HOSTED BY

ELSEVIER

Contents lists available at ScienceDirect

Journal of Acute Disease

journal homepage: www.jadweb.org

Original article http://dx.doi.org/10.1016/j.joad.2015.06.007

# Prevalence and epidemiologic profile of acute cutaneous leishmaniasis in an endemic focus, Southwestern Iran

Mohammad-Hossein Feiz-Haddad[1], Hamid Kassiri[2*], Niusha Kasiri[1], Assiae Panahandeh[2], Masoud Lotfi[2]

[1]*Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*

[2]*Faculty of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*

ARTICLE INFO

*Article history:*
Received 17 Feb 2015
Received in revised form 30 May 2015
Accepted 5 Jun 2015
Available online 29 Jul 2015

*Keywords:*
Epidemiology
Prevalence
Cutaneous leishmaniasis
Iran

ABSTRACT

**Objective:** To evaluate the cutaneous leishmaniasis prevalence in Shadegan County, Iran, during 2007–2009.

**Methods:** This is a descriptive research which concentrates on the 100 patients who we referred to the Shadegan Health Center. The disease was diagnosed based on clinical exam and microscopic observation of the parasites in the lesion site. The patients' data were recorded. The statistics have examined the various epidemiological aspects of the disease by considering descriptive indices such as gender, age, occupation, month and seasonal distribution, number and site of the lesions. Information analysis was performed using SPSS software.

**Results:** Overall, 100 cases consisting of 32 females (32%) and 68 males (68%) were examined for the presence of active ulcers. Most of the infection was in age group 11–20 years (31%) and the lowest in 31–40 years group (7%). Most of the active ulcers were on the feet (42%). The majority (47%) had one lesion. Most of the cases (42%) had occurred during 2007. All cases were observed in the rural areas.

**Conclusions:** This study showed that the male sex and people under 20 years of age are mostly at risk. Therefore, education for groups at risk is very important.

## 1. Introduction

Cutaneous leishmaniasis (CL), a zoonotic disease, is still a public health problem in many parts of the world, especially in tropical and sub-tropical countries. The CL exists in 88 countries with 1.5 million new cases per year[1,2]. World Health Organization has, in fact, announced leishmaniasis as the sixth most significant disease in tropical and subtropical areas[3]. Almost all the CL cases (90%) occur in only seven countries, *i.e.* Iran, Afghanistan, Algeria, Brazil, Peru, Syria, and Saudi Arabia[4].

Two epidemiological forms of the CL are present in Iran: anthroponotic CL (ACL) and zoonotic CL (ZCL). The ACL is urban type that caused by *Leishmania tropica* and main vector and reservoir of the disease are *Phlebotomus sergenti* and human, accordingly. The ACL can be seen more in Tehran, Shiraz, Kerman, Bam, Mashhad, Sabzevar and Neishabour cities[5–8]. The ZCL is rural type and it is caused by *Leishmania major* (*L. major*). The vector and reservoir are *Phlebotomus papatasi* and rats, correspondingly. The ZCL is mainly seen in the areas of some cities such as, Esfahan, Sarakhs, Lotfabad, Kashmar, Kashan, Khuzestan and Ilam and Golestan Provinces. In recent years, factors such as new settlement, environmental changes, war, uncontrolled urbanization, converting agricultural lands to residential form caused more contacts between humans and vectors of the leishmaniasis resulted in significant increase[9–15]. Approximately, 20000 cases of the disease are annually reported from different parts of Iran. However, it is assumed that the actual amount has been expected to be five times higher[16,17]. The CL caused by

*Corresponding author: Hamid Kassiri, PhD, Department of Medical Entomology and Vector Control, Faculty of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
Tel: +98 6113738269
Fax: +98 6113738282
E-mail: Hamid.kassiri@yahoo.com

Peer review under responsibility of Hainan Medical College.

Foundation Project: Supported by Ahvaz Jundishapur University of Medical Sciences.

*L. major* is still an abundant and increasing public health issue in many rural regions of 15 out of 30 provinces of Iran[18]. The *L. major* is main species of CL in Khuzestan Province[19–21]. Since the epidemiological characteristics of CL in Shadegan County have yet to be scrutinized in recent years, basic information is needed to determine future control measures for organizing a proper program in order to fight against the disease more fruitfully.

## 2. Materials and methods

Shadegan is a county in Khuzestan Province, Southwestern Iran. The county is bordered with Abadan, Khorramshahr, Ahwaz and Mahshahr countties and led to south of the Persian Gulf. The capital of the county is Shadegan with population of 138 226, in 23 813 families at an area of 3 600 $km^2$. Shadegan and Khanafereh are two main districts of the county. The majority of the county's residents are ethnic Arab and speaking Arabic language. Shadegan is located in bordering with Iraq country and located in a low landing area, with geographical coordinates of 30°40′ N, 48°40′ E and positioned in the highest point, 10 m above sea level. The climate is classified as very warm region[22].

A descriptive cross-sectional study was designed to evaluate individuals with CL lesions ($n$ = 100) who referred to the Health Centers in Shadegan County during 2007–2009. The contributors were being examined by general practitioners in the Health Centers. Informed consents were provided and a special questionnaire was completed with specific epidemiologic characteristic agents including gender, age, occupation, lesion site, lesion number and seasonal occurrence.

The most indurate margin lesions were carefully chosen and cleaned from debris with normal saline to provide appropriate smears on the slides. Necrotic and purulent lesions were treated with precise care and debris was removed before sampling. Skin scratching from the lesion was obtained and smears were prepared on a slide, following fixation in methanol for 20–30 s. The samples were then stained with Giemsa for 20–30 min and examined microscopically for presence of amastigotes agents. At least, two Giemsa-stained slides were prepared for each patient for microscopic examination. The *Leishmania* amastigotes were detected under the microscope, the CL was confirmed and the patient's completed questionnaire was evaluated. Finally, the obtained data were analyzed by means of descriptive statistics.

## 3. Results

*Leishmania* amastigotes were identified by microscopic examination in 100 patients during 2007–2009 in Shadegan County. The mean prevalence rate of the disease in the study area was calculated as 0.3 (Table 1). The disease was found to infect both gender and all the age groups (Tables 2 and 3). However, association of CL infection and gender was observed in 68% ($n$ = 68) males and 32% ($n$ = 32) females. Although the maximum rate (31%) of infection was recorded in 11–20 years age group, the lowest rate (7%) was signified by the 31–40 years age group. Overall, more than 50% of samples with *Leishmania* lesions were noted to be for the individuals older than 10 and younger than 30 years old who were the most active group of the population due to their behavior, occupation and education.

Frequency of CL based on the lesion number varied with single lesion that was observed in the majority of patients (47%). In addition, double lesions were seen in 22% of cases, 6% of patients presented with 3 and 25% with 4 or more than 4 lesions (Table 4).

The patients' residential location and occupation are important aspects for defining environment where the infections might have taken place. The utmost common frequencies of infections were noted to be in patients who were living in Khanafereh and Jefal sub-counties with 36% and 30%, respectively. The lowest percentages were described in patients from Bozibe and Hosseini sub-counties with 6% and 7%, followed by Abshar and Darkhovein with 8% and 13%, individually (Table 5). Table 6 shows the distribution of CL among patients based on occupations in Shadegan County, during 2007–2009. As the statistics

**Table 1**
Changes of the cutaneous leishmaniasis cases and prevalence rates in Shadegan County, Khuzestan Province, Southwestern Iran.

| Years | Frequency No. (%) | Prevalence/1 000 |
|---|---|---|
| 2007 | 42 (42.0) | 0.3 |
| 2008 | 20 (20.0) | 0.4 |
| 2009 | 38 (38.0) | 0.2 |
| Total | 10 (100.0) | 0.3 |

**Table 2**
Frequency distribution of cutaneous leishmaniasis according to gender in Shadegan County, Khuzestan Province, Southwestern Iran.

| Years | Female No. (%) | Male No. (%) | Total No. (%) |
|---|---|---|---|
| 2007 | 17 (40.5) | 25 (59.5) | 42 (100) |
| 2008 | 5 (25.0) | 15 (75.0) | 20 (100) |
| 2009 | 10 (26.3) | 28 (73.7) | 38 (100) |
| Total | 32 (32.0) | 68 (68.0) | 100 (100) |

**Table 3**
Frequency distribution of cutaneous leishmaniasis according to age group in Shadegan County, Khuzestan Province, Southwestern Iran.

| Age groups | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| 0–10 years | 13 (30.9) | 6 (30.0) | 9 (23.7) | 28 (28.0) |
| 11–20 years | 15 (35.8) | 7 (35.0) | 9 (23.7) | 31 (31.0) |
| 21–30 years | 9 (21.4) | 4 (20.0) | 12 (31.5) | 25 (25.0) |
| 31–40 years | 0 (0.0) | 1 (5.0) | 6 (15.8) | 7 (7.0) |
| > 40 years | 5 (11.9) | 2 (10.0) | 2 (5.3) | 9 (9.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

**Table 4**
Frequency distribution of cutaneous leishmaniasis cases according to the number of lesions on the body in Shadegan County, Khuzestan Province, Southwestern Iran.

| Lesion frequency | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| 1 | 18 (42.8) | 10 (50.0) | 19 (50.0) | 47 (47.0) |
| 2 | 8 (19.1) | 3 (15.0) | 11 (28.9) | 22 (22.0) |
| 3 | 2 (4.7) | 3 (15.0) | 1 (2.7) | 6 (6.0) |
| 4 | 14 (33.4) | 4 (20.0) | 7 (18.4) | 25 (25.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

**Table 5**
Frequency distribution of cutaneous leishmaniasis cases according to residential location in Shadegan County, Khuzestan Province, Southwestern Iran.

| Residential location | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| Darkhovein | 1 (2.4) | 2 (10.0) | 10 (26.3) | 13 (2.7) |
| Jefal | 17 (40.5) | 7 (35.0) | 6 (15.8) | 30 (30.0) |
| Hosseini | 0 (0.0) | 2 (10.0) | 5 (13.1) | 7 (7.0) |
| Abshar | 1 (2.4) | 0 (0.0) | 7 (18.4) | 8 (8.0) |
| Khanafereh | 20 (47.6) | 7 (35.0) | 9 (23.7) | 36 (36.0) |
| Bozibe | 3 (7.1) | 2 (10.0) | 1 (15.2) | 6 (6.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

show, the students (32%) and housewives (13%) followed by children (22%) among other various occupations pointed to be the highest frequency for CL lesions in Shadegan County.

The lesions were to be positioned in different sites of the patients' body. Feet were the most frequently affected limbs (42%). However, other major limbs for lesion location were hands with 17%. The combination of lesion sites was to be found for feet and hands with 13%. Detailed lesions location was shown in Table 7.

Tables 8 and 9 summarize different months and seasons of the year for distribution of *Leishmania* cases during 2007–2009. The CL patients could be found in all months however, as the table indicates, the most number of cases were increased in December, remained high in the following months, and reached its peak in March (Table 8). The number of patients then began to decline in April, continued to the following months and reached its lowest quantity between August and November. After all, the seasonal distribution of the disease in the Shadegan County reflected that the CL frequency was more prominent in two seasons of winter and spring (Table 9).

**Table 6**
Frequency distribution of cutaneous leishmaniasis cases according to occupation in Shadegan County, Khuzestan Province, Southwestern Iran.

| Occupation | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| Child | 10 (23.8) | 6 (30.0) | 6 (15.8) | 22 (22.0) |
| Student | 18 (42.8) | 8 (40.0) | 7 (18.4) | 32 (32.0) |
| Housewife | 6 (14.3) | 1 (5.0) | 6 (15.8) | 13 (13.0) |
| Farmer | 0 (0.0) | 2 (10.0) | 2 (5.3) | 4 (4.0) |
| Others | 8 (19.1) | 3 (15.0) | 17 (44.7) | 28 (28.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

**Table 7**
Frequency distribution of cutaneous leishmaniasis cases according to lesion site in patients' body in Shadegan County, Khuzestan Province, Southwestern Iran.

| Lesion sites | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| Hands | 8 (19.1) | 4 (20.0) | 5 (13.1) | 17 (17.0) |
| Feet | 16 (38.1) | 6 (30.0) | 20 (52.6) | 42 (42.0) |
| Faces | 1 (2.4) | 4 (20.0) | 1 (2.7) | 7 (7.0) |
| Hands and feet | 6 (14.3) | 2 (10.0) | 5 (13.1) | 13 (13.0) |
| Hands and faces | 2 (4.7) | 0 (0.0) | 3 (7.9) | 4 (4.0) |
| Feet and faces | 0 (0.0) | 2 (10.0) | 1 (2.7) | 3 (3.0) |
| Others | 9 (21.4) | 2 (10.0) | 3 (7.9) | 14 (14.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

**Table 8**
Frequency distribution of cutaneous leishmaniasis cases according to month in Shadegan County, Khuzestan Province, Southwestern Iran.

| Months | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| April | 4 (9.5) | 6 (30.0) | 0 (0.0) | 10 (10.0) |
| May | 5 (11.9) | 4 (20.0) | 1 (2.7) | 10 (10.0) |
| June | 5 (11.9) | 1 (5.0) | 0 (0.0) | 6 (6.0) |
| July | 5 (11.9) | 1 (5.0) | 1 (2.7) | 7 (7.0) |
| August | 1 (2.4) | 1 (5.0) | 0 (0.0) | 2 (2.0) |
| September | 2 (4.6) | 0 (0.0) | 0 (0.0) | 2 (2.0) |
| October | 1 (2.4) | 1 (5.0) | 1 (2.7) | 3 (3.0) |
| November | 2 (4.6) | 0 (0.0) | 1 (2.7) | 3 (3.0) |
| December | 3 (7.1) | 6 (30.0) | 3 (7.8) | 12 (12.0) |
| January | 6 (14.7) | 0 (0.0) | 6 (15.7) | 12 (12.0) |
| February | 3 (7.1) | 0 (0.0) | 12 (31.5) | 15 (15.0) |
| March | 5 (11.9) | 0 (0.0) | 13 (34.2) | 18 (18.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

**Table 9**
Frequency distribution of cutaneous leishmaniasis cases according to season in Shadegan County, Khuzestan Province, Southwestern Iran.

| Seasons | 2007 No. (%) | 2008 No. (%) | 2009 No. (%) | Total No. (%) |
|---|---|---|---|---|
| Spring | 14 (33.3) | 11 (55.0) | 1 (2.6) | 26 (26.0) |
| Summer | 8 (19.1) | 2 (10.0) | 1 (2.6) | 11 (11.0) |
| Autumn | 6 (14.3) | 7 (35.0) | 5 (13.2) | 18 (18.0) |
| Winter | 14 (33.3) | 0 (0.0) | 31 (81.6) | 45 (45.0) |
| Total | 42 (100.0) | 20 (100.0) | 38 (100.0) | 100 (100.0) |

## 4. Discussion

A cross-sectional study was designed to analyze the existing statistics and demographic information to detect epidemiological features of CL in 100 patients admitted to Shadegan County Health Center during 2007–2009. Prevalence rates in the years of 2007, 2008 and 2009 were calculated at 0.3, 0.4 and 0.2, respectively. The average of prevalence rate in the mentioned three years was 0.7 for every thousand population. The highest frequency of the disease documented for 2007 with 42%. The average prevalence rate of CL in Hamadan Province was 2.05 per hundred thousand during 2002 till 2007. These rates were recorded at 0.8, 2.05, 1.76, 3.11, 2.05 and 2.52 per hundred thousand of population during the above five years, respectively[23].

The current study showed that the male (68%) are more in risk than female (32%). In numerous studies from other parts of the Iran, the results confirmed the same. For instance, studies from Hamadan (93.8% male, 6.2% female) and Kashan (61.34% male, 36.8% female) were inconsistent with the obtained results from Shadegan County and approved the rations alike[24,25]. This rate from other parts of the world also follows very similar rhythm, *e.g.*, a study from Pakistan reported 56.6% of the patients with CL to be male[26]. More than double of CL incidence in men against women in the current study, can be defensible by men comprising the majority of seasonal immigrants as work labor in open environments like farms and firms, covering fewer parts of body than women, traveling

more in deserts and harsh environment, and being possibly more expose to sandflies bites during activities period. Improving the individuals' knowledge who have to travel to endemic areas can obviously reduce the interaction rate with sandflies bites[27].

According to current results, frequency of CL was considerably allied with age. The disease was found to infect all the age groups. However, the highest and lowest frequency rates were observed among 11–20 and 31–40 years old individuals, respectively. Additionally, more than 50% of patients were older than 10 and younger than 30 years old who were the most active population group due to their performance, occupation and education. Generally, it can be expected that higher risk of infection take place in patients who live in the vicinity of disease sites and work in endemic areas[28]. Yet, this cannot always be the issue *i.e.* while, a scholar reported 51.1% of cases for the age of 6–15 years old[29], and another study set up the highest prevalence among 16–50 years old individuals[30] or in areas with abundant reservoirs and vectors such as Isfahan where people contacted high rate with infectious resource, and incorporated a great number of natives; 5–6 years old was to be reported as the most infected group[31,32]. Therefore, it can hence be concluded that infection incidence rates in different areas vary depend upon the study place and age groups. It should also bear in mind, whiles the most individuals develop life-time immunity against the disease, the incidence rate gradually decreases in adults and elderly people. In the other words, in other parts of the country while the number of native people is low or the population is frequently altered, the disease can be assigned in all age groups[33]. For that reason, the above explanation can be applied for the current results in which the lowest incidence rates were observed in 31–40 and more than 40 years old groups.

Many different factors such as sandfly species and biting behavior, people social and cultural activities, and climate type could influence the lesions sites in the body limbs. In the present study, most lesions were found to be in the feet (42%) and hands (17%). However, 7% for face was recorded to be as the highest part of the body. It is expected that the body areas which are not covered properly are more exposed to bites of sandflies. Studies conducted in Yazd (55.1%) and Mirjaveh (78%), supported the obtained results from current study for lesions sites on the hands and feet[34,35]. In addition, a study accomplished in Saudi Arabia during a 5-year period represented 34% of the lesions observed in the upper and 42% in lower limbs[36]. Besides, another study from Gorgan County in north of Iran with 70.3% confirms the lesions in the same organs[37]. One of the factors for effective distribution of patients with lesions sites in the body is the covering status. Furthermore, sandflies prefer to feed their blood meal from appropriate selected host sites with specific chemical landmarks and attractions such as concentration of carbon dioxide which apparently was felt by sandflies more from the feet and hands[23]. As per other studies, the current assignment also showed that the hands and feet due to the above reasons are more interested by sandflies for biting rather than other body limbs.

Considering lesions number in the patient's body, single lesion (47%) was more common than both double (22%) and four or more lesions (25%). The obtained findings were consistent with previous study by Talari *et al.* (69.7% one lesion, 22% multiple)[37]. A report by Kassiri *et al.* (54% single, 24.4% several and 21.6% double lesions) appointed also similar results[38]. In contrast, a study from Gorgan County showed that only 26.8% had single lesion and the remaining patients involved with double or more than double lesions[36]. Biting behaviors by the sandflies could explicate the 53% multiple lesions for current study. This result is consistent with the results in Karami's study from Isfahan County in which 54% patients had more than one lesion[39]. Insemination following rubbing or receiving infected bites at different times could be other reasons for numerous lesions. Remarkably, the studies in some patients from Khuzestan Province also confirmed until about 370 lesions were only for a single patient.

With respect to months and seasonal CL distribution, the current study showed that the maximum frequency was observed in March and February with 18 (18%) and 15 (15%) cases, respectively. However, the minimum amounts were documented at 2% in August and September, equally. According to findings, the CL cases had increased in mid-Autumn and this increase continued and reached its maximum until the end of winter cutting little slowly in early Spring. Approaching the warm season, the frequency of the cases had declined and reached its lowest point in August and September. The emerging peaks of cases are probably related to the incubation period of the disease and seasonal activity of the respective phlebotomine sand fly vectors that extend from August and September for this region after which a peak of infections was recorded until next year's February. In a study by Tabibian *et al.* the most cases with CL were reported for autumn (69%)[40]. The study findings from Haji-Abad city also confirmed the above, in which the most cases were noted to be on February and March. However, these figures are different in Iran's central focus where the most cases are recorded in November and December[41].

A combination study on age groups and occupation in the current study showed that 11–20 (31%) years old group and students (32%) were the most common individuals for CL. Children, teenagers and even young adults were more susceptible to disease and this may be due to incomplete body coverage, carelessness and their presence outside the home. In Hamadan Province, the most cases were also accounted to be for active group of 15–49 years and 85.7% patients were categorized as workers. Therefore, frequency distribution of CL based on occupation and age showed that a significant percentage of cases (85.7%) were young adults who were at activity age and have been infected to CL due to migration to endemic areas for seeking jobs. In contrast, the situation was quite different in endemic areas for cutaneous lesions in which the most common cases were noted to be in children under 14 years old[23].

Frequency distribution of people with CL based on their place of residence were appointed in sub-counties of Darkhovein, Jefal, Hosseini, Abshar, Khanafereh and Bozibe at 13%, 30%, 7%, 8%, 36% and 6%, respectively. Khanafereh showed the most common CL frequency at 36% and all the patients have been approved to be from rural areas. Therefore, the reasons for the highest rate could probably be due to inappropriate and thatched homes, lack of sanitation facilities, garbage and manure depot in these areas and living close to the insect larval nests.

One of the strengths of this study was establishment of Reference Laboratory in the region to disease definitive diagnosis and treatment of CL under the Health Center for recovery's attainment. Also, one of the limitations for this study was lack of full records for all positive patients referred to the Reference Laboratory in Health Center which was thought to be due to introduction of the Health Center to private practice physicians though, the amounts not to be significant.

Concluding the obtained results from present study, CL is posed as a health problem in Shadegan County. Although, the number of recorded cases of CL was 100 during 2007–2009, it was thought to be that the actual number could be much higher than this. Therefore, scheduling for the disease control and taking suitable procedures are crucial to decrease the occurrence of the disease in this area. Health education and group training via media, combating against rodents, full protection during the transmission season, environmental improvement plus appropriate garbage and manure dumping and applying insecticide impregnated nets should also be incorporated in preparation for fighting against the disease. The current study was encountered with some limitations including finding passive cases and not referring all the patients to the County Reference Laboratory Health Centers. The study also revealed that gender, age, place of residence, and occupation play major responsibilities in the incidence of the disease. Furthermore, the disease was found to possess a seasonal mode of frequency in the region. Finally, according to the study results and prevalence of the disease in the study area, serious public health monitoring for proper preparation against the disease should be in place.

## Conflict of interest statement

The authors report no conflict of interest.

## Acknowledgments

The paper is issued from a research project with project No. 89S86 and financial support was provided by Ahvaz Jundishapur University of Medical Sciences. We also would like to thank the Shadegan Health Center and Mr. Mehdi Kamandar who helped for doing this investigation.

## References

[1] Kassiri H, Kassiri A, Lotfi M, Farajifard P, Kassiri E. Laboratory diagnosis, clinical manifestations, epidemiological situation and public health importance of cutaneous leishmaniasis in Shushtar County, Southwestern Iran. *J Acute Dis* 2014; **3**: 93-8.

[2] Kassiri H, Sharififard M. A biosystematic and morphometric investigation of the characters of rodents (Mammalia: Rodentia) as reservoir hosts for zoonotic cutaneous leishmaniasis in an endemic focus of Sistan-Baluchistan Province, Iran. *Arch Clin Infect Dis* 2015; **10**(1): 1-7.

[3] Vazirianzadeh B, Saki J, Jahanifard E, Zarean M, Amraee K, Navid Pour SN. Isolation and identification of *Leishmania* species from sandflies and rodents collected from Roffaye District, Khuzestan Province, southwest of Iran. *Jundishapur J Microbiol* 2013; **6**(6): 1-4.

[4] Mahmoodi MR, Mohajery M, Tavakkol Afshari J, Taghae Shakeri M, Yazdan Panah MJ, Berenji F, et al. Molecular identification of *Leishmania* species causing cutaneous leishmaniasis in Mashhad, Iran. *Jundishapur J Microbiol* 2011; **3**(4): 195-200.

[5] Vahabi A, Rassi Y, Oshaghi MA, Vahabi B, Rafizadeh S, Sayyad S. First survey on knowledge, attitude and practice about cutaneous leishmaniasis among dwellers of Musian district, Dehloran County, southwestern of Iran, 2011. *Life Sci J* 2013; **10**(12s): 864-8.

[6] Yavar R, Abedin S, Reza AM, Ali OM, Sina R, Mehdi M, et al. *Phlebotomus papatasi* and *Meriones libycus* as the vector and reservoir host of cutaneous leishmaniasis in Qomrood District, Qom Province, Central Iran. *Asian Pac J Trop Med* 2011; **4**: 97-100.

[7] Aghaei AA, Rassi Y, Sharifi I, Vatandoost H, Mollaie H, Oshaghi MA, et al. First report on natural *Leishmania* infection of *Phlebotomus sergenti* due *Leishmania tropica* by high resolution melting curve method in Southeastern Iran. *Asian Pac J Trop Med* 2014; **7**: 93-6.

[8] Hanafi-Bojd AA, Yaghoobi-Ershadi MR, Haghdoost AA, Akhavan AA, Rassi Y, Karimi A, et al. Modeling the distribution of cutaneous leishmaniasis vectors (Psychodidae: Phlebotominae) in Iran: a potential transmission in disease prone areas. *J Med Entomol* 2015; http://dx.doi.org/10.1093/jme/tjv058.

[9] Doroodgar A, Mahbobi S, Nemetian M, Sayyah M. An epidemiological study of cutaneous leishmaniasis in Kashan (2007–2008). *J Semnan Univ Med Sci* 2009; **10**(3): 177-84.

[10] Desjeux P. The increase in risk factors for leishmaniasis worldwide. *Trans R Soc Trop Med Hyg* 2001; **95**(3): 239-43.

[11] Alvar J, Yactayo S, Bern C. Leishmaniasis and poverty. *Trends Parasitol* 2006; **22**(12): 552-7.

[12] Dehghani R, Kassiri H, Mehrzad N, Ghasemi N. The prevalence, laboratory confirmation, clinical features and public health significance of cutaneous leishmaniasis in Badrood city, an old focus of Isfahan Province, Central Iran. *J Coast Life Med* 2014; **2**(4): 319-23.

[13] Kassiri H, Shemshad K, Lotfi M, Shemshad M. Relationship trend analysis of cutaneous leishmaniasis prevalence and climatological variables in Shush county, south-west of Iran (2003–2007). *Acad J Entomol* 2013; **6**(2): 79-84.

[14] Yaghoobi-Ershadi MR. Phlebotomine sandflies (Diptera: Psychodidae) in Iran and their role on *Leishmania* transmission. *J Arthropod Borne Dis* 2012; **6**: 1-17.

[15] Karimi A, Hanafi-Bojd AA, Yaghoobi-Ershadi MR, Akhavan AA, Ghezelbash Z. Spatial and temporal distributions of phlebotomine sand flies (Diptera: Psychodidae), vectors of leishmaniasis, in Iran. *Acta Trop* 2014; **132**: 131-9.

[16] Doudi M, Hejazi SH, Razavi MR, Narimani M, Khanjani S, Eslami G. Comparative molecular epidemiology of *Leishmania major* and *Leishmania tropica* by PCR-RFLP technique in hyper endemic cities of Isfahan and Bam, Iran. *Med Sci Monit* 2010; **16**(11): CR530-5.

[17] Sharifi I, Zamani F, Aflatoonian MR, Fekri AR. An epidemic of cutaneousl leishmaniasis in Baft district in Kerman Province and its probable causative risk factors. *Iran J Epidemiol* 2008; **4**(1): 53-8.

[18] Yaghoobi-Ershadi MR, Akhavan AA, Zahraei-Ramazani AR, Jalali-Zand AR, Piazak N. Bionomics of *Phlebotomus papatasi* (Diptera: Psychodidae) in an endemic focus of zoonotic cutaneous leishmaniasis in central Iran. *J Vector Ecol* 2005; **30**(1): 115-8.

[19] Ghasemian M, Maraghi S, Samarbafzadeh AR, Jelowdar A, Kalantari M. The PCR-based detection and identification of the parasites causing human cutaneous leishmaniasis in the Iranian city of Ahvaz. *Ann Trop Med Parasitol* 2011; **105**(3): 209-15.

[20] Maraghi S, Samarbaf Zadeh A, Sarlak AA, Ghasemian M, Vazirianzadeh B. Identification of cutaneous leishmaniasis agents by nested polymerase chain reaction (nested-PCR) in Shush city, Khuzestan Province, Iran. *Iran J Parasitol* 2007; **2**(3): 13-5.

[21] Kassiri H, Shemshad Kh, Kassiri A, Shojaee S, Sharifinia N, Shemshad M. Clinical laboratory and epidemiological research on cutaneous leishmaniasis, in the south west of Iran. *Arch Clin Infect Dis* 2012; **7**(4): 128-31.

[22] Wikipedia. Shadegan. [Online] Available from: https://en.wikipedia.org/wiki/Shadegan#cite_note-2 [Accessed on 10th February, 2015]

[23] Zahirnia AH, Moradi AR, Norozi NA, Bathaii JN, Erfani H, Moradi A. Epidemiological survey of cutaneous leishmaniasis in Hamadan Province (2002–2007). *J Hamadan Univ Med Sci* 2009; **16**(1): 43-4.

[24] Doroodgar A, Javadian E, Dehghani R, Hooshyar H, Mofarrah, Sayyah AM. Prevalence of cutaneous leishmaniasis in Kashan, New foci. *J Ilam Univ Med Sci* 1997; **17**: 1-9.

[25] Birjees MK. Epidemiology of cutaneous leishmaniasis in Larkana district of Sindh province with particular reference to phlebotomine sandflies. Islamabad: Public Health Division, National Institute of Health; 2001.

[26] World Health Organization. Control of the leishmaniases. Geneva: World Health Organization; 2010. [Online] Available from: http://whqlibdoc.who.int/trs/WHO_TRS_949_eng.pdf [Accessed on 10th February, 2015]

[27] Doudi M, Ghasemi F, Setorki M. Genetic polymorphism analysis of Leishmania tropica isolated from three endemic regions (Bam, Kermanshah and Mashhad) in Iran by PCR-RFLP technique and based on ITS1 sequences. *Afr J Microbiol Res* 2012; **6**(12): 2970-5.
[28] Berman JD. Human leishmaniasis: clinical, diagnostic, and chemotherapeutic developments in the last 10 years. *Clin Infect Dis* 1997; **24**(4): 684-703.
[29] Klaus SN, Frankenburg S, Ingber A. Epidemiology of cutaneous leishmaniasis. *Clin Dermatol* 1999; **17**(3): 257-60.
[30] Nadim A, Faghih M. The epidemiology of cutaneous leishmaniasis in the Isfahan province of Iran. *Trans R Soc Trop Med Hyg* 1968; **62**(4): 534-42.
[31] Momeni Al, Aminjavaheri M. Clinical picture of cutaneous leishmaniasis in Isfahan, Iran. *Int J Dermatol* 1994; **33**(4): 260-5.
[32] Pourmohammadi B, Motazedian MH, Kalantari M. Rodent infection with *Leishmania* in a new focus of human cutaneous leishmaniasis, in northern Iran. *Ann Trop Med Parasitol* 2008; **102**(2): 127-33.
[33] Sadeghi-Nejad B. [Prevalence of cutaneous leishmaniasis in patients referring to health centers Khuzestan province from 1998–1999]. *Third Congr Med Parasitol* 2000: 292. Persian.
[34] Ardehali S, Rezaee HR, Nadim A. *Leishmania parasite and leishmaniasis*. 2nd ed. Tehran: Iran University Press; 1994.
[35] David Humes H. *Kelley's essentials of internal medicine*. 2nd ed. Philadelphia: Lippincott Williams & wilkins; 2001.
[36] Abbasi A, Ghanbary MR, Kazem Nejad K. The epidemiology of cutaneous leishmaniasis in Gorgan 1998–2001. *Sci J Army Univ Med Sci* 2004; **4**: 175-9.
[37] Talari SA, Talaei R, Shajari G, Vakili Z, Taghaviardakani A. Childhood cutaneous leishmaniasis: report of 117 cases from Iran. *Korean J Parasitol* 2006; **44**(4): 355-60.
[38] Kassiri H, Kasiri A, Najafi H, Lotfi M, Kasiri E. Epidemiological features, clinical manifestation and laboratory findings of patients with cutaneous leishmaniasis in Genaveh County, Bushehr Province, Southern Iran. *J Coast Life Med* 2014; **2**(12): 1002-6.
[39] Karami M, Doudi M, Setorki M. Assessing epidemiology of cutaneous leishmaniasis in Isfahan, Iran. *J Vector Borne Dis* 2013; **50**(1): 30-7.
[40] Tabibian E, Shokouh SJH, Dehgolan SR, Moghaddam AD, Tootoonchian M, Noorifard M. Recent epidemiological profile of cutaneous leishmaniasis in Iranian military personnel. *J Arch Mil Med* 2014; **2**(1): 1-4.
[41] Hanafi-Bojd AA, Yaghoobi-Ershadi MR, Zamani GH, Barzekar A, Jafari R, Pour Abazari G. [Epidemiological aspects of cutaneous leishmaniasis in Hajiabad district, Hormozgan province, 2003]. *Hormozgan J Med Sci* 2006; **10**(1): 63-70. Persian.