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Investigation of Epidemiological Aspects of Cutaneous Leishmaniasis in Jahrom, Fars Province, Between 2015 and 2019

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Abstract

Background: Cutaneous leishmaniasis is one of the diseases caused by the *Leishmania* parasite, which is considered a health problem in Iran. Jahrom, a county in Fars province located in the south of Iran, is one of the endemic foci of cutaneous leishmaniasis.
Objectives: The present study investigated the epidemiology of cutaneous leishmaniasis in Jahrom between 2015 and 2019.
Methods: A descriptive-analytical study was performed to evaluate the epidemiology of cutaneous leishmaniasis in patients referred to the Jahrom Health Center between 2015 and 2019.
Results: A total of 584 cases were identified, of which (347) 59.4% were males and (237) 40.6% were females. The acute cases were observed in all age groups, and the highest proportion was seen at less than 10 years of age. The numbers of patients with cutaneous leishmaniasis from 2015 to 2019 were 180, 88, 117, 108, and 91, respectively. Cutaneous leishmaniasis was more common in autumn and winter. The proportion was higher in males and urban inhabitants. There was a statistically significant difference between the genders and places of residence ($P < 0.05$). Also, the highest proportion of lesions was on the hands (48.8%).
Conclusions: Based on the findings in Jahrom city, the proportion of the disease was higher in younger age groups, males, urban inhabitants, and autumn. The most common lesions were on the hands, feet, and face.

Keywords: Epidemiology, Cutaneous Leishmaniasis, Jahrom, Fars, Iran

1. Background

Cutaneous leishmaniasis is the most common type of leishmaniasis globally, often caused by three parasitic species, *Leishmania tropica*, *L. major*, and *L. infantum*. The disease is endemic in 88 countries, and its prevalence is higher in tropical and subtropical regions, so that it is among the six most common diseases in these regions (1-5). Zoonotic cutaneous leishmaniasis accounts for most leishmaniasis cases in Iran [14]. Leishmaniasis is endemic in many parts of the Islamic Republic of Iran. This disease is common in most parts of Iran from north to south and east to west. Recently, new outbreaks have been reported in the east of the country, including the villages of Neishabour [15]. Although cutaneous leishmaniasis is a malignant and non-fatal disease, it is a health problem in Iran due to skin lesions and their effects on the body, especially in children. Cutaneous leishmaniasis occurs in dry and wet forms and has a wide range of clinical symptoms. Humans and dogs in urban areas and rodents in rural areas are the main reservoirs of this disease (6, 7).

Sandflies transmit *Leishmania* parasites to the hosts through infected bites, causing leishmaniasis (8). The primary vector of dry cutaneous leishmaniasis is *Phlebotomus sergenti*, and that of wet cutaneous leishmaniasis is *P. papatasi* (5, 7). Mosquito bites lead to the transmission of the *Leishmania* parasite to the skin, which eventually causes wounds due to the multiplication and growth of the parasite in macrophages. Wounds last for six to 18 months and heal in the end by leaving a scar (8). Annually, about 700,000 to 1,300,000 new cases and 20,000 to 30,000 deaths occur in the world due to cutaneous leishmaniasis, 95% of which is in the Mediterranean, Middle East, and Central Asia, and about two-thirds in six countries: Afghanistan, Iran, Brazil, Iraq, Syria, and Algeria (2, 6). Cutaneous leishmaniasis is one of Iran's most common vector-borne diseases and is the second most common vector-borne disease after malaria. About 20,000 new disease cases are reported annually in Iran, but estimates show that the actual number is about 80,000 to 100,000 (8-11). The disease incidence in Iran is estimated to be about 28 per 1000 people, with the highest rate in the eastern regions of the Caspian Sea, southern, southeastern, and cen-

tral regions of the country (7, 12-14).

Various factors affect leishmaniasis incidence, including climate change, environmental conditions, occupation, gender, and vegetation (1, 15). Climate change, reduced rainfall, dam construction, drying of rivers, deforestation, declining vegetation, agricultural expansion, migration to cities, and suburbanization have led to the transmission of the leishmaniasis parasite and the spread of the disease in these areas. Working in open spaces and animal husbandry is the other factor affecting the exposure to the disease vector and incidence (16-21). In general, this disease lasts for six to 18 months. Although the disease treatment is done locally and systemically, the person is faced with the consequences and drug side effects such as arrhythmia, increased liver enzymes, anemia, thrombocytopenia, and leukopenia. However, treatment is ineffective in resistant cases (6, 9, 22). Therefore, adequate measures are essential to prevent the disease, which requires the identification of at-risk groups and the epidemiology of the disease in these areas.

Fars province is one of the endemic areas of cutaneous leishmaniasis in Iran. In recent years, the incidence of this disease has ranked first or second (2). Various factors such as urbanization, migration, climate change, and drought have affected the incidence of this disease in the province. Studies in Fars province have shown that Shiraz, Marvdasht, Lar, Khonj, and Arsanjan counties have high risks and are the endemic foci of cutaneous leishmaniasis in Fars province (23). Jahrom city is located in the south of Fars province and is considered a hypo-endemic area of the disease in this province. The disease incidence in this city is reported between 41-135.6% of a per 100000 people, but due to its proximity to endemic areas, including Lar, Shiraz, and Zarrin Dasht counties, there is a risk of increasing the incidence of the disease and becoming an endemic area (24). As a result, it is necessary to study and be aware of the epidemiology of the disease in this city.

2. Objectives

The present study was conducted to investigate the epidemiology of cutaneous leishmaniasis in Jahrom city between 2015 and 2019 to determine the epidemiological status and groups at risk of the disease, take effective health measures, and prevent or reduce its prevalence.

3. Methods

3.1. Study Area

This descriptive-analytical study was performed to evaluate the epidemiology of cutaneous leishmaniasis in Jahrom city between 2015 and 2019. Jahrom city in the south of Fars province has a population of 186,269 people, a warm climate, and latitude and longitude of 28°3' N and 53°3' W, located 1050 meters above the sea level.

3.2. Data Collection

To collect information, we referred to the Communicable Diseases Unit of Jahrom City Health Center and examined all Jahrom city residents diagnosed with cutaneous leishmaniasis based on smear tests and clinical manifestations between 2015 and 2019. The required data, including the patient's age, gender, residence place, travel history, date of diagnosis, date of symptom onset, and the lesion location, were evaluated.

3.3. Data Analysis

The chi-square test in SPSS V.22 was used for comparing the proportion of cutaneous leishmaniasis between different gender groups, age groups, residency statuses (rural and urban), and seasons.

4. Results

A total of 584 patients with cutaneous leishmaniasis registered in Jahrom Health Center between 2015 and 2019 were included in the study. According to the findings, the highest proportion occurred in 2015 and the lowest in 2016. The majority of the patients aged 0 - 40 years, and the highest proportion was seen in the category of 0 - 10 years (28.8%). Cutaneous leishmaniasis was more common in autumn (38.7%) and winter (36.5%) and among city residents (65.7%) (Table 1). The chi-square test showed a significant difference between age groups (P = 0.03), autumn and winter seasons (P = 0.002), and urban and rural inhabitants (P = 0.002) (Table 1).

In this study, 59.4% of the patients were males, and 40.6% were females. There was a significant difference in the proportion of cutaneous leishmaniasis between genders (P = 0.01). There was a statistical difference between the years studied, and in all years, the disease proportion was higher in males than in females. Among patients with travel history, 38% were females, and 61.2% were males. There was a statistically significant difference between them (Table 2).

The most common sites of cutaneous leishmaniasis lesions were the hands (28.3%) and the face (24.5). In males, most lesions occurred on the hands (48.8%) and feet (24.3), but in females, most lesions were on the hands (48.7) and face (24.8). The chi-square test showed a significant difference between the sites of lesions in total patients (P = 0.001), males (P = 0.001), and females (P = 0.001) (Table 3).

Table 1. Demographic Characteristics of Cutaneous Leishmaniasis in Patients in Jahrom City Between 2015 and 2019

Variables	Frequency	Percent	P Value
Year			0.03
2015	180	30.8	
2016	88	15.1	
2017	117	20.0	
2018	108	18.5	
2019	91	15.6	
Age			0.03
< 10 years	168	28.8	
11 - 20 years	96	16.4	
21 - 30 years	107	18.3	
31 - 40 years	79	13.5	
41 - 50 years	50	8.6	
51 - 60 years	45	7.7	
> 60 years	39	6.7	
Season			0.001
Spring	63	10.8	
Summer	82	14.0	
Autumn	226	38.7	
Winter	213	36.5	
Residence			0.002
Rural	200	34.3	
Urban	383	65.7	

5. Discussion

Cutaneous leishmaniasis is spreading nearly all over Fars province and is a serious and increasing public health problem in Jahrom. According to the findings, the highest proportion of disease occurred in 2015 and the lowest in 2016 and then 2019. This study aimed to analyze the epidemiological data of cutaneous leishmaniasis in Jahrom city of Fars province during 2015 - 2019. In this study, a total of 584 patients with cutaneous leishmaniasis were referred to urban and rural health centers in Jahrom to be treated. This disease has a different prevalence in different years and seems to be a public health problem in this city. According to the present study, the average prevalence of cutaneous leishmaniasis in Jahrom city was 55 per 100,000, which according to the existing studies, is about twice the average prevalence of the disease in Iran (27.5 per 100,000) (2). A 10-year study of the disease incidence by Rahmanian et al. from 2006 to 2014 showed that the highest number of cases belonged to 2006 (1,200 cases) and the lowest to 2010 (90 cases), but then it increased in 2013 (24). This indicates that the disease in this city does not have a constant trend. Most cases of cutaneous leishmaniasis occurred in the age group of fewer than 10 years.

In the study conducted in Marvdasht city, most cases belonged to the age group of 15 - 30 (25). The highest incidence was in the age group of 10 to 30 years in Isfahan and 15 - 24 years in Andimeshk (9, 15). Also, the highest incidence of the disease occurred in the age group under 10 years in Khorasan Razavi, 10 to 30 years in Khatam city, and 15 - 24 years in Hamedan (9, 20, 26). In the study of Norouzinezhad et al. in Iran, the disease prevalence was higher in the age group under 15 years (2). In the study of Rahmanian et al., who studied the 10-year trend of cutaneous leishmaniasis in Jahrom city, the disease incidence was higher in the age group over 30 years (24). People become relatively immune in endemic areas of cutaneous leishmaniasis due to past infections. As a result, younger age groups are less susceptible to the disease due to their immunity.

In this study, the proportion of cases was higher in men than in women. In the study of Nilforouzadeh et al. in Isfahan, the disease proportion was higher in men (61.8%)

Table 2. Frequency of Cutaneous Leishmaniasis Based on Gender in Jahrom City Between 2015 and 2019

Year and Gender	Frequency	Percent	P Value
2015			0.03
Female	75	41.7	
Male	105	58.3	
2016			0.001
Female	31	35.2	
Male	57	64.8	
2017			0.03
Female	50	42.7	
Male	67	57.3	
2018			0.001
Female	39	36.1	
Male	69	63.9	
2019			0.05
Female	42	46.2	
Male	49	53.8	
Total			0.01
Female	237	40.6	
Male	347	59.4	

Table 3. Frequency of Lesions Caused by Cutaneous Leishmaniasis

Site of Lesion	Frequency	Percent	P Value
Total			0.001
Hand	285	48.8	
Face	143	24.5	
Feet	112	19.2	
Body	29	5.0	
Hand, face, and trunk	15	2.5	
Male			0.001
Hand	169	48.8	
Face	57	16.5	
Feet	84	24.3	
Body	22	6.4	
Hand, face, and trunk	14	4.0	
Female			0.001
Hand	116	48.7	
Face	55	23.1	
Feet	59	24.8	
Body	7	2.9	
Hand, face, and trunk	2	0.5	

than in women (38.2%) (12). In the Almasi Hashiani et al. study in Marvdasht, 60.2% of the patients were males, and 39.8% were females (25). The other male prevalence rates are 64.1% in Ilam (2012), 56% in Andimeshk (2013), 52% in Khorasan Razavi (2013), 61% in Khatam (Yazd), and 93.8% in Hamedan. These differences were statistically significant (9, 22, 28-30). In the study of Jorjani et al. in Golestan, the disease proportion was higher in men (56.7%) (27). Among the most common causes of the disease in men, we can mention their outdoor employment, less clothing, and body exposure to the disease vector, while the disease in women can be due to the high spread of the disease vector. In the present study, most disease cases belonged to urban residence. In Hamedan and Isfahan, the proportion of the disease was higher in urban areas than in rural areas (12, 26). In Norouzinezhad et al.'s study in Iran, the disease prevalence was higher in urban areas (2). In the study of Jorjani et al. in Golestan, the disease prevalence was higher in rural areas (81.5%) than in urban areas (27). Among the reasons for the increased disease in urban areas are the migration of people from rural to urban areas, drought, and creating a suitable environment for the growth of the disease reservoir and vector in the city.

It is worth mentioning that most cases of the disease were observed in autumn and winter in the present study. In a study conducted in Marvdasht (2011), most cases of the disease occurred in autumn (53.7%) (25). In the study of Jorjani et al. in Golestan, disease prevalence was higher in autumn (27). Also, in studies conducted in Isfahan, Andimeshk, and Khatam city, most disease cases occurred in autumn in October, November, and December, which was statistically significant (12, 20, 28). Because there is usually a commune period of several months between the bite of the disease vector and the onset of symptoms, and most of the time, the vector is active in the spring, most symptoms appear in the fall. According to the findings of our study, most cutaneous leishmaniasis lesions were on the hands and the least on the trunk. In the study of Mohammadi et al. in Marvdasht (2018), most lesions were on the hand (76.18%) (29). In Isfahan, most lesions were on the hand and the least on the trunk (12). In Ilam, most lesions were on the hands (52%) and the least on the trunk (3.6%), which was statistically significant (30). In Andimeshk, the most common site of lesion was on the hands and then on the legs (28). In Lamerd, the most and the least organs involved with lesions were the hands and trunk, respectively (27). In Hamedan, the most involved organs were the hands and feet (71.6%) (26). Because the leishmaniasis vector cannot bite through clothes, it usually affects uncovered limbs, especially the hands, legs, and face.

The limitations of the present study are the migration of the patients to other cities, infection of people due to travel to other parts of the country, unknown location of patients at the time of mosquito bites, and failure of some patients to refer to the Jahrom City Health Center for treatment.

5.1. Conclusions

According to the findings, cutaneous leishmaniasis infection was higher in younger age groups, men, urban dwellers, and autumn in Jahrom city. The most common lesions were on the hands, feet, and face. Therefore, it is necessary to pay attention to the risk groups and perform disease control interventions such as indoor and outdoor residual spraying in the appropriate season to control the disease.

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Footnotes

Authors' Contribution: HA did data analysis and wrote and edited the final draft. MZ and JM performed data collection and wrote the first draft. MS contributed to the design, analysis, and manuscript preparation. All authors read and approved the final manuscript.

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References

1. Ebrahimi S, Alipour H, Azizi K, Kalantari M. Construction of PX-LmGP63 using CRISPR-Cas9 as primary goal for GP63 gene knockout in Leishmania major and leishmanization. *Jundishapur J Microbiol*. 2021;**14**(1). doi: 10.5812/jjm.112965.
2. Norouzinezhad F, Ghaffari F, Norouzinejad A, Kaveh F, Gouya MM. Cutaneous leishmaniasis in Iran: Results from an epidemiological study in urban and rural provinces. *Asian Pac J Trop Biomed*. 2016;**6**(7):614–9. doi: 10.1016/j.apjtb.2016.05.005.
3. Bailey F, Mondragon-Shem K, Hotez P, Ruiz-Postigo JA, Al-Salem W, Acosta-Serrano A, et al. A new perspective on cutaneous leishmaniasis-Implications for global prevalence and burden of disease estimates. *PLoS Negl Trop Dis*. 2017;**11**(8). e0005739. doi: 10.1371/journal.pntd.0005739. [PubMed: 28796782]. [PubMed Central: PMC5552022].

4. Postigo JA. Leishmaniasis in the World Health Organization Eastern Mediterranean Region. *Int J Antimicrob Agents*. 2010;**36 Suppl 1**:S62–5. doi: 10.1016/j.ijantimicag.2010.06.023. [PubMed: 20728317].
5. Franta Z, Vogel H, Lehmann R, Rupp O, Goesmann A, Vilcinskas A. Next generation sequencing identifies five major classes of potentially therapeutic enzymes secreted by Lucilia sericata medical maggots. *Biomed Res Int*. 2016;**2016**:8285428. doi: 10.1155/2016/8285428. [PubMed: 27119084]. [PubMed Central: PMC4826915].
6. Karimian F, Vatandoost H, Rassi Y, Maleki-Ravasan N, Choubdar N, Koosha M, et al. wsp-based analysis of Wolbachia strains associated with Phlebotomus papatasi and P. sergenti (Diptera: Psychodidae) main cutaneous leishmaniasis vectors, introduction of a new subgroup wSerg. *Pathog Glob Health*. 2018;**112**(3):152–60. doi: 10.1080/20477724.2018.1471438. [PubMed: 29745300]. [PubMed Central: PMC6056827].
7. Alipour H, Izadpanah L, Azizi K, Shahriari-Namadi M, Kalantari M. Potential co-infection of Wolbachia with Leishmania among sand fly vectors caught from endemic leishmaniasis foci in Fars province, southern Iran. *J Parasit Dis*. 2021;**45**(3):817–22. doi: 10.1007/s12639-021-01366-1. [PubMed: 34475664]. [PubMed Central: PMC8368175].
8. Ebrahimi S, Kalantari M, Alipour H, Azizi K, Asgari Q, Bahreini MS. In vitro evaluation of CRISPR PX-LmGP63 vector effect on pathogenicity of Leishmania major as a primary step to control leishmaniasis. *Microb Pathog*. 2021;**161**(Pt A):105281. doi: 10.1016/j.micpath.2021.105281. [PubMed: 34752910].
9. Khajedaluee M, Yazdanpanah MJ, SeyedNozadi S, Fata A, Juya MR, Masoudi MH, et al. [Epidemiology of cutaneous leishmaniasis in population covered by Mashhad University of Medical Sciences in 2011]. *Med J Mashhad Univ Med Sci*. 2014;**57**(4):647–54. Persian.
10. Yaghoobi Ershadi MR, Zahraei-Ramazani AR, Akhavan AA, Jalali-Zand AR, Abdoli H, Nadim A. Rodent control operations against zoonotic cutaneous leishmaniasis in rural Iran. *Ann Saudi Med*. 2005;**25**(4):309–12. doi: 10.5144/0256-4947.2005.309. [PubMed: 16212124]. [PubMed Central: PMC6148012].
11. Shirzadi MR, Gouya MM. *National Guidelines for cutaneous leishmaniasis surveillance in Iran*. Ministry of Health and Medical Education (MOH). Zoonoses Control Department, Tehran Iran; 2012. 77 p.
12. Nilforoushzadeh MA, Shirani Bidabadi L, Hosseini SM, Fadaei Nobari R, Jaffary F. Cutaneous leishmaniasis in Isfahan province, Iran, during 2001-2011. *J Skin Stem Cell*. 2014;**1**(2). doi: 10.17795/jssc23303.
13. Izadpanah L, Alipoor H, Shahriari-Namadi M, Azizi K, Kalantari M, Soltani A, et al. Morphological identification of leishmaniasis vectors and their species diversity in Fars Province, Southern Iran. *J Health Sci Surveill Syst*. 2020;**8**(3):135–9.
14. Alipour H, Darabi H, Dabbaghmanesh T, Bonyani M. Entomological study of sand flies (Diptera: Psychodidae: Phlebotominae) in Asalouyeh, the heartland of an Iranian petrochemical industry. *Asian Pac J Trop Biomed*. 2014;**4**(Suppl 1):S242–5. doi: 10.12980/APJTB.4.2014C678. [PubMed: 25183089]. [PubMed Central: PMC4025275].
15. Razavi Termeh SV, Vahid S. [Cutaneous leishmaniasis susceptibility mapping using multi-criteria decision-making techniques analytic hierarchy process (AHP) and analytic network process (ANP)]. *J Environ Health Res*. 2018;**3**(4):275–86. Persian.
16. Khademvatan S, Salmanzadeh S, Foroutan-Rad M, Bigdeli S, Hedayati-Rad F, Saki J, et al. Spatial distribution and epidemiological features of cutaneous leishmaniasis in southwest of Iran. *Alexandria J Med*. 2019;**53**(1):93–8. doi: 10.1016/j.ajme.2016.03.001.
17. WHO. *Control of the leishmaniases: Report of a meeting of the WHO Expert Commitee on the Control of Leishmaniases*. Geneva: World Health Organization; 2010.
18. WHO. *Cutaneous leishmaniasis*. World Health Organization; 2011. Available from: http://www.who.int/leishmaniasis/cutaneous_leishmaniasis/en/index.html..
19. Parvizi P, Ahmadipour F. [Fauna, abundance and dispersion of sandflies in three endemic areas of cutaneous leishmaniasis in rural Fars province]. *J Shahid Sadoughi Univ Med Sciences Health Serv*. 2011;**19**(2):173–82. Persian.
20. Barati H, Barati M, Lotfi MH. [Epidemiological study of cutaneous leishmaniasis in Khatam, Yazd province, 2004-2013]. *Paramedical Sciences and Military Health*. 2015;**10**(2):1–5. Persian.
21. Kargar Shouroki F, Neghab M, Mozdarani H, Alipour H, Yousefinejad S, Fardid R. Genotoxicity of inhalational anesthetics and its relationship with the polymorphisms of GSTT1, GSTM1, and GSTP1 genes. *Environmental Science and Pollution Research*. 2019;**26**(4):3530–41. doi: 10.1007/s11356-018-3859-0. [PubMed: 30519912].
22. Jaffary F, Abdellahi L, Nilforoushzaheh MA. [Review of the prevalence and causes of antimony compounds resistance in different societies review article]. *TUMS Publications*. 2017;**75**(6):399–407. Persian.
23. Zare M, Rezaianzadeh A, Tabatabaee H, Aliakbarpoor M, Faramarzi H, Ebrahimi M. Spatiotemporal clustering of cutaneous leishmaniasis in Fars province, Iran. *Asian Pac J Trop Biomed*. 2017;**7**(10):862–9. doi: 10.1016/j.apjtb.2017.09.011.
24. Rahmanian V, Rahmanian K, Sarikhani Y, Jahromi AS, Madani A. [Epidemiology of cutaneous leishmaniasis, west south of Iran, 2006-2014]. *J Res Med Dent Sci*. 2018;**6**(2):378–83. Persian.
25. Almasi-Hashiani A, Shirdare MR, Emadi J, Esfandiari M, Pourmohammadi B, Hossieni SH. [Epidemiological study of cutaneous leishmaniasis in Marvdasht, Fars province, Iran]. *Journal of North Khorasan University of Medical Sciences*. 2012;**3**(4):15–23. Persian. doi: 10.29252/jnkums.3.4.15.
26. Zahirnia AH, Moradi AR, Nourouzi NA, Bathaei S, Erfani H, Moradi A. [Epidemiological survey of cutaneous Leishmaniasis in Hamadan province (2002-2007)]. *J Hamadan Univ Medl Sci Health Serv*. 2009;**16**(1):43–7. Persian.
27. Jorjani O, Mirkarimi K, Charkazi A, Shahamat YD, Mehrbakhsh Z, Bagheri A. The epidemiology of cutaneous leishmaniasis in Golestan Province, Iran: A cross-sectional study of 8-years. *Parasite Epidemiol Control*. 2019;**5**. e00099. doi: 10.1016/j.parepi.2019.e00099. [PubMed: 30937404]. [PubMed Central: PMC6430073].
28. Nejati J, Mojadam M, Hanafi Bojd AA, Keyhani A, Habibi Nodeh F. [An epidemiological study of cutaneous leishmaniasis in Andimeshk (2005-2010)]. *J Ilam Univ Med Sci*. 2014;**21**(7):94–101. Persian.
29. Mohammadi J, Faramarzi H, Ameri A, Bakhtiari H. [Epidemiological study of cutaneous leishmaniasis in Marvdasht, Iran, 2017]. *Armaghane Danesh*. 2018;**23**(4):488–98. Persian.
30. Roghani AR, Yasemi MR, Jalilian M, Abdi J, Rezai Tavirani K. [Epidemiology of cutaneous leishmaniasis in Ilam province]. *Res Med*. 2013;**36**(5):50–3. Persian.