



Lifetime prevalence of cutaneous leishmaniasis scar in the city of Kherameh, Fars province, Iran (2015)

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Abstract

Background: Second only to malaria, cutaneous leishmaniasis is considered the most serious disease in tropical and subtropical areas around the world. Although leishmaniasis is a self-limited disease, the scar left by it on the affected person's skin can cause mental and emotional problems. The present study investigated the lifetime prevalence of cutaneous leishmaniasis scar among the affected people in the city of Kherameh in 2015.

Materials and Methods: Using a census method in this cross-sectional study, we interviewed 11905 families in the city of Kherameh. The epidemiological data were collected using a researcher-made questionnaire prepared through scientific methods and were analyzed through Pearson, t-test, Fisher's, and Chi-square tests.

Results: The cutaneous leishmaniasis prevalence was estimated to be 31.49% across the studied area, with the scar lifetime prevalence of 25.93% and 20.32% among the female and male participants, respectively. The highest age-gender specific prevalence was found among the 5-9 years old female participants. Furthermore, the risk of the disease recurrence was found to be 0.68%.

Conclusion: There was a high rate of the cutaneous leishmaniasis prevalence in the region under study and it was found that the disease do not provide lifelong immunity. To control the disease, it is necessary to find more effective solutions and take appropriate controlling actions.

Keywords: Cutaneous Leishmaniasis, Prevalence, Sand Fly, Scar, Iran.

Introduction

Despite the significance advances made in controlling diseases during the recent years, Leishmaniasis is still regarded as one of the six most serious diseases affecting inhabitants in tropical and subtropical areas in the world (1,2). However, it is generally forgotten due to the lack of effective, economical, and available medicines (3,4). Leishmaniasis is a parasitic disease caused by a unicellular organism named *Leishmania* and it is conveyed to human by the bite of *Phlebotomus* fly

(5), and is clinically classified as a cutaneous, mucocutaneous, diffuse cutaneous, and visceral disease (6).

Among its clinical forms, cutaneous leishmaniasis is the most frequent type, and about 350 million people are at risk of developing it. The global prevalence of the disease is 12 million people and its annual incidence is about 1.5 to 2 million people (7-9). Cutaneous leishmaniasis is endemic in 88 countries of the world including Afghanistan, Algeria, Colombia, Brazil, Iran, Syria, Ethiopia,

North Sudan, Costa Rica, and Peru with the highest prevalence rate in the world (10-12).

Along with the increased deforestation, urbanization, population dynamicity, and climate change in many areas of the world, leishmaniasis has turned into a major challenge for public health (13). Every year, about 15 thousand people develop leishmaniasis in Iran and according to the available studies, the actual rate is 4 to 5 times greater than what is reported (14). Although leishmaniasis rarely leads to death, three main reasons can make it hard for the patients to bear the disease, especially its complications: First, it threatens the patients' appearance and beauty. Second, the disease takes long to be treated. And finally, some lesions and scars will be left on the patient's skin. Based on the type of leishmaniasis, the time to recover from the disease lasts 2 to 6 months in the rural type, while it lasts 6 to 15 months in the urban type (15-17).

The sources of the urban type of the disease are humans and dogs, and the source of the rural type is rats (15,18). The rural type is considered a serious health problem in the countries of the Eastern Mediterranean area including Iran (19). Fars Province is one of the most critical areas prone to leishmaniasis in Iran, and leishmaniasis cases are increasing in some parts of the province including the city of Kherameh, Shiraz (20,21).

The degree of the leishmaniasis prevalence is affected by economic, social, cultural, environmental, and ecologic factors (22). Given the varieties and biological conditions of the disease, it is not practical to select a single method to control leishmaniasis (23). One of the important strategies for controlling leishmaniasis is the use of personal protective equipment (24). Studies have shown that using insecticide-treated mosquito nets can protect people in 50% to 60% of the cases against infections or leishmaniasis (25).

According to different reports, the prevalence of cutaneous leishmaniasis has been 1.8% to 37.9% in different provinces of Iran (26). Several studies have been conducted on the prevalence of cutaneous leishmaniasis in different parts of the world including: Inci et al in Turkey (27), Khan et al in Surgul village in India (28), Eilami and Khalili in Yasuj (29), and Aflatunian et al in Bam (30).

These studies have estimated point prevalence in short-term periods in the affected areas. Besides, to the best of our knowledge, there is no comprehensive study on the prevalence of leishmaniasis scar. Given this gap in the literature, the present study aimed at investigating the prevalence of cutaneous leishmaniasis scars among the families in the city of Kherameh in 2015.

Materials and Methods

The present study is a cross-sectional research conducted in 2015. The epidemiological data were collected using a researcher-made questionnaire prepared through scientific methods. The questionnaire items were about year of the development of leishmaniasis lesions and the type of lesions (active or passive), secretion or non-secretion, and finally the use of bed nets. The research population included all families (12384 in total) living in Kherameh, Fars province who completed the questionnaires through the census method including interviews and examinations. The families reluctant to participate in the study were excluded. In this study, experienced individuals (health workers who were familiar with leishmaniasis lesions and scars for many years) were employed as interviewers. The interviewers personally referred to the participating families and interviewed the family members to find out if they had developed active wounds and scars. The questionnaires were completed based on the respondents' answers to the interviews. The collected data were analyzed using Pearson correlation test, t-test, Fischer test, and chi-square test in SPSS software (version 16) and EXCEL (version 2007). The research hypotheses were tested at significant level of 0.05.

Results

There were 12384 families in the city of Kherameh at the time of conducting the study. However, 479 families were excluded from the study: 69 families had migrated to the region under study and 410 families either avoided participating in the study or were not present when the researchers referred to them to complete the questionnaires.

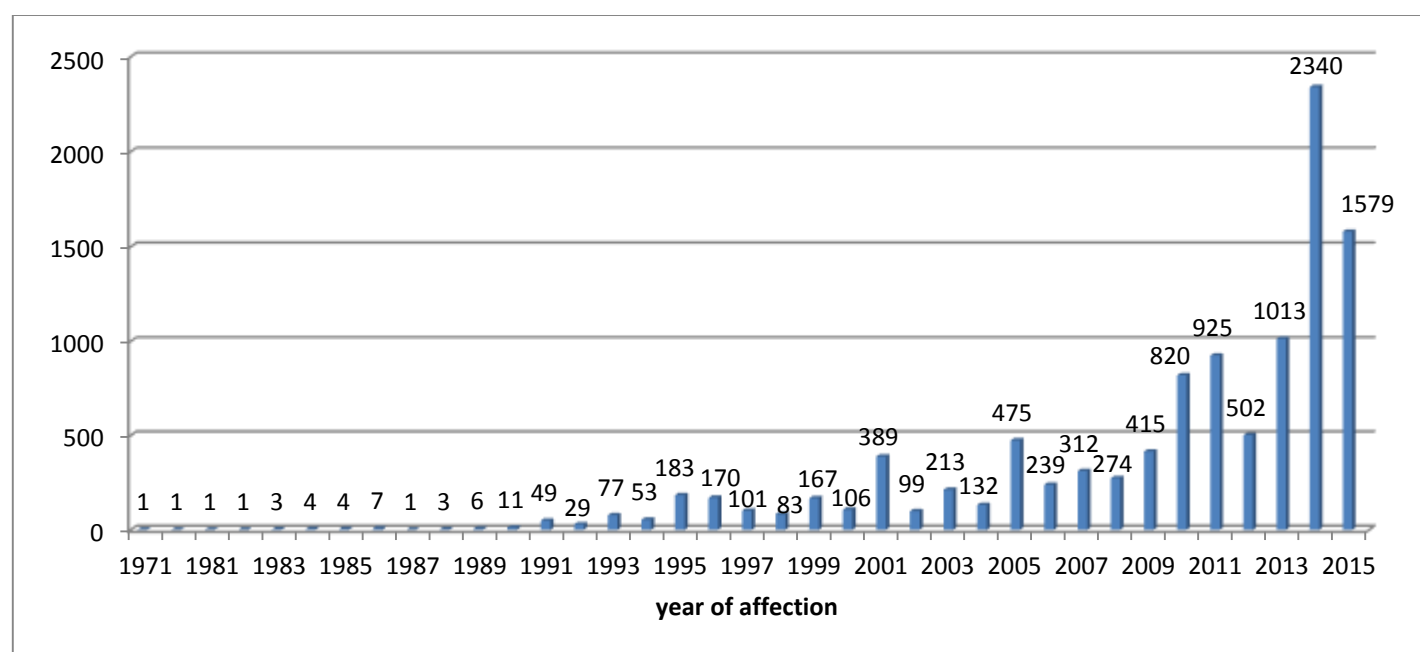
The participants were 11905 family mothers. The mean and standard deviation of the mothers' age was 42.47 ± 14.694 . The mean and standard deviation for the family size was 3.65 ± 1.878 people. The results of the study indicated that the participating mother had different education levels: primary education in 3145 families (26.3 %), middle school education in 2179 families (18.2 %), high school diploma in 2109 families (17.6 %), associate degree and higher in 900 families (7.5 %), and 3572 uneducated families (29.8 %). Besides, most participants were housewives (11214.51 families = 94.2 %). In addition, most families (6941 families = 58 %) had an income lower than 5 million Rials per month (table 1).

Table 1: Demographic characteristics of the participants

Variable	Subgroup	Frequency (%)
Age (year)	Below 24 years	922 (7.7)
	25-34	3346 (27.9)
	35-44	2887 (24.1)
	45-54	2155 (18.0)
	55-64	1503 (12.6)
	65-74	771 (6.4)
	75 and higher	391 (3.3)
Occupation	Housewife	11281 (94.2)
	Employee	430 (3.6)
	Worker	38 (0.3)
	Retired	47 (0.4)
	Others	111 (0.9)
Number of family members	1-3	5557 (46.4)
	4-5	5417 (45.2)
	Higher than 5	931 (8.4)
Family income (Rial)	> 5000000	6941 (58)
	5000000-15000000	4256 (35.5)
	<15000000	707 (5.9)

In the study, 43467 people in the region under study were examined for scars and active lesions. Since few cases had been found from 1970 to 1980, 1981 was considered the starting point of investigation. From the early of 1981 until 2015, a total number of 10787 patients with cutaneous leishmaniasis were

identified in 25 districts through the city. In the 34-year period under study, the minimum number of cutaneous leishmaniasis cases was found during 1981-1990 and the maximum number of cases was identified during 2013-2015 (Figure 1).

**Figure1:** Cutaneous leishmaniasis frequency based on year of affection

The besides, the prevalence of cutaneous leishmaniasis in the region under study was 31.49%. The lowest prevalence was found in Eslam Abad region and the highest was in Salamat Abad (Table 2). The lifetime prevalence of scars was estimated to be 25.93% among the females and 20.32% among the males. The highest prevalence

of the disease was found in the age group below 10 years old. The age group 5-9 years old showed the highest age-gender specific prevalence rate. As the present study was a cross-sectional investigation, the prevalence of the scars was estimated for each age group through a cross-sectional perspective (Table 3).

Table 2: Prevalence of cutaneous leishmaniasis in different regions in the city of Kherameh

Region	Frequency of CL		Prevalence
	Female (%)	Male (%)	
Abshoor	280(18)	261(16.78)	541(34.79)
Ahmad Abad	55(11.85)	45(9.69)	100(21.98)
Bonjeer	107(14.59)	102(13.91)	209(35.89)
Eslam Abad	15(1.59)	12(1.27)	27(2.97)
Esmaeel Abad	37(18.5)	27(13.5)	64(31.5)
Ghavam Abad	230(22.59)	180(17.60)	410(39.98)
Gheshlag - Darniyan	112(27.86)	84(20.89)	196(48.75)
Helal Abad	74(17.09)	65(15.01)	139(32.10)
Hossein Abad	102(21.16)	72(14.93)	174(35.89)
Kafdahak	241(14.96)	226(14.03)	467(28.50)
Kamjan	244(14.61)	203(12.16)	447(26.24)
Kharestan	157(18.69)	122(14.52)	279(33.21)
Kheir Abad	662(17.59)	519(13.79)	1181(31.36)
Kooh Kheiareh	258(11.47)	232(10.31)	490(21.74)
Mehr Abad	51(5.92)	32(3.71)	83(9.63)
Moez Abad	736(11.70)	598(9.50)	1334(21.12)
Moez Abad-e-Goorgeer	77(18.96)	75(18.47)	152(37.43)
Noor Abad	124(27.61)	84(18.70)	208(46.32)
Roobahghan	153(26.37)	105(18.10)	258(44.48)
Salamat Abad	80(24.02)	80(24.02)	160(48.94)
Sejel Abad	417(17.96)	288(12.40)	705(30.11)
Kherameh City	945(8.14)	864(7.44)	1809(15.66)
Shahrak-e-Isar	314(15.92)	246(12.42)	560(28.39)
Sofla	142(18.20)	144(18.46)	286(36.92)
Soltan Abad	284(18.82)	223(14.77)	507(30.28)
Total	5897(54.67)	4889(45.33)	10786 (100)

Table 3: Prevalence of Cutaneous Leishmaniasis based on age and gender

categories		Active lesion	Scar	Total	Total %	Population	Age-gender specific prevalence
Age (year)	Gender						
0-4	Female	191	621	812	1616	2253	36.04
	Male	155	649	804	(34.35)	2451	32.80
5-9	Female	114	604	718	1417	1991	36.06
	Male	100	599	699	(34.63)	2100	33.28
10-14	Female	56	501	557	1125	1592	34.98
	Male	62	506	568	(35.20)	1604	35.41
15-19	Female	36	388	424	851	1276	33.22
	Male	40	387	427	(31.67)	1411	30.26
20-24	Female	51	407	458	933	1812	25.27
	Male	47	428	475	(23.92)	2088	22.74
25-29	Female	76	385	461	790	2531	18.21
	Male	47	282	329	(14.44)	2939	11.19
30-34	Female	69	374	443	759	2456	18.03
	Male	48	268	316	(14.71)	2701	15.25
35-39	Female	43	331	374	623	2003	18.67
	Male	28	221	249	(15.02)	2143	11.61
40-44	Female	58	295	353	550	1487	23.73
	Male	27	170	197	(17.39)	1674	11.76
45-49	Female	50	252	302	457	1221	24.73
	Male	29	126	155	(18.33)	1271	12.19
50-54	Female	47	260	307	492	880	34.88
	Male	27	158	185	(26.24)	995	18.59
55-59	Female	25	202	227	355	838	27.08
	Male	18	110	128	(21.24)	817	15.66
Higher than 60	Female	70	391	461	818	2078	22.18
	Male	65	292	357	(20.41)	1928	18.51
Total		1579	9207	10786	10786	46791	23.05

As it can be seen, 42.4% of the active lesions were secretory and 57.6% were non-secretory. The independency between the two attributes o interest, i.e. gender, and type of lesion, is shown by Fishers

exact test (0.218). The results of the study concerning the number of leishmaniasis lesions (active lesions and scars) indicated that most patients had only one scar (Table 4).

Table 4: The frequency of active lesions and scars among the patients

Frequency of active lesions and scars	Lesion		Scar	
	Female Number (%)	Male Number (%)	Female Number (%)	Male Number (%)
1	360 (40.6)	295 (42.6)	2280 (45.5)	1953 (46.5)
2	222 (25.1)	187 (27)	1332 (26.6)	1160 (27.6)
3 and more	304 (34.3)	210 (30.3)	1396 (27.9)	1077 (25.7)
Total	886 (100)	692 (100)	5008 (100)	4190 (100)

The findings showed that 18.4% of the families did not have bed nets and 6.6% of those who had bed nets did not use them. It was also found that 92.8%of the patients used bed nets.

In addition, the means and standard deviations for the time of installation, packing, and using bed nets were 20.73± 1.284, 7.22± 0.851, and 13.52± 1.403 hours, respectively. The results of Kolmogorov-Smirnov test showed that the data are not normally distributed.

The results of t-test indicated that there was no statistically significant relationship between the average time of installing bed nets by families with new cases of leishmaniasis (20.81± 1.262 hours) and the families without new cases (20.79± 1.315 hours) (t=0.373, df=1135.321, p=0.709). In contrast, there was a significant relationship between the average time of packing the bed nets by families with new cases of the disease (7.30± 0.89 hours) compared to the families without new cases (7.19 ±0.83 hours) (t=3.451, df=1088.172, p=0.001). Besides, no significant relationship was found between the average durations of using bed nets by families with new cases of leishmaniasis (13.51 ±1.39 hours) compared to the families without new cases (13.60± 1.42 hours) (t=-1.826, df=8921, p=0.068).

The results of the Chi-square test indicated a statistically significant relationship between using bed nets and developing leishmaniasis (χ=23.932, df =1, p=0.001).

The Pearson test demonstrated a statistically significant relationship between age and the number of leishmaniasis-induced scars (r=0.146, p=0.001). There was also a significant relationship between age and active lesions (r=0.171, p=0.001). The results of t-test showed that there was a statistically significant difference between the mean age of the people with secretive lesions (27.51 ±22.975) and that of the people with non-secretive lesions (24.74± 20.344). The results of the Fisher's exact test showed that there was no significant

difference between the gender and type of lesion in terms of secretion (Fisher=0.06). Besides, no significant relationship was found between gender and the number of active lesions (t=1.620, df=3785.200, p=0.105). Furthermore, the results of the chi-square test showed no statistically significant relationship between gender and secretive active lesions (Chi 0.327, df =1, p=0.568). Of 10786 people with leishmaniasis, a total of 68 patients (42.65% males and 57.35% females) developed the disease for the second time. This study showed that the risk of the disease for recurrence in the region in question was 0.63%.

Discussion

The World Health Organization (WHO) has advocated and recommended studies on various aspects of leishmaniasis (31). The stigmas left by cutaneous leishmaniasis can cause many mental problems for the patients. For instance, Afghan mothers with cutaneous leishmaniasis scar are forbidden to touch their children, and young women with cutaneous leishmaniasis scars are not allowed to get married. In Colombia, cutaneous leishmaniasis scars are used as a reason for men to abandon their wives (32). Given the lack of research on the prevalence of cutaneous leishmaniasis in the world, this cross-sectional study investigated the lifetime prevalence of cutaneous leishmaniasis scars in the city of Kherameh in 2015. The main findings of this study showed that the overall prevalence of the infection was 31.49%, with a higher rate among the females than the males. However, other studies conducted in Iran reported higher prevalence rates among men than women (33, 11). Similarly, Yazdanpanah et al. found that the prevalence of cutaneous leishmaniasis was twice as much among men than women (22). The prevalence of the disease was higher among men in the studies conducted by Nilforoushzadeh et al., in Isfahan, Reithinger et al. in Afghanistan, Soares et al in Amazon Center [34-

36]. Women's skin is more tender and sensitive than men's (37,38). The higher prevalence of the disease among females compared to males can be because of their more sensitive skin, which may increase the probability of bites and higher prevalence of the disease.

The highest prevalence of the disease was found in the participants in age group below 10 years old. In the present study, 3.63% of the people had an active lesion and the highest frequency of the infection (21.91%) was found in the age group 0-4. This finding is consistent with the results of a study by Khajedaluae et al. in Khorasan (39). In another study by Doroodgar et al., the highest prevalence of the infection was found in the age group 20-29 years old in Kashan (40). Findings of our study revealed the high endemicity of the disease in Kherameh.

The findings of the study showed that the patients often had one lesion that matched the epidemiological condition of rural cutaneous leishmaniasis. Given the observation made by Saberi et al. (41) who indicated that hunted rodents in the city of Kherameh were all *Tatera indica* and the only parasite found was *L-Major*, it might be implied that cutaneous leishmaniasis in the region of the study was the rural type of the disease. The present study found a weak, positive and significant relationship between age, the number of scars, and the number of active lesions caused by leishmaniasis. This was consistent with the results of a study by Mesgarian et al. (14) who suggested that the number of lesions caused by cutaneous leishmaniasis would increase with age. The results also showed that active lesions got secretive at higher ages. According to the investigations and also based on the fact that self-treatment was common in the city of Kherameh especially among older people; the number of secretive lesions could increase.

There was a statistically significant relationship between gender and the number of leishmaniasis-induced scars. In other words, the number of lesions was higher in women than men, and the reason might be the fact that women's skin was more sensitive than that of men. However, no statistically significant relationship was found between gender and the number of active lesions, as indicated by the previous research (42). The results also showed that there was no significant relationship between gender and secretion of active lesions. In other words, these two characteristics were independent of each other.

The findings of our study indicated that 25% of the families under study did not use bed nets and it might be due to their low income. The study conducted by Abazid et al. in Aleppo (Syria) showed that although it was commonly believed that using

bed nets was the best preventive way, the families' behaviors in terms of using personal protective equipment such as bed nets, insecticides, and window screens was still low (43). In the studies conducted by Heshmati et al. [44] in Yazd and Vahhabi et al. (45) in Dehloran, the rate of using personal protective equipment by families was low. The finding of the present study also showed that 92.8% of the patients with active lesions used bed nets. The study carried out by Ali et al. (46) revealed that only 25.20% of the patients used bed nets. The effectiveness of using bed nets in preventing leishmaniasis depended on various factors including treatment with insecticide, the shape and size of the nets, and whether the nets were torn or not (35). Faraj et al. and Jalouk et al. suggested that using mosquito nets covered with insecticides did not have a high efficiency and significant effect on decreasing leishmaniasis. However, Hubertus et al. stated that preventing the disease through the use of mosquito nets not covered with insecticides was often impossible (47-49). Given the fact that most patients were using bed nets, and the families using bed nets were only 1.41 times less likely to develop leishmaniasis compared to those who did not use bed nets, it could be said that using bed nets had little effects on preventing leishmaniasis. However, further research is needed to test the effect of using bed nets in preventing leishmaniasis.

The present study showed that there was no significant relationship between installing bed nets and developing leishmaniasis. The results of a study by Mohaghegh et al. showed that phlebotomine were active from 7 P.M. to 6 A.M. (50). The families with lower frequency of using bed nets from 7 P.M to 9 P.M developed active phlebotomine. It was also found out that the time of packing bed nets had an impact on developing leishmaniasis. In other words, packing bed nets late would have an impact on developing leishmaniasis, as this would decrease of insecticide effects and the lower resistance of the mosquito nets due to the sunshine. The findings of the study showed that the duration of using bed nets was not effective in developing leishmaniasis. In other words, leaving bed nets installed in unnecessary hours did not affect the control of the disease. In addition, leaving the bed nets installed for a long time might cause them to get torn and their protective effect might decrease.

The present study indicated that the risk of developing leishmaniasis for the second time was 0.63% in the city of Kherameh. The study carried out by Jaffari et al. in Isfahan showed a recurrence rate of 6.8% (17). It is worth mentioning that recall bias might exist in this regard. That is to say, it may

be possible if the people with leishmaniasis had been slightly wrong when telling the first year of developing the disease. It is recommended that such similar studies be replicated in cities with a high prevalence of cutaneous leishmaniasis and compare their findings with the results of this study.

Conclusion

Cutaneous leishmaniasis has been increasing in recent years and this can be due to climate change or implemented controlling actions (education, waste of rats and distribution of bed nets) which might be either done incorrectly or they did not have a significant role in decreasing the rate of the disease. Hence, accurate and comprehensive studies have to be done to investigate each possible reason.

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