

## **Ten years clinical and epidemiological picture of cutaneous Leishmaniasis in the Dasht-e-Azadegan County, Southwestern Iran**

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**Original Article****Ten years clinical and epidemiological picture of cutaneous Leishmaniasis in the Dasht-e-Azadegan County, Southwestern Iran**

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## ABSTRACT

**Objectives:** The aim of this research was to identify the epidemiological and the clinical aspects of cutaneous leishmaniasis (CL) in cases who were reported from an endemic focus; Dasht-e-Azadegan County; between 2005 and 2014.

**Design:** Descriptive- Analytical Study

**Setting:** School of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

**Subjects:** A total of 1749 patients who were definitely infected with leishmaniasis were studied.

**Intervention:** In this descriptive-analytical study, all patients were diagnosed with positive direct smear for CL among the individuals living in the above county of the Khuzestan Province, southwestern Iran. Doubtful active ulcers of all patients were scraped, smeared on the slides, stained and examined microscopically for the presence of *Leishmania* amastigotes. Information was collected by the means of a checklist. The checklist used included clinical and socio-demographic data. The SPSS software was used for descriptive statistics.

**Main outcome measure:** We considered the following demographic and epidemiological parameters: patient's age, gender, place of residence (city, village), season, month, location of ulcers on the body, and the number of body lesions.

**Results:** Overall, 1749 patients were referred to the county health center for treatment. In the present study, 961 (55%) of the cases lived in urban areas. About 52.6% of the patients were males. Most of the lesions were in the hands (34.5%). About 48.2% of the cases had just one wound. Most of the patients were in the age group of 11–30 years (45%). Our findings showed that the most incidence of CL occurred in winter (51.6%).

**Conclusion:** A large number of patients in the age group 11–30 years showed that the active population is at risk of CL and education this age group is important for the control of this disease. Due to the findings of this study, CL is seemed to be of the wet form in Dasht-e-Azadegan.

**KEY WORDS:** active ulcer, demography, incidence, sand fly, zoonosis

## INTRODUCTION

Cutaneous leishmaniasis is a common parasitic disease between humans and animals and a major health issue <sup>[1]</sup>. It is appeared as small bumps (papules), which are gradually enlarged to form ulcers. This disease inflicts heavy economic burdens on families, communities and countries, especially in developing countries. The cause of this disease is various parasites in the genus *Leishmania*. The disease is transmitted to humans by the bite of female infected sand flies that usually live in the forests, caves and the nests of small rodents <sup>[2]</sup>. Cutaneous leishmaniasis (CL) can be seen in two rural or wet (zoonotic) and urban or dry (anthroponotic) forms <sup>[3]</sup>.

Unlike other infectious diseases, the prevalence of this disease is increasing <sup>[4]</sup>; so that one person gets infected with CL every second. It is endemic in 88 countries and a health problem in many countries in the Middle East, Africa, Central Asia, South America, etc <sup>[5-7]</sup>. Annually, 2 million new cases of infection with leishmaniasis are observed, of which half a million are associated with the visceral leishmaniasis and 1.5

million are related to CL <sup>[8]</sup>. Ninety percent of cases of CL occur in 7 countries, namely Afghanistan, Algeria, Brazil, Iran, Peru, Saudi Arabia and Syria <sup>[9]</sup>.

In Iran, about 20,000 cases of CL are reported from different parts of the country each year; while its actual rate is estimated to be several times higher than the reported rate <sup>[10]</sup>. The prevalence of this disease is high in Khorasan, Fars, Isfahan, Khuzestan and Kerman Provinces. In recent years, provinces such as Ilam, Yazd and Bushehr had the highest incidence of new cases of this disease. In general, provinces such as Yazd, Bushehr, Khorasan, Fars, Ilam, Khuzestan and Isfahan, with an average incidence of 166 cases per 100000 people, have the highest incidence of this disease; and the western and northwestern provinces of the country have the lowest incidence of infection with CL (less than 10 per 100,000 people) in the country <sup>[11,12]</sup>.

Studies show that the number of leishmaniasis cases is increasing due to human-induced environmental changes, such as uncontrolled exploitation of wood resources, mining, damming, expansion of agricultural lands, new irrigation practices, road development in forests, and extensive migration to cities and urbanization. In addition, poverty and malnutrition are among the most important factors affecting the spread of disease. In general, risk factors are expressed based on parameters such as age, gender, economic conditions, and other social factors <sup>[13]</sup>.

Given the above-mentioned reasons, the importance of addressing this disease is evident. Ecological and epidemiological studies that evaluate the important risk factors for the spread of CL in different parts of Iran are of great importance due to their effective role in controlling the disease and taking preventive measures. Over the past years, several studies have been conducted on the epidemiology of CL in different parts of Iran. Given the lack of any similar study in recent years in the county of Dasht-e-Azadegan, which is one of the oldest counties of Khuzestan Province with high incidence of this disease, this study aimed to evaluate the epidemiologic and clinic aspects of CL in this county from 2005 to 2014.

## **SUBJECTS AND METHODS**

### **Ethics Statement**

This study has been ethically approved by the research ethics committee of the Ahvaz Jundishapur University of Medical Sciences, Iran (Approval ID: IR. AJUMS.REC.1397.257 and Approval Date: 2018-06-23). The confidentiality of the records of patients was assured. Informed consent was obtained from all participants after explaining the study purpose, with the verbal consent of the infected individuals. For children participating in the study, informed consent form was completed by their parents. Written consent was not obtainable because most of the subjects involved in the study were with low literacy in Persian language. The study has been done in accordance with the provisions of the Hillsinki Declaration. No photographs or names of individuals or patients are found in the article.

Dasht-e-Azadegan is one of the counties of Khuzestan Province in the southwest of Iran. The center of this county is the city of Susangerd. This county is bordered to the east by the counties of Shoush and Ahvaz. Based on the 2016 census conducted by the Statistical Center of Iran, the population of this county was estimated to be 107000. Due to its close proximity to Saudi Arabia and Iraq, the weather of this county is affected by the hot dry winds blowing from these two countries. The relative humidity of this region is high in all seasons due to its proximity to the Hawr- al-Azim, Arvand River and the Persian Gulf.

This cross-sectional descriptive-analytical study was conducted to investigate the epidemiological status of CL in the county of Dasht-e-Azadegan. The statistical population consisted of all individuals diagnosed with CL from 2005 to 2014 through verification of clinical laboratory tests (biopsy of suspicious lesions, preparation of smears, examination of parasites and clinical approval) and treated in the health center of Dasht-e-Azadegan. Slit-skin method was applied for getting the sample, which was next extended on a glass slide. In order to identify the leishman-donovan bodies (amastigotes), the provided smear was stained by Giemsa, and subsequently examined under light microscopy.

The population under research was selected among the people clinically doubtful to CL who were referred to the Parasitology Lab of the Health Center of Dasht-e-Azadegan, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. Considering that the inclusion and exclusion criteria, all people who were settling in Dasht-e-Azadegan County one year prior to appearance of the ulcer and had minimum one lesion doubtful to CL were included in this research. Those people whose smears displayed negative result in terms of viewing *Leishmania* parasites and had any trip six months prior to appearance of the ulcer were excluded from the research. A consent form was obtained from each patient. Information such as patient's age, gender, place of residence (city, village), season, month, location of ulcers on the body, and the number of body lesions was recorded for each patient in the checklist using the face to face interview method. After collecting the data, they were analyzed using SPSS 18, as well as descriptive statistics and chi-square test. Significance level was considered to be  $p < 0.05$  at all stages of the study.

## RESULTS

During the period 2005-2014, the data of 1749 patients with CL who visited the disease prevention and control unit affiliated to the Health Center of the county of Dasht-e-Azadegan were recorded. The incidence of the disease during this 10-year period followed an ascending and descending trend; so that the number of cases in 2005 with 359 people was higher than that of the following years, and then a descending trend continued for 8 years, and again the incidence rate rose in 2014 with 432 cases of disease. Regarding the results of the regression between the variables of time and the incidence of the disease, the descending trend was significant during the years 2005 to 2014 ( $R = 0.65$ ).

The highest number of patients with CL was observed in the age group 11-30 years (45%) and the lowest number was observed in the age group over 30 years (12%). The results showed that there was a significant difference between the age groups and the incidence of cutaneous leishmaniasis ( $p < 0.05$ ) (Table 1). The gender-based study of the frequency of CL cases showed that 52.6% of the cases were male and 47.4% were female (Table 1). There was no significant difference between the incidence of the disease and gender. The hands (34.5%), feet (30.8%), face (24.1%) and other limbs (10.6%) were the most frequent sites of involvement. The chi-square test showed a significant difference between the anatomic sites of the lesions and the incidence of CL ( $p < 0.05$ ) (Table 1).

In terms of month, the highest and lowest incidence of the disease was observed during January (19.2%) and August (2.4%), respectively (Table 2). The study of the incidence of this disease in terms of season showed that 10.5%, 10.4%, 27.5% and 51.6% of the cases were observed in spring, summer, autumn and winter, respectively (Table 3). There was a significant difference between the incidence rate of CL, seasons and months ( $P < 0.05$ ). Table 3 shows that the most cases of CL lived in urban areas (55%).

There was no statistically significant difference in the incidence rate of CL in urban and rural areas. Meanwhile, most of the patients (48.2%) had an ulcer on the body (Table 3). Statistical analysis showed a significant difference between the number of ulcers on the body and frequency of CL cases ( $p < 0.05$ ).

## DISCUSSION

Epidemiologic studies that identify and assess the risk factors for the spread of CL and ultimately improve disease control are of great importance [14]. The present study investigated the epidemiology of cases of CL visiting the health center of Dasht-e-Azadegan from 2005 to 2014. During these years, a high oscillation of in the incidence of CL was observed. The incidence of the disease in 2005 was 3.3 cases per one thousand people, and then the rate of incidence declined for 8 years until it increased again in 2014, with 4 cases per one thousand people. One of the risk factors of this disease is to travel to areas where it is endemic. If, for whatever reason, people, especially the non-natives, are exposed to the vectors of the disease, the incidence rate of the disease will increase [15]. War and disasters cause changes in the trend of the disease in the affected areas due to migration and population changes. In fact, population displacement is a very important factor in the epidemic of CL, especially its urban type [16].

One of the objectives of this study was to investigate the age distribution of patients. The age distribution of patients showed that a significant percentage (45.2%) of patients were in the age group 10-30 years, which constitute the active and dynamic age of the community. The results of the present study were consistent with the results of the study by Hamzavi et al. in Kermanshah [17] and Doroodgar et al. Doroodgar *et al* [18]. Fazaeli *et al* [19], Sharifi *et al* [20], and Sufizadeh *et al* [21] reported the highest incidence rate of the disease in the under-10 age group, which was not consistent with the results of the present study.

In this study, 52.6% of the patients were males and 47.4% were females. In the studies conducted in the counties of Gonbad and Neyshabur, similar to our study, there was no significant difference between the two genders in terms of the incidence rate of CL. The absence of a difference in the prevalence of the disease between the two genders indicates that in this area, all individuals were equally exposed to sandflies [22, 23]. Moreover, the study by Fazaeli *et al*, who examined about 3100 patients during the years 2007-2008, did not show any significant difference between the two genders in terms of the incidence rate of this disease [19], which was consistent with the results of the present study. However, in the studies by Bahrami and Momeni, males were more infected with CL than females [24, 25]. The study by Ayatollahi *et al* in Abarkuh County of Yazd Province in 2006 showed that the incidence rate of CL was higher in females than in males [26]. The relatively high proportion of males compared to females in some studies can be due to males' weaker immune system, occupations, lower clothing coverage, warm weather and more exposure to sandflies.

In this study, most of the lesions were observed on the hands and then on the feet. In a research by Doroodgar *et al* in Kashan (2009), 46.6% of the ulcers were on the hands and the rest on the feet, face and other parts of the body, which was consistent with the results of the present study [18]. However, the study by Uzun *et al* in Turkey showed that most of the lesions are on the face, feet and other limbs, respectively [27]. In the studies by Fazaeli *et al* in Mirjawa [19], Gurel *et al* in Turkey [28], and Ullah *et al* in Pakistan [29], the highest incidence rates of ulcers were reported to be on the face, hands and feet, respectively. In general, cutaneous lesions in CL usually occur on the exposed parts of the body and in places most exposed to the

bites of sand flies. Considering the fact that other parts of the body are covered and hands and feet are not covered, especially in children who sleep early, these areas are more like to be bitten by the infected sandflies, and consequently the likelihood of lesion in these areas increases.

In this study, in terms of the number of lesions, most patients had only one lesion. In a study by Sharifi *et al* in the county of Bam, 60% of patients had one ulcer <sup>[30]</sup>. In the study by Hamzavi, the number of active lesions on the body of each patient varied between 1 - 23 with an average of 2.24 ulcers per person. Totally, 54.5% of the patients had one ulcer, 19.2% had two ulcers, 9.6% had three ulcers, and the rest had four ulcers and more <sup>[31]</sup>. But in the studies by Rafati in Damghan <sup>[32]</sup> and Abbasi in Gorgan <sup>[33]</sup>, over 60% of the patients had more than one ulcer on their bodies. The number of lesions may be due to the infected bites at different times, or autoinoculation through scratching.

In the present study, the number of cases of CL was higher among urban dwellers than among rural dwellers. This might be due to the presence of large creeks and soil grounds near Dasht-e-Azadegan, marginalization, large number of reservoirs on the outskirts of the city, lack of programs to control vectors (sand flies) and reservoirs, lack of sufficient training available for the people, lack of environmental improvement, people's occupation, lack of timely treatment of the disease and the density of human population in these areas. Therefore, basic measures must be taken to reduce the incidence of this disease in urban areas.

One of the most important factors affecting CL is the type of weather, which is subject to different conditions such as seasons and months. The results of this study showed that the incidence rate of CL is higher in winter and autumn. On the other hand, the accuracy of the seasonal dispersal pattern of the disease in the county of Dasht-e-Azadegan confirms the existence of local disease transmission very well. In a study conducted in the county of Ghasreshirin, most cases were reported in autumn (34%) and winter (19%) <sup>[34]</sup>. In Kassiri's studies conducted in Genaveh, Shushtar, Ahvaz and Shadegan, it was found that most cases of this disease were observed in winter (56.3%) and autumn (24.4%) in Genaveh; in Shushtar, the most cases of the disease were observed in winter (38.8%) and autumn (29.6%), in Ahvaz, in winter (58.1%) and autumn (19.7%), and in Shadegan, in winter (45%) and spring (26%) <sup>[35-38]</sup>. The present study shows that the disease does not have the same seasonal distribution, and the incidence of the disease is not the same throughout the year, which is one of the characteristics of rural CL. It is noteworthy that, in the western and southern counties of Khuzestan Province, autumn and winter are relatively favorable seasons for the proliferation and activity of sandflies. In the hot summer days, from June to September, the lowest incidence rate of this disease is observed in Dasht-e-Azadegan, which is due to decreased activity and proliferation of carriers (sandflies) in these months.

## CONCLUSION

According to the findings of the present study, it can be easily inferred that in this county and its neighboring cities, including urban and rural areas, the transmission of the disease is indigenous and easily carried out by the disease-vector sandflies. Indigenous transmission phenomenon can be exacerbated due to the presence of reservoirs, leading to the complete establishment of the disease in the region and increased disease endemicity in this county and other favorable parts of Khuzestan Province. Given the complications and the high costs of treatment, and in order to prevent mental and psychological trauma

caused by CL, effective measures should be taken to prevent the disease. The use of window nets, bed nets and repellents will be effective in preventing the disease. Training the community with the importance of using full coverage of body, environmental health measures (including collection of garbage and construction waste), control of stray dogs, rapid diagnosis and treatment of infected people can help reduce disease cases in the region.

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**Authors' Contribution:** Hamid Kassiri: Manuscript preparation, research project director, scientific advisor, technical advisor, data analysis, development of study idea, experimental work, abstracted data, writing the manuscript and corresponding author; Ahmad Jalali: Fieldwork and collecting data , ; Masoumeh Mardani Kateki: research project director; Masoud Lotfi : Manuscript preparation and data analysis.

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**TABLES:****Table 1:** Distribution of cutaneous leishmaniasis cases in Dasht-e-Azadegan County, southwestern Iran (2005-2014) based on gender, lesion sites on the body and age group

Year s	Gender		Lesion sites				Age group		
	Female	Male	Hands	Feed	Faces	Others	0-10	11-30	>31
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
2005	195 (54.3)	164 (45.7)	126 (35.1)	108 (30.1)	76 (21.2)	49 (13.6)	148 (41.2)	158 (44.0)	53 (14.8)
2006	132 (50.2)	131(49. 8)	97 (36.9)	78 (29.7)	65 (24.7)	23 (8.7)	130 (49.4)	106 (40.3)	27 (10.3)
2007	31 (31.3)	68 (68.7)	31 (31.3)	28 (28.3)	25 (25.3)	15 (15.1)	40 (40.4)	49 (49.5)	10 (10.1)
2008	46 (47.0)	52 (53.0)	34 (34.7)	33 (33.7)	25 (25.5)	6 (6.1)	40 (40.8)	55 (56.1)	3 (3.1)
2009	35 (49.3)	36 (50.7)	31 (43.6)	21 (29.6)	10 (14.1)	9(12.7)	34 (47.9)	36 (50.7)	1 (1.4)
2010	30 (42.9)	40 (57.1)	36 (51.4)	19 (27.1)	12 (17.2)	3 (4.3)	25 (35.7)	37 (52.9)	8 (11.4)
2011	94 (49.0)	98 (51.0)	77 (40.1)	59 (30.7)	44 (22.9)	12 (6.3)	91 (47.4)	74 (38.5)	27 (14.1)
2012	38 (47.5)	42 (52.5)	24 (30.0)	28 (35.0)	22 (27.5)	6 (7.5)	39 (48.8)	30 (37.5)	11 (13.7)
2013	22 (25.9)	63 (74.1)	24 (28.2)	28 (32.9)	27 (31.8)	6 (7.1)	24 (28.2)	48 (56.5)	13 (15.3)
2014	206 (47.7)	226 (52.3)	124 (28.7)	136 (31.5)	116 (26.8)	56 (13.0)	181 (41.9)	194 (44.9)	57 (13.2)
Total	829 (47.4)	920 (52.6)	604 (34.5)	538 (30.8)	422(24. 1)	185 (10.6)	752 (43.0)	787 (45.0)	210 (12.0)

**Table 2:** Distribution of cutaneous leishmaniasis cases in Dasht-e-Azadegan County, southwestern Iran (2005-2014) based on month

Month	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
		No. (%)	No. (%)	No. (%)		No. (%)	No. (%)		No. (%)	No. (%)	No. (%)
April	29 (8.1)	14 (5.3)	9 (9.1)	3 (3.1)	6 (8.5)	1 (1.4)	4 (2.1)	11 (13.7)	2 (2.3)	3 (0.7)	82 (4.7)
May	15 (4.2)	18 (6.8)	3 (3.0)	2 (2.0)	0 (0.0)	0 (0.0)	7 (3.6)	4 (5.0)	3 (3.5)	4 (0.9)	56 (3.2)
June	5 (1.4)	15 (5.7)	0 (0.0)	4 (4.1)	4 (5.6)	0 (0.0)	2 (1.0)	8 (10.0)	3 (3.5)	5 (1.1)	46 (2.6)
July	8 (2.2)	16 (6.1)	7 (7.1)	3 (3.1)	0 (0.0)	0 (0.0)	4 (2.1)	3 (3.75)	3 (3.5)	10 (2.3)	54 (3.1)
August	8 (2.2)	6 (2.3)	4 (4.0)	5 (5.1)	1 (1.4)	0 (0.0)	4 (2.1)	2 (2.5)	3 (3.1)	8 (1.9)	41 (2.4)
September	33 (9.2)	10 (3.8)	4 (4.0)	3 (3.1)	2 (2.8)	2 (2.9)	17 (8.9)	4 (5.0)	3 (3.5)	8 (1.9)	86 (4.9)
October	28 (7.8)	20 (7.6)	4 (4.0)	4 (4.1)	4 (5.6)	5 (7.1)	19 (9.9)	5 (6.2)	4 (4.7)	8 (1.9)	101 (5.8)
November	24 (6.7)	29 (11.0)	4 (4.0)	8 (8.2)	6 (8.5)	8 (11.4)	8 (4.2)	4 (5.0)	2 (2.4)	38 (8.8)	131 (7.5)
December	48 (13.4)	40 (15.2)	24 (24.3)	24 (24.5)	4 (5.6)	9 (12.9)	20 (10.4)	11 (13.7)	8 (9.5)	61 (14.1)	249 (14.2)
January	45 (12.4)	53 (20.2)	22 (22.2)	12 (12.2)	17 (24.0)	18 (25.7)	43 (22.4)	9 (11.2)	18 (12.2)	99 (22.9)	336 (19.2)
February	48 (13.4)	30 (11.4)	14 (14.3)	18 (18.4)	23 (32.4)	17 (24.3)	30 (15.6)	13 (16.2)	22 (25.9)	118 (7.3)	333 (19.0)
March	68 (19.0)	12 (4.6)	4 (4.0)	12 (12.2)	4 (5.6)	10 (14.3)	34 (17.7)	6 (7.5)	14 (16.4)	70 (16.2)	234 (13.4)
Total	359 (100)	263 (100)	99 (100)	98 (100)	71 (100)	70 (100)	192 (100)	80 (100)	85 (100)	432 (100)	1749 (100)

**Table 3:** Distribution of cutaneous leishmaniasis cases in Dasht-e-Azadegan County, southwestern Iran (2005-2014) based on lesion frequency, residential area and season

Year s	Lesion frequency			Residential Area		Seasons			
	1 No. (%)	2 No. (%)	3≤ No. (%)	Urban No. (%)	Village No. (%)	Spring No. (%)	Summer No. (%)	Autumn No. (%)	Winter No. (%)
2005	183 (51.0)	88 (24.5)	88 (24.5)	211 (58.8)	148 (41.2)	49 (13.6)	49 (13.6)	100 (27.8)	161(44.8 )
2006	157 (59.7)	45 (17.1)	61 (23.2)	162 (61.6)	101 (38.4)	47 (17.9)	32 (12.2)	89 (33.8)	95 (36.1)
2007	46 (46.5)	22 (22.2)	31(31.3)	58 (58.6)	41 (41.4)	12 (12.1)	15 (15.2)	32 (32.3)	40 (40.4)
2008	48 (49.0)	27 (27.5)	23 (23.5)	40 (40.8)	58 (59.2)	9 (9.2)	11 (11.2)	36 (36.7)	42 (42.9)
2009	36 (50.7)	18 (25.4)	17 (23.9)	44 (62.0)	27 (38.0)	10 (14.1)	3 (4.2)	14 (19.7)	44 (62.0)
2010	37 (52.9)	19 (27.1)	14 (20.0)	32 (45.7)	38 (54.3)	1 (1.4)	2 (2.9)	22 (31.4)	45 (64.3)
2011	107 (55.7)	61 (31.8)	24 (12.5)	104 (54.2)	88 (45.8)	13 (6.8)	25 (13.0)	47 (24.5)	107 (55.7)
2012	36 (45.0)	22 (27.5)	22 (27.5)	40 (50.0)	40 (50.0)	23 (28.8)	9 (11.2)	20 (25.0)	28 (35.0)
2013	37 (43.5)	27 (31.8)	21 (24.7)	29 (34.1)	56 (65.9)	8 (9.4)	9 (10.6)	14 (16.5)	54 (63.5)
2014	156 (36.1)	124 (28.7)	152 (35.2)	241 (55.8)	191 (44.2)	12 (2.8)	26 (6.0)	107 (24.8)	287 (66.4)
Total	843 (48.2)	453 (25.9)	453 (25.9)	961 (55.0)	788 (45.0)	184(10. 5)	181(10. 4)	481 (27.5)	903 (51.6)