *Lesihmania* amastigotes (Fig. 2). Information reported from CL positive patients on possible factors relevant to the CL infection was used for the analysis and displayed in table 1.

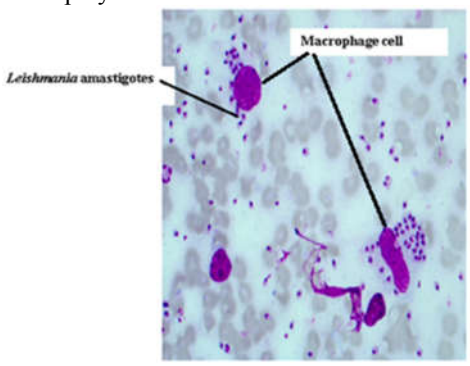


**Figure 2** *Leishmania* amastigotes are seen inside & outside of macrophage cells of CL lesion smears stained with Giemsa (10X 100X1).

Most of the CL patients in this study profile were sleeping indoor (98.66%), on beds (85.9%) using non impregnated bed nets (75.50%). There were protective wire mesh or screens in windows of 99.35% of CL patients' houses and majority (92.1%) had a habit of closing windows during the night.

A few CL patients in this study profile (10.37%) burned mosquito coils indoor as a mosquito repellent and only 1% of patient sprayed insecticide outside/ vicinity of their houses. Figure 3 displays that the outdoor activities that CL patients in this study profile were done during the daytime.

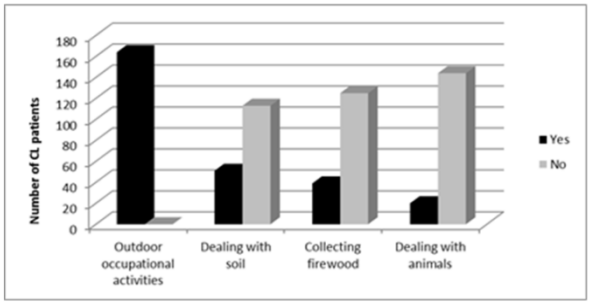


**Figure 3** Different outdoor activities done by CL patients' profile in Hambantota district during this study period.

Outdoor activities were occupational activities, activities dealing with soil, collecting firewood from forests and shrub jungles and rearing animals. According to the present findings, during the day time, all CL positive patients (100%) had outdoor occupational activities. Among them 27.6% dealt with soil, 21.1% used shrub jungles to collect firewood, 10.8% reared animals. Further, findings of this study showed that 13.42% CL patients kept organic matter such as chicken manure, dried leaves, coconut husks and cow dung in their peri-domestic area. In addition 20.13% of CL patients stored paddy in their houses from six to eighteen months. Not only that but eighty percent of CL patients had animals such as dogs (n=134), cats (n=82), Chickens and pigeons (n=52), and cattle (n=19) which were living in their domestic (5.96%) or peri-domestic (44.37%) areas (Fig. 4). In this study profile, 26.83% CL patients reported the presence of rats inside their houses at night.

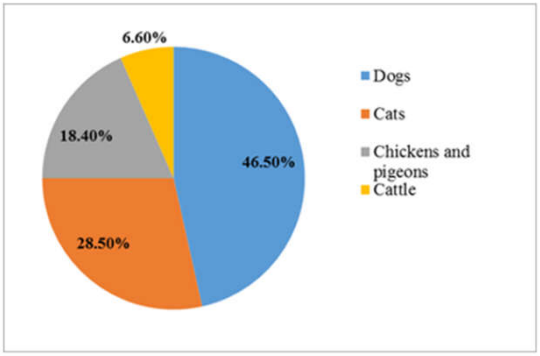


**Figure 4** Percentage values of animals lived indoor or outdoor of CL patients in Hambantota district during the study period.

## DISCUSSION

Previous studies (Siriwardana et al, 2010; Sudarshani et al, 2017) and present study both indicated that the localized transmission of parasite causes the cutaneous leishmaniasis in Hambantota district Sri Lanka. *Phlebotomus argentipes* is considered as the potential vector for CL in Sri Lanka. Presence of potential vector in domestic and/or peri-domestic areas of residencies in Hambantota district is needed for acquiring *Leishmania* infection. The transmission of *Leishmania* may be sylvatic/zoonotic cycle via reservoir hosts or anthroponotic cycle via humans. In addition, life style factors of people are also important for the acquiring *Leishmania* infection. According to the WHO recommendations, insecticide-treated bed nets are one of the most effective methods of reducing indoor vector-human contact (WHO, 1970). Majority of CL patients in this study profile closed windows at night, slept indoor on beds but with non-impregnated bed nets. Some patients, nearly 11% used mosquito repellents to protect from mosquitoes and sand flies at night. That means majority of CL patients in this study profile use generally self-protective measures indoor to protect especially from mosquito biting during nights.Only a few number of patients used insecticides spraying in outdoor vicinity in their houses. According to the findings of Coura-Vital *et al.* (2013) and Votypka *et al.* (2012) lack of insecticide spraying inside and vicinity of houses and non- usage of bed nets impregnated with insecticide can place people at risk of sand fly exposure**.**

All CL patients in the current study profile had many outdoor activities in day time which were relevant to their occupations.

According to the occupation they were categorized as laborers, farmers, fishermen, skill-workers and self-employed persons and government servants, and also as students and house-wives (Sudarshani *et al*, 2017). In 2010 Siriwardhana *et al*. reported that outdoor occupation is a risk factor for CL in the northern area of Sri Lanka. In addition some patients in the current study profile had other outdoor activities namely, working with soil, collecting firewood from their own lands or entering to shrub jungles or forests in their vicinity and handling their pet animals or farmed animals etc. during the day time. According to Weigle *et al.* (1993) agricultural activities and forest contact, especially clearing the forests increase the risk of *Leishmania* infections. Nilforoushzadeh *et al*. (2014) also pointed out that jobs involved with soils, animals and farms increase the CL cases more than controls. Outdoor occupational activities and other activities such as dealing with soil, wandering in jungle areas to collect firewood and animal rearing may increase the human–vector contact at vector biting hours.

Hambantota is an agricultural area and 96% of people live in rural areas (District Secretary Division-Hambantota, 2016). There were some CL patients who kept organic substances such as dried leaves, cow dung, coconut husks and chicken manure as organic fertilizers in their peri-domestic areas. Meanwhile, some CL patients in this area stored paddy inside their houses from 6 to 18 months. Researchers indicated that places with organic substances such as cow dung or dry leaves which are considered as food sources for the larvae of sand flies, provide ideal conditions for the oviposition and breeding sites of sand flies (Pont, 1994).

Rodents, dogs, cats, bats and other domestic animals are among the reservoir hosts which maintain zoonotic transmission of leishmaniasis in different localities. Barnett *et al.* (2005) reported that cattle in close to houses are a risk factor for leishmaniasis. Nawaratna *et al.*(2009) also proposed that CL is a zoonotic disease in Sri Lanka. More patients in this profile also had animals such as dogs, cats, cattle and chickens in indoor or in their peri-domestic areas which are reared as pets or to get milk and eggs or for agricultural purposes. A study done in Brazil reported that the presence of dogs, cattle and rodents are considered as the most important risk factor for the transmission of CL parasites as they increase the density of sand flies around houses (Belo *et al*, 2013). Researchers (Lane *et al*, 1990; Palit *et al*., 2005) indicated that *P. argentpes*, is mainly zoophilic and it prefers to fed on man as the second choice. Even though chicken houses do not act as breeding sites, they attract blood seeking females as well as males seeking mates (Alexander *et al,* 2002).

## CONCLUSIONS AND RECOMMENDATIONS

Peri-domestic environment of majority of CL patients may act as preferable feeding, resting and breeding places for vector sand fly species due to the availability of organic substances and reservoir hosts in the area. Hence, *Leishmania* infections in Hambantota district may rise due to outdoor activities of CL patients at day time as it increases human vector contact. Identification of vector sand fly species and its breeding and resting places and reservoirs of the CL infection in Hambantota district are important aspects. Cross sectional studies are needed to identify the risk factors of CL in the study area and to set up an effective control program in Hambantota district.

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