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Risk Factors of Anthroponotic Cutaneous Leishmaniasis Among Residents in Endemic Communities in Southeast of Iran in 2019

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ABSTRACT

***Introduction*:** In this study, we aimed to identify the risk factors associated with the incidence of A.C.L in three endemic areas of Kerman City. Moreover, the residents' knowledge, attitudes, and practices towards A.C.L were assessed.

Materials and Methods: A descriptive cross-sectional study was conducted among 195 residents of three endemic areas in Kerman City involved by A.C.L disease from January to March 2019. The risk factors for A.C.L were recorded using a checklist. Structured questionnaire was administered for data collection. Data were analyzed by ANOVA, correlation analysis, and linear regression via SPSS version 22.

Results: The main risk factors for A.C.L identified in the study areas included construction waste, presence of old and dilapidated houses, poor sanitary conditions, refugee and immigration, as well as the presence of domestic animals in close physical proximity to humans. The response rate of this questionnaire was 100 %. Among the respondents, 41.5 % were males and 58.5 % were females. Majority of the respondents (61%) claimed that they had heard about A.C.L and were familiar with this infectious disease. Only 25%, 66.7%, and 32% of the respondents had good knowledge, attitudes, and practices towards A.C.L, respectively. No significant association was found between the participants' gender and their levels of knowledge (P = 0.827), attitudes (P = 0.446), and practices (P = 0.603).

Conclusions: The residents of endemic areas had a weak level of knowledge towards A.C.L. So, educational programs should be implemented in order to improve the residents' knowledge in Kerman City.

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Introduction

Leishmaniasis is a vector-borne protozoan disease transmitted to humans by the bite of blood-feeding female phlebotomine sand flies. Although these flies are often not fatal, they pose a major public health problem worldwide [1]. Although leishmaniasis remains a neglected vector-borne disease, about 1.3 million people are diagnosed with cutaneous leishmaniasis annually in the world [2]. The presence of this vector-borne disease has

been reported in 102 countries worldwide, including Iran, where an estimated one billion people are at the risk of contracting the disease [3-5]. According to the last report of WHO report in 2018, most cases of cutaneous leishmaniasis were reported from 48 countries throughout the world [4].

Cutaneous leishmaniasis is more difficult to control in endemic areas than other infectious diseases, which can be due to the complexity of epidemiological and biological aspects of the disease [1]. Despite the efforts made to control the disease, it is still endemic in countries such as Syria, Afghanistan, Brazil, Iraq, Iran, Pakistan, Colombia, and Algeria [4].

Anthroponotic Cutaneous Leishmaniasis (A.C.L) and Zoonotic Cutaneous Leishmaniasis (Z.C.L) are two epidemiological forms of the vector-borne protozoan disease in Iran caused by *Leishmania tropica* and *Leishmania major*, respectively [6]. Moreover, two sand fly species were identified as the main vectors of Cutaneous Leishmaniasis in Iran; A.C.L and ZCL that are mainly transmitted by *Phlebotomus sergenti* and *Ph. Papatasi*, respectively [6]. The annual incidence of cutaneous leishmaniasis is very high in Iran, so that it ranks among the first six countries in the world in terms of the incidence of the disease [2]. In Iran, A.C.L is widely distributed in several provinces including Tehran, Kerman, Mashhad, Yazd, and Shiraz [7]. Kerman province is one of the endemic centers of A.C.L in Iran. In other words, several cases have been reported in different cities of the province including Kerman, Bam, Rafsanjan, Baft, Shahrbabak, and Sirjan [8].

The distribution of A.C.L is affected by various factors, including epidemiological factors, environmental factors, migration, urbanization, and natural disasters [9]. Some of the most effective ways of controlling A.C.L include prevention through using personal protective equipment and environmental interventions aimed at eliminating the vectors and the reservoirs of the disease [10]. In general, health behaviors and hygiene practices can be influenced by individuals' gender, age, education, and knowledge [11]. Therefore, assessing the levels of knowledge, attitudes, and practices (KAP) of residents of endemic areas is necessary in designing health promotion interventions and reducing the risk of exposure. Moreover, identifying the risk factors associated with the disease in the endemic areas can help to reduce incidence of the disease. In recent years, many studies were conducted on KAP towards leishmaniasis in Asia and Africa [12-19]. In Iran, KAP studies on leishmaniasis were conducted in Fars [14], Ilam [20], and Isfahan provinces [21] in the past years.

Kerman, a city in the southwest of Iran, is one of the endemic foci of A.C.L. Therefore, we need to understand the KAP of residents living these areas and the risk factors associated with the disease. In this study, we aimed to identify the risk factors associated with A.C.L in three endemic areas in the suburb of Kerman City. The present study also aimed to assess and compare the levels of KAP towards A.C.L among residents in these areas. To the best of our knowledge, the present survey is the first KAP study on A.C.L and associated risk-related factors among residents in three endemic areas (Allahabad, Shahrak Sanati, and Sarasiab) in the suburb of Kerman City.

Materials and Methods

Study design

A descriptive cross-sectional study was conducted from January to March 2019 in endemic areas of Kerman, Iran. To this end, three endemic areas, including Allahabad, Shahrak Sanati, and Sarasiab with indigenous A.C.L cases and a high potential for sand fly breeding were selected from the suburb of Kerman City.

Study site

The research location included three endemic and high risk zones affected by A.C.L in the suburb of Kerman City; Allah Abad, Shahrak Sanati, and Sar Asiab. Kerman City, the capital of Kerman province, is located in the southeast of Iran (30.2839° N, 57.0834° E) and southwest of the Kavir-e Lut. The population of Kerman City is about 821.374 people living in 221389 households, making it the 10th most populous city in Iran (Figure 1).

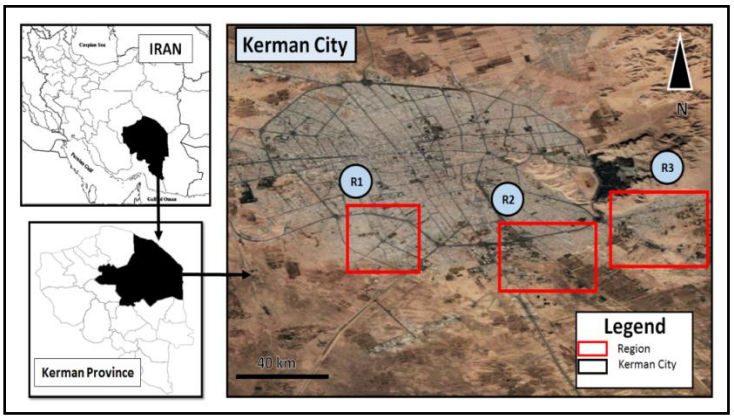

Figure 1: Location of the study areas in an Endemic Region in Kerman City, Southeast of Iran.

(**R1:** Allah Abad, **R2:** Shahrak Sanati, and **R3:** Sar Asiab). Images were provided through Google Earth Professional (https://www.google.com/earth/versions/#download-pro)

Data collection

Risk factors for the incidence of A.C.L in the three endemic areas were investigated and data were recorded through a checklist. The checklist included environmental, behavioral, and socioeconomic risk factors. A questionnaire by Vahabi *et al.* was administered for data collection after some modifications. Validity of this questionnaire was confirmed by a panel of experts in vector biology and control of disease. The questionnaire's reliability was also confirmed by Cronbach's alpha coefficient of 0.85. Data collection was done using a well briefed team of vector biology and control students. The questionnaire consisted of four sections. The first section consisted of demographic data of the participants. The second section consisted of questions for assessing the residents' knowledge over A.C.L (Eight questions) [20]. The third section assessed the attitude (Six questions) and the fourth section assessed practices of the residents towards A.C.L (Five questions). Sample size was calculated as 195 residents based on equation 1:

$$N = \frac{Z^2 p(1-p)}{d^2} \qquad (1)$$

In the study area, the residents who agreed to participate and complete the questionnaires were enrolled in this survey.

Statistical analysis

Data analysis was performed by SPSS version 22. Descriptive statistics (mean, standard deviation, charts, and frequency distribution tables) and appropriate inferential statistics such as independent T-Test, One-way ANOVA, Pearson correlation test, and Simple linear regression were used. In the statistical analyses, P-value of less than 0.05 was considered statistically significant. Results were reported in mean ± standard deviation. The heat map was made by the GraphPad Prism version 8.

Ethical issue

This study received ethical approval from the Ethics Committee of Kerman University of Medical Sciences (IR.KMU.REC.1397.424). All participants and heads of households signed written informed consents for taking part in the study and taking photos from their residence areas. Results of this study were presented to the Leishmaniasis Research Center, Kerman University of Medical Sciences and the Department of Vector Biology and Control in the School of Public Health, Kerman University of Medical Science.

Results

Socio-demographic characteristics

A total of 195 individuals responded to the questionnaires in this study; 41.5 % males and 58.5 % females. About 20% of the respondents were illiterate and 80% were literate, but majority of

them had primary school education (44.1%). Only 8.7% of participants had university education. Most females (60.5 %) were housekeeper; whereas most male participants (32.8 %) were self-employed. The demographic characteristics of the participants are described in table 1.

Table 1: Socio-demographic characteristics of the study population

Characteristics	N	Percentage (%)
Gender		
Male	81	41.5
Female	114	58.5
Age groups (years)		
< 20	12	6.66
21-30	47	24.12
31-40	64	32.82
41-50	48	25.12
over 50	22	11.28
Education		
Illiterate	39	20.0
Primary	86	44.1
Diploma	53	27.2
University	17	8.7
Occupation		
Self-employed	64	32.8
Housewife	118	60.5
Unemployed	6	3.1
Employed	7	3.6
Student	64	32.8
Family size		
1–3	60	30.8
3–6	107	54.9
6–9	20	10.3
over 9	8	4.1

History of A.C.L infection in family members of respondents

Majority of the study population (88.2%) reported no family history of A.C.L infection. About 10 % reported that some of their family members had previous infection and had recovered. However, 1 % of the participants reported that some of their family members have A.C.L currently. The level of knowledge was higher among participants who reported a previous infection in one of their family members (9.95 ± 1.96) than the other respondents.

Respondents' knowledge about A.C.L

Only 25% of the respondents had a good knowledge about A.C.L. The mean knowledge score was 4.66 ± 2.37 (Score: Minimum 0, Maximum 12). The knowledge scores of females and males were 4.69 ± 2.34 and 4.62 ± 2.42, respectively. No significant relationship was found between the female and male participants in terms of knowledge (P = 0.827). The residents in the age group of 41-50 years had a higher level of knowledge (5.29 ± 2.29) about A.C.L. However, one-way ANOVA showed no significant difference between different age groups in terms of knowledge about A.C.L. (P = 0.268). Academic education was associated with a higher level of knowledge (4.88 ± 2.1) compared with other levels of education, but no significant relationship was found between knowledge about A.C.L. and the level of education (P = 0.478). The employed participants had higher levels of knowledge (5.29 ± 2.81) regarding A.C.L. Moreover, one-way ANOVA showed no significant relationship between the level of knowledge and occupation (P = 0.478), (Table 2).

Table 2: Relationship between the participants' knowledge regarding A.C.L and socio-demographic characteristics in Kerman City

	Socio-demographic characteristics		Mean ± SD	*P*-value
Knowledge	Gender	Male	4.62 ± 2.42	0.827
		Female	4.69 ± 2.34	
	Age	< 20	4.17 ± 2.17	0.268
		21-30	4.38 ± 2.27	
		31-40	4.52 ± 2.43	
		41-50	5.29 ± 2.29	
		over 50	4.95 ± 2.4	
	Education	Illiterate	4.13 ± 2.4	0.478
		Primary	4.79 ± 2.3	
		Diploma	4.77 ± 2.5	
		University	4.88 ± 2.1	
	Occupation	Self-employed	4.52 ± 2.3	0.802
		Housewife	4.68 ± 2.4	
		Unemployed	5.17 ± 2.1	
		Student	4.66 ± 2.37	
		Employed	5.29 ± 2.8	

Most respondents (61%) reported that they have heard about A.C.L and are familiar with the disease. Majority of them (65.6%) knew that sandflies are the vectors of A.C.L. Regarding the peak incidence of A.C.L., 24.1 % reported summer and 49.2 % noted winter as the peak incidence time for A.C.L. Majority of the participants had no knowledge about the agent (87%) and the reservoir (67%) of A.C.L. About 49.22% of the respondents selected daytime as the time of sand fly bites. More than half of the respondents (51.3%) believed that using door/window screens and sleeping under nets are preventive measures for A.C.L. Less than half of the respondents (41.5%) believed that using chemical drugs was the best method of treating A.C.L. The number and percentage of participants' answer to questions regarding knowledge towards A.C.L in the three study areas are described in table 3.

Table 3: Knowledge towards A.C.L among the population

Variable	N	Percentage (%)
Do you know A.C.L?		
Yes	119	61
No	76	39
Do you know A.C.L vector?		
Stagnated water	12	6.2
Contact with infected human	2	1
Sandflies	128	65.6
I don't know	53	27.2
What is the reservoir of A.C.L?		
Rodents	32	16.4
Human	2	1
Other animals	27	13.8
I don't know	132	67.7
What is the agent of A.C.L?		
Bacteria	5	2.6

Variable	N	Percentage (%)
Parasites	11	5.6
Viruses	9	4.6
I don't know	170	87.2
Time of sandflies biting?		
Nighttime	63	32.3
Daytime	96	49.23
I don't know	36	18.47
Peak A.C.L incidence time?		
Summer	47	24.1
Winter	96	49.2
Spring	2	1
Autumn	4	2.1
I don't know	46	23.6
A.C.L preventive measures?		
Use of repellents on body	19	9.7
Use of door/window screens and nets	100	51.3
Both of repellents and screens and nets	35	17.9
I don't know	41	21
Best method of treatment for A.C.L?		
Chemicals drugs	81	41.5
Traditional drugs	16	8.2
Don't need	10	5.1
I don't know	88	45.1

Attitudes towards A.C.L among the residents

In total, 66.7% of the respondents had good attitudes towards A.C.L. The mean attitude score of the residents was 15.58 ± 4.69 (Score: Minimum 0, Maximum 21). Attitude scores of the male and female residents were 15.89 ± 4.91 and 15.37 ± 4.53, respectively. No significant relationship was observed between the attitudes of females and males (P = 0.446) towards the disease. The number and percentage of the respondents' answer to attitude questions are represented in Table 4. Moreover, heat map of the respondents' attitudes (based number) towards A.C.L. (Table 4) is shown in figure 2 based on the three study areas.

Table 4: Attitudes regarding A.C.L in the study population of Kerman City

Variable	Percentage (%)
A. How much are you probably getting the A.C.L?	
Zero	22.1
Low	23.6
Medium	20.0
High	34.4
B. Do you have concerns about A.C.L?	
Zero	23.6
Low	14.4
Medium	9.7
High	52.3
C. How much do you believe that A.C.L can be prevented?	
Zero	18.5

Variable	Percentage (%)
Low	6.7
Medium	18.5
High	56.4
D. How much impact does A.C.L have on your beauty?	
Zero	9.73
Low	0
Medium	7.2
High	83.07
E. Does education have impact on preventing A.C.L?	
Zero	9.2
Low	3.6
Medium	15.4
High	71.8
F. How much is the health authority's contribution in the control of A.C.L?	
Zero	12.3
Low	4.6
Medium	19.0
High	64.1

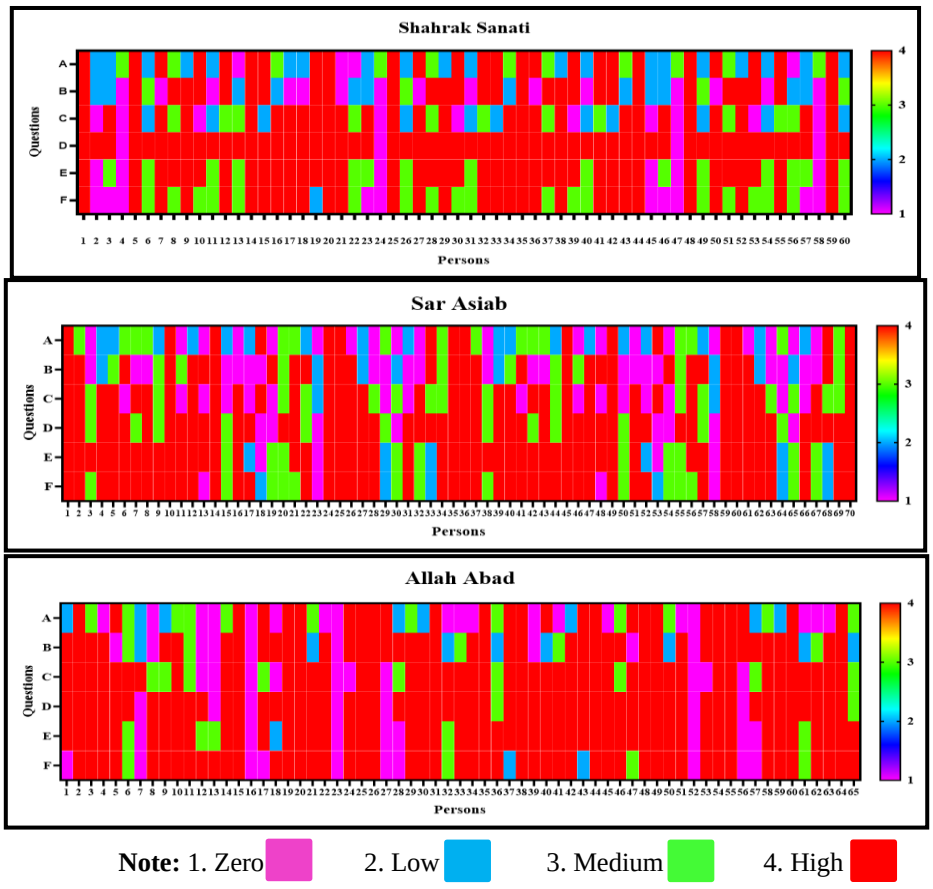

Figure 2: Heat map showing attitudes (based number) towards A.C.L in the study population in Kerman City, Southeast of Iran. Shahrak Sanati (total number of questioned persons = 60), Sar Asiab (total number of questioned persons = 70), and Allah Abad (total number of questioned persons = 65)

Practices related to A.C.L

Based on the findings, only 32% of the respondents had good practices towards A.C.L. The mean practice score was 2.83 ± 1.31 (Score: Minimum 0, Maximum 5). The scores of practice were 2.89 ± 1.26 and 2.79 ± 1.35 for the male and female participants, respectively. No significant relationship was found between the practices of females and males (P = 0.603). The number and percentage of the participant's answers to practice questions in three study areas are indicated in table 5.

Table 5: Practices towards A.C.L in the study population in Kerman City

Variable	N	Percentage (%)
Do you use a bed net for sleeping?		
Yes	123	63.1
No	72	36.9
Do your doors and windows have screens?		
Yes	66	33.8
No	129	66.2
Do you use repellent?		
Yes	15	7.7
No	180	92.3
Are you interested in participating in A.C.L control program?		
Yes	133	68.2
No	62	31.8
Are you dressing your wound when having A.C.L?		
Yes	83	42.5
No	112	57.5

KAP scores of the three study areas

The Mean ± Standard deviation of knowledge, attitudes, and practices towards A.C.L. in the three study areas are shown in table 6. No significant difference was observed in the Mean ± Standard deviation scores of attitude towards A.C.L. among residents of the three study areas (P = 0.365), but significant differences were found in the Mean ± Standard deviation scores of knowledge (P = 0.000) and practices (P = 0.006) among the residents of these three study areas.

Table 6: Mean ± standard deviation of KAP scores among the study population in Kerman City, Southeast of Iran

Study areas	Knowledge	Attitudes	Practice
Shahrak Sanati	3.82 ± 2.311	15.39 ± 4.113	2.62 ± 1.250
Allah Abad	4.09 ± 2.363	16.24 ± 5.341	2.60 ± 1.367
Sar Asiab	5.91 ± 1.871	15.14 ± 4.492	3.23 ± 1.230

Effect of knowledge and attitude scores on practice

Simple linear regression revealed a significant relationship between knowledge and practices (P = 0.000) towards A.C.L. In general, for each unit of increase in the knowledge score, the average correct practices of the residents increased by 0.23 points. No significant relationship was seen between attitudes and practices (P = 0.166) towards A.C.L. among the residents (Table 7).

Table 7: Effects of knowledge and attitude scores on the participants' practice

Variable	Estimate	*P*-value
Knowledge	0.233	0.000
Attitudes	0.026	0.166

Pearson correlation among KAP

Pearson correlation revealed a significant positive correlation between knowledge and attitude (P = 0.000, r = +0.270), between knowledge and practice (P = 0.000, r = +0.446), as well as between practice and attitude (P = 0.004, r = +0.207).

Risks factors of A.C.L

The risk factors of A.C.L. identified in the endemic areas of Kerman City included environmental, behavioral, and socioeconomic factors. The risk factors are depicted in figures 3 and 4 (4A, 4B, 4C and 4D).

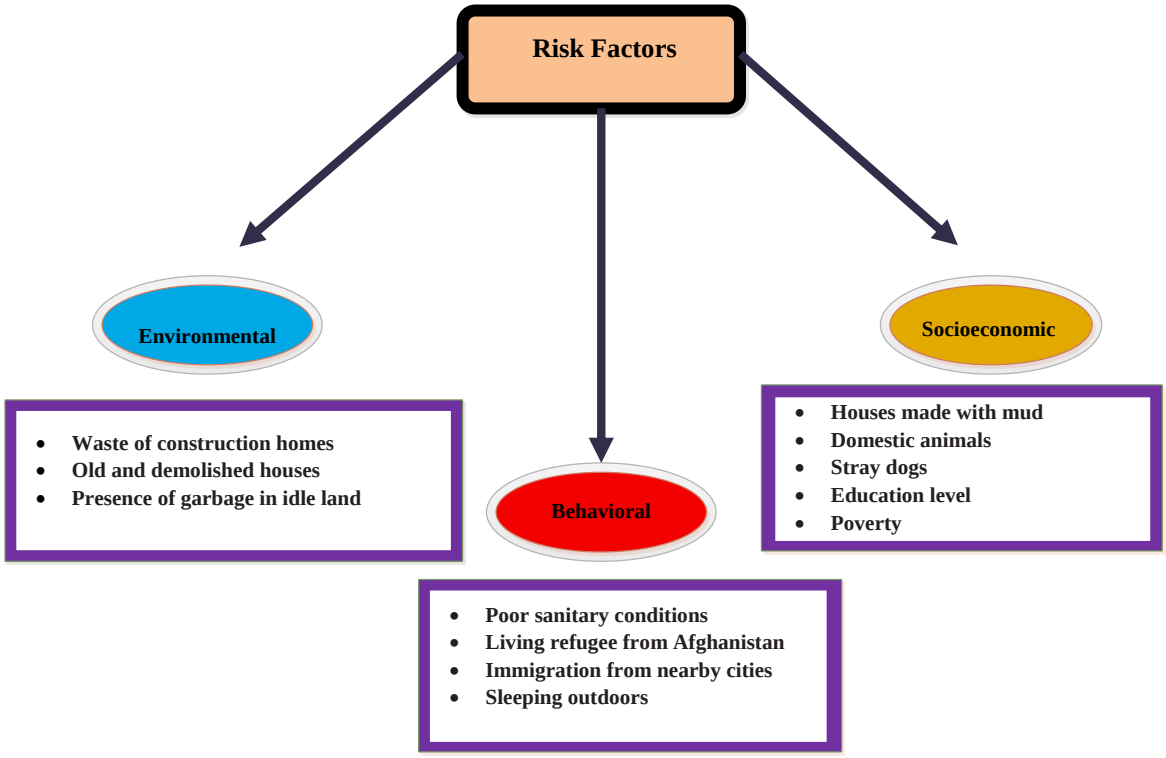

Figure 3: Risk factors of ACL in the endemic regions of A.C.L in Kerman City, Southeast of Iran

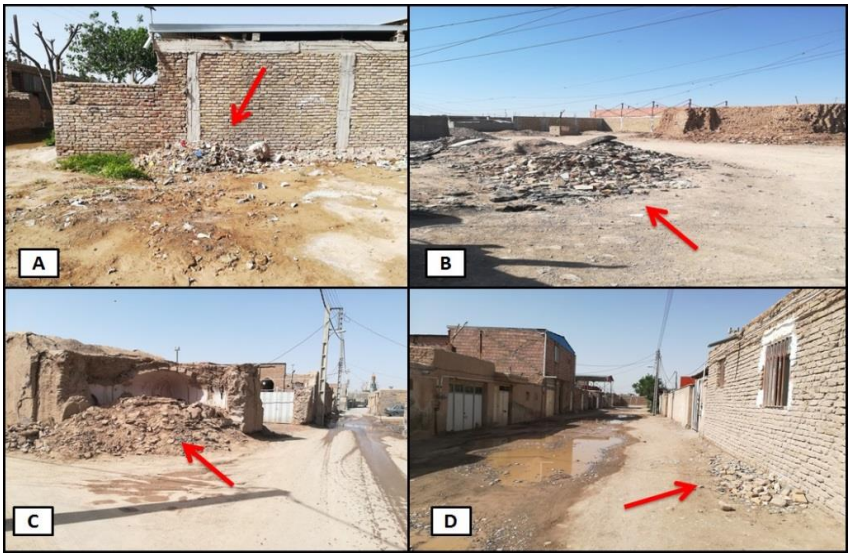

Figure 4: Photos of some risk factors in the endemic regions of A.C.L in Kerman City, Southeast of Iran.

A & B. construction waste in construction sites, C. Old and dilapidated houses, D. Deposition of garbage near uncompleted and abandoned buildings. Photos were taken during the field work in April 2019.

Discussion

In the present study, the participants' levels of knowledge, attitudes, and practices towards A.C.L were assessed and compared in three endemic areas in the suburbs of Kerman city. Furthermore, the main risk factors associated with the incidence of A.C.L were investigated in these three endemic areas.

Based on the findings, 25%, 66.7%, and 32% of the respondents had good knowledge, attitudes, and practices towards A.C.L, most of them (61%) reported that they have heard about A.C.L and are familiar with the disease. the participants' gender had no significant association with their levels of knowledge (P = 0.827), attitudes (P = 0.446), and practice (P = 0.603). The main risk factors for A.C.L included construction waste, presence of old and dilapidated houses, poor sanitary conditions, refugee and immigration, and presence of domestic animals in close physical proximity to humans. The environmental risk factors identified in the study areas included construction waste, presence of old dilapidated buildings, and deposition of garbage in landfill and near abandoned or uncompleted buildings (Figure 4A, 4B, 4C and 4D). The behavioral risk factors identified in the study areas included poor sanitary conditions, refugees from Afghanistan living in the suburbs, and immigration from nearby cities such as Bam and Jiroft. In addition, sleeping outdoors increased the risk of sand fly bites. In these areas, many houses were made by mud and mud houses provide a shelter for sand flies (Figure 4 C). In the same vein, keeping domestic animals such as stray dogs in close physical proximity to humans, having low education level, and living in poverty are among other important socioeconomic risk factors of A.C.L in these endemic areas.

Most of the previous Leishmaniasis KAP studies in Iran focused on CL. A previous study conducted by Sarkari *et al.* in Fars province of Iran reported that only 83% of the studied population had heard about CL (locally called Salak) [14]. In the present study, 61% of the respondents reported that they had heard about A.C.L. In a study conducted by Hejazi *et al.* (2010) in Isfahan province of Iran, the overall KAP score was low among 28.9% of mothers with children affected by Cutaneous Leishmaniasis [22]. However, we found that 25%, 66.7%, and 32% of the residents had good levels of knowledge, attitudes, and practice towards A.C.L., respectively. The results of Vahabi *et al.'s* (2013) study showed that only 47.9% of the studied population had good knowledge about Cutaneous Leishmaniasis [23]; whereas, in the present study, 25% of the total population had good levels of knowledge regarding A.C.L.

The results of a study by Amin *et al*. in a CL endemic region in Saudi Arabia indicated that over 76% of the studied population recognized the infectious nature of the disease [17]. In other words, the studied population had good awareness regarding the vector of the disease, which is not in concordance with the present findings. According to Akram *et al*., residents of Punjab in Pakistan had a poor knowledge regarding CL and its vector [12], which is in agreement with the findings of our study. Nandha *et al*. carried out a study in India and indicated that the residents had poor awareness regarding the vector, transmission, risk factors, and control measures of leishmaniasis [18]. In the present study, only 25% of the respondents had good awareness towards A.C.L. In contrast, studies conducted by Singh et al. in epidemic areas in India [23] and Ahluwalia et al. in Bangladesh [24] revealed that most residents were aware of leishmaniasis.

The incidence of A.C.L is associated with some risk factors such as socioeconomic, cultural, demographic, religious, and environmental factors. Other important risk factors for the spread of A.C.L include migration of laborers from rural to urban areas and climate changes [25].

The main environmental risk factors associated with A.C.L identified in the endemic areas included construction wastes, presence of old and dilapidated buildings, and deposition of garbage in landfills as well as near uncompleted and abandoned buildings. Some houses in endemic areas were made from mud, which is a risk factor

for A.C.L. A previous study in Kerman City indicated that poor interior housing condition was a risk factor for A.C.L [25]. Valero *et al*. demonstrated that houses built using nondurable wall materials, un-plastered walls, and brick wall as well as presence of cracks or holes in the walls of houses increased the risks of this neglected disease [26].

Conclusions

Overall, the residents of endemic areas had a weak knowledge towards A.C.L. In this regard, educational programs are required to improve the residents' knowledge in these endemic areas in Kerman City. Moreover, due to the recent rise in incidence rate of A.C.L in Kerman City and the presence of various risk factors in endemic areas, the disease should be considered as a serious public health problem and health strategies should be implemented to control and prevent expansion of the disease to new areas.

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Conflict of interests

The researchers declared no conflict of interest.

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