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Original Article

Public Perceptions of Risk Factors for Zoonotic Cutaneous Leishmaniasis in an Endemic Area: A Case-Control Study in the Mehran District, Ilam Province, Southwestern Iran (2022–2023)

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Abstract

Background: Zoonotic cutaneous leishmaniasis (ZCL) is one of the most prevalent vector-borne diseases. The understanding of the knowledge, attitudes, and practices regarding ZCL in Iran has not been thoroughly examined. This investigation focused on the risk factors for ZCL within an endemic region in the Mehran District of Ilam Province.

Methods: This case-control study was conducted from 2022 to 2023. Cases (n=372) were selected using the incident case approach from the Centers for Disease Control (CDC). Similarly, 372 controls were chosen through cluster random sampling from the general population. To measure exposure to various risk factors, a validated, research-developed questionnaire was utilized. Binary logistic regression modelling was employed to assess the association between the development of leishmaniasis and several risk factors. A p-value of 0.05 was set as the threshold for statistical significance.

Results: Living near rodent nests or holes (Odds Ratio: 6.51), having bathroom and toilet located outside the house (OR: 5.88), residing close to farms or gardens (OR: 8.26) or specific plants (OR: 6.22), observing a rodent near one's home (OR: 2.66), and the accumulation of building debris near residential areas (OR: 13.03) significantly increased risk of developing cutaneous leishmaniasis. In contrast, the use of insecticides (OR: 0.03) and lotions or other insect repellents (OR: 0.31) significantly decreased the risk of this disease.

Conclusion: The development of ZCL in the Mehran district, Ilam province, southwest Iran, is hindered by inadequate health education and public awareness regarding the disease, as well as insufficient adherence to Iran's care guidelines.

Keywords: Sand fly; Leishmaniasis; Risk factors; Environmental; Behavioral

Introduction

A vector-borne illness called leishmaniasis is spread to humans and other animals by the bites of infected female sand flies (1). Leishmaniasis is classified into 3 main forms: cutaneous (ACL and ZCL), mucocutaneous, and visceral (3–5). There have been reports of leishmaniasis in Iran, both cutaneous and visceral. It is estimated that between 700,000 to 1 million new cases of leishmaniasis occur annually worldwide (2). Visceral leishmaniasis (VL), also known as kala-azar, is fatal if left untreated in over 95% of cases, and there are between 20,000 to 40,000 documented deaths from this form of disease each year worldwide. In Iran,

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Phlebotomus papatasi and *Leishmania major* are the main vectors and causative agents of ZCL, respectively (3–9). *Phlebotomus caucasicus*, *Ph. mongolensis*, *Ph. andrejevi*, *Ph. alexandri*, and *Ph. ansari* are the other sand flies that are considered to be secondary or probable vectors of *Leishmania* among reservoir rodents (10–13).

One of the primary methods for vector control is the residual spraying of various insecticides, which the WHO recommends in regions associated with human cases; however, this method has not proven to be entirely successful (14, 15).

The most significant risk factors for the increase in leishmaniasis incidence and prevalence are those that are man-made and have been discussed in this study. Environmental factors, socioeconomic status, demography, and human behaviour pose major risks for human leishmaniasis (16). Additionally, an increase in certain risk factors, such as widespread migration, deforestation, urbanization, and immunosuppression, is unquestionably man-made and is primarily responsible for the rise in leishmaniasis occurrence globally. Human exposure to infected sand flies may increase as a result of changes in the environment and population movements, which are likely to alter the number, range, and density of vectors and reservoirs (16). Leishmaniasis typically only occurs in poverty-stricken areas with poor access to healthcare (17). The majority of leishmaniasis cases have been reported in individuals whose homes are situated close to garbage dumps (16). Leishmaniasis cases can be decreased by adopting sleeping practices such as sleeping indoors, utilizing nets and mosquito nets, and spraying (16). According to Kassiri et al. (18), men are more likely than women to contract leishmaniasis. This difference in incidence may be caused by men working outside and coming into contact with vectors of the disease. Another study carried out in the province of Esfahan discovered a strong correlation between leishmaniasis transmission and economic status (19). Some studies conducted in Iran show poor levels of knowledge, attitudes, and practices (KAP) towards leishmaniasis. According to a survey conducted in Abuzid Abad, Kashan City, Esfahan Province, 59.8% of female students had a good knowledge about the life cycle and prevention of leishmaniasis (20). In a survey carried out in the central Iranian district of Esfahan, it was shown that while over 90% of participants knew well about the disease's symptoms, only 28.6% were aware of its vector (21). A further study conducted in Yazd, which is close to the province of Esfahan, found that approximately 21% of the cases were well-informed about the leishmaniasis vector (22). More than half of respondents to a KAP survey on visceral leishmaniasis in Sudan (Kala-azar) believed the disease was less dangerous than malaria, with 95.6% of respondents knowing about the disease. Regarding breeding sites and biting times, respondents also possessed very little knowledge (23). According to a study conducted in Colombia, almost 35% of the cases believed that sand flies served as the leishmaniasis vector (24). According to the findings of a survey conducted in Nepal, 1–2.2 percent of participants agreed that sand flies were the source of Kala-azar (25). According to a study conducted in the Musian district in Ilam Province, a suitable health education course for family members, particularly students and health volunteers, should be prepared and organised to help them better understand the disease's main factors, modes of transmission, and prevention to control and reduce the prevalence of zoonotic cutaneous leishmaniasis (26).

This research represents the first investigation into the environmental and behavioral risk factors associated with zoonotic cutaneous leishmaniasis in the Mehran District, an endemic area in Ilam Province, southwestern Iran. Health officials can more effectively control the disease in the region by raising public awareness of its risk factors. It is important to note that the Mehran District is one of the primary ZCL foci, where the main reservoir host

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(*Tatera indica*) and vector (*Ph. papatasi*) are well-established (27, 28). This province has the highest rates of yearly incidence of cutaneous leishmaniasis, according to data released in 2010–14, as a result of a rise in cases in recent years. With 30,000 residents and a distance of 85 km from the province's centre, Mehran City is one of the most significant endemic areas for cutaneous leishmaniasis, and it is responsible for the majority of the disease's annual cases in the province. According to reports, between 2016 to 2021, the disease's incidence rate in Mehran City was 1933, 1316, 437, 220, 450, and 146 cases per 100,000 inhabitants, respectively. It appears that fewer people are visiting healthcare centres and reporting cases of this disease as a result of the COVID-19 outbreak. It is hoped that the findings of this investigation will aid in the decrease and management of cutaneous leishmaniasis in Ilam Province.

Materials and Methods

Study design and location

This case-control study was conducted in Mehran City, located in the western region of Ilam Province (Fig. 1). At an elevation of 155 meters, Mehran is situated at 33°7′15″ N latitude and 42°9′45″ E longitude. Summer temperatures reach beyond 50 °C, and there is roughly 250 mm of rainfall on average per year. The city is about 12 km from the boundary line between Iran and Iraq. The location, climate, and shared border with Iraq have significantly influenced the epidemiology of the disease in Mehran (29).

Sample size

Based on a study by Lehlewa et al. (30), the prevalence of sleeping indoors- a known risk factor for leishmaniasis- was 73.1% in the case group and 84.8% in the control group. Using the formula below, with a type I error of 0.05 and power of 80%, the sample size for each group was determined to be 372 individuals.

$$n = 2 * \frac{(z_\alpha + z_\beta)^2 * [(p_1 * q_1) + (p_2 * q_2)]}{(p_1 - p_2)^2}$$

$$= 2 * \frac{(1.96 + 0.84)^2 * [(0.731 * 0.269) + (0.848 * 0.152)]}{(0.731 - 0.848)^2} = 372$$

Case definition and its selection

Individuals with cutaneous leishmaniasis, confirmed by either a physician or a reference laboratory, were classified as cases. The incident case approach was used for case selection. After the study team was established at the study location, all newly reported cases to the Centers for Disease Control (CDC) were included as cases for this study.

Control definition and its selection

The control group consisted of healthy individuals with no history of leishmaniasis. To select the control group, a sample from the general population of Mehran City was selected randomly. First, the city was divided into several distinct areas based on the number of available health centres. Then, the population size of each distinct was determined, and the number of samples that should have been selected from each distinct was determined by a proportional-to-size approach. A clustering map for each distinct was created, and several clusters were selected at random. The sampling team was then dispatched to the southeast corner of the chosen cluster and moved in a clockwise direction, inviting households in that cluster to participate in the study as the control group. Throughout this process, the study's objectives were explained, and informed consent was obtained from the participants.

Inclusion and exclusion criteria

The study's inclusion criteria required participants to be capable of responding to questionnaires, possess basic literacy skills, and reside in an endemic area. Individuals with mental or cognitive disorders, as well as those temporarily residing in the area, were excluded from the study.

Exposure measurement of and questionnaire development

To assess the exposure to risk factors associated with Cutaneous Leishmaniasis, a research-made questionnaire was developed. This process began with a comprehensive systematic review, utilizing relevant MeSH terms such as "Risk Factor*", "Cutaneous Leishmaniasis," "Oriental Sore," "Observational Studies," "Case-Control," and "Old World Leishmaniasis." The review included searches in international databases, including Scopus, Medline/ PubMed, and Web of Science. The articles retrieved from these databases underwent a detailed three-phase screening process, which included reviewing the title, abstract, and full text. After this screening, the reviewers compiled a list of all identified risk factors for leishmaniasis. Related or similar risk factors were then merged or classified into unique items to simplify the analysis. Then, the generated questionnaire was divided into two sections, including environmental and behavioural risk factors.

To verify the validity and reliability of the research questionnaire, three experts in parasitology, medical entomology, and research methodology were selected and asked to provide feedback regarding the questionnaire's appropriateness, clarity, and comprehensiveness.

Questionnaire content validity indices

Inter-Rater agreement

Using a conservative approach, the total number of questions rated as either "completely favourable" or "favourable" (out of four available options: completely favourable, favourable, somewhat favourable, and unfavourable) was calculated. This total was then divided by the overall number of questions to determine the agreement index. An overall agreement index between 70% and 80% was considered acceptable.

Relevancy

The relevancy index was calculated for each question in the entire questionnaire. Relevancy was determined in four levels: 1) Unfavorable: The question content is unrelated to the required content; 2) Somewhat favourable: The question needs major revision to better represent the content characteristics; 3) Favourable: The question requires minor revision to better represent the content characteristics; and 4) Completely favourable: The question is fully relevant to the desired topic.

Clarity

The clarity index for each question was evaluated on four levels: 1) Unfavorable: The wording of the question is unclear and fails to effectively convey the intended concept; 2) Somewhat favourable: The question requires significant revision to communicate the appropriate concept; 3) Favorable: The question needs only minor revisions to effectively convey the intended concept; 4) Completely favourable: The wording of the question clearly and effectively communicates its meaning.

Comprehensiveness

Comprehensiveness was evaluated to determine whether the questionnaire adequately covered all topics related to the subject. This evaluation was conducted for the entire questionnaire and categorized into four levels: 1) Incomplete: The current questions do not cover all necessary topics; 2) Relatively comprehensive: Major revisions are needed to obtain suitable comprehensiveness; 3) Comprehensive: Minor revisions are needed to obtain suitable comprehensiveness; 4) Completely comprehensive: All relevant topics are adequately covered by the current questions.

Determining content validity indices

The appropriateness and clarity indices were calculated at two levels: for each question and the entire questionnaire. In addition, the comprehensiveness index was calculated only for the whole questionnaire. To measure content validity, the Content Validity Index (CVI) and Content Validity Ratio (CVR) were employed.

Reliability

The reliability of the questionnaire was assessed using Cronbach's alpha and intra-class correlation (ICC).

Content validity and reliability

In this study, the CVI and CVR were 89% and 91%, respectively. Furthermore, the ICC was 88% and Cronbach's alpha was 82%, indicating acceptable levels of validity and reliability.

Statistical analysis

SPSS version 16.0 was used to analyze the data. Numbers and percentages were used to represent qualitative data, and mean and standard deviation (SD) were used to describe quantitative data. The chi-square and Fisher exact tests were used to compare data. A binary logistic regression model was used to assess the association between several risk factors with leishmaniasis by calculating the odds ratio (OR) and 95% confidence interval (CI). The significance level was considered at 5%.

Results

The demographic characteristics of the study groups are presented in Table 1. Women comprised 66.7% of the case group and 62.9% of the control group (p= 0.283). Also, 60.5% in the control group and 59.4% in the case group were married (p= 0.765). The other findings indicated that there was no difference in job status (p= 0.093) or education (p= 0.847) between the two study groups. Table 1 indicates the distribution of the other demographic characteristics.

Table 2 shows the distribution of behavioural and environmental risk factors in the case and control groups. As shown in Table 2, living near rodent nests or holes and crevices increased the risk of getting the disease (OR: 6.51; 95% CI: 61 to 9.20).

Moreover, the odds of getting the disease increased by 5.88 times (95% CI: 4.26 to 8.07) when a bathroom and toilet are located outside the house. Additionally, the odds of developing cutaneous leishmaniasis were increased by 8.26 (95% CI: 5.81 to 11.74) and 6.22 (95% CI: 4.49 to 8.61), respectively, by residing near farms or gardens or in areas with special plants. Observing a rodent near one's home increases leishmaniasis odds by 2.66 times (95% CI: 1.97 to 3.60) compared to those who have never seen a rodent. Moreover, there was a significant association between the development of cutaneous leishmaniasis with the accumulation of building debris near residential areas (OR: 13.03; 95% CI: 8.63 to 19.70) and the tendency to sleep outside during the coldest times of the year (OR: 10.55; 95% CI: 7.48 to 14.86).

When sleeping outside the house, the use of insecticides (OR: 0.03; 95% CI: 0.02 to 0.05) and lotions or other insect repellents (OR: 0.31; 95% CI: 0.23 to 0.43) decreased the odds of cutaneous leishmaniasis. Also, using insecticide spray or insect repellent while sleeping inside the house decreased the odds of cutaneous leishmaniasis (OR: 0.04; 95% CI: 0.03 to 0.07). The situation of the risk variables is presented in Table 2.

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Table 1. Demographic characteristics of participants in the case and control groups in Mehran City, Ilam Province, southwest of Iran (2023–2024)

Variable	Control (n=372)	Case (n=372)	p-value
Gender			0.283
Male	138 (37.1%)	124 (33.3%)	
Female	234 (62.9%)	248 (66.7%)	
Marital status			0.765
Single	147 (39.5%)	151 (40.6%)	
Married	225 (60.5%)	221 (59.4%)	
Occupation			0.093
Self-employed	84 (22.6%)	69 (18.5%)	
Unemployed	62 (16.7%)	72 (19.4%)	
Employee	105 (28.2%)	82 (22.0%)	
Housewife	106 (28.5%)	131 (35.2%)	
Farmer	15 (4.0%)	18 (4.8%)	
Education			0.847
<Diploma	66 (17.7%)	72 (19.4%)	
Diploma and bachelor	288 (77.4%)	283 (76.1%)	
>Master	18 (4.8%)	17 (4.6%)	
Age (years)	33.73±9.22	33.53±10.29	0.669
Duration of residence (years)	17.77±11.19	17.69±11.35	0.925
Household size (persons)	4.05±1.42	4.56±1.57	<0.001*

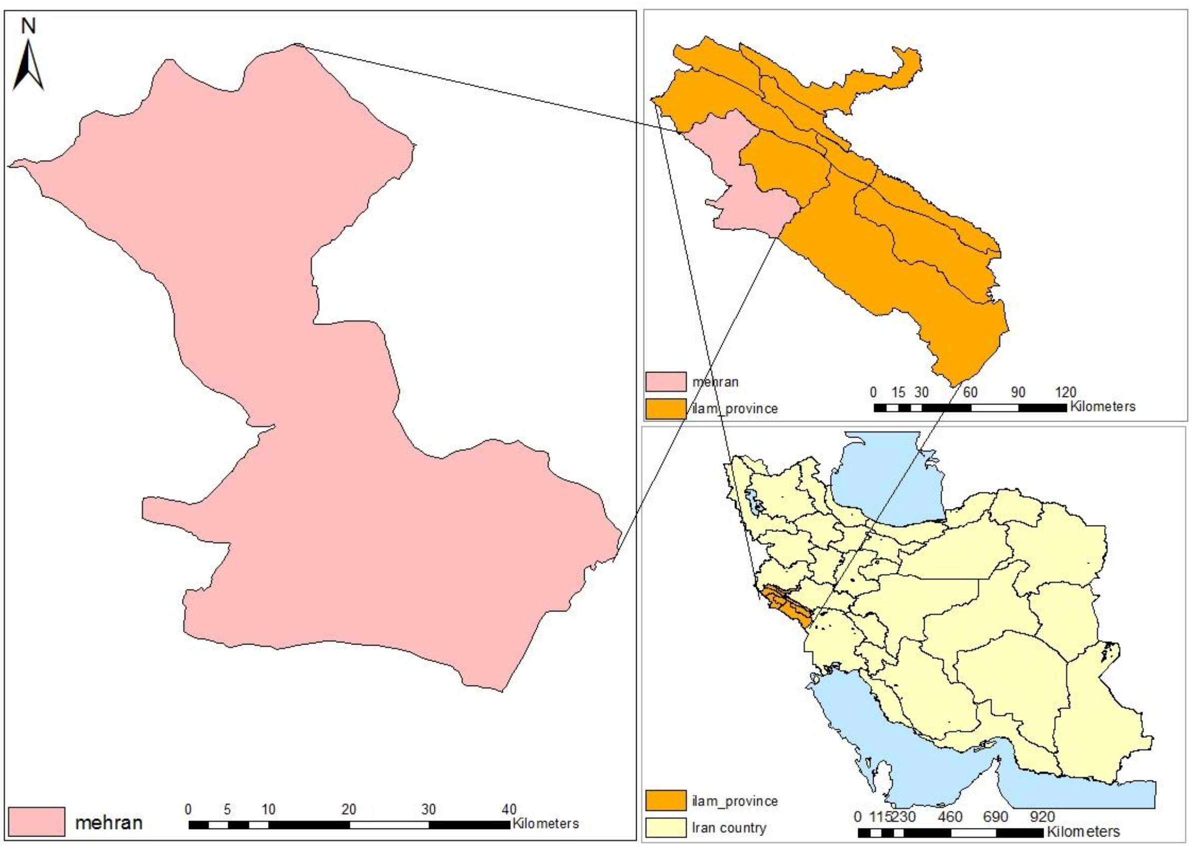

Fig. 1. Geographical map of the study site in Mehran City, Ilam Province, southwest of Iran, a known endemic area for cutaneous leishmaniasis

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Table 2. Distribution of risk factors for cutaneous leishmaniasis in the case and control groups, in Mehran City, Ilam Province, southwest of Iran(2023–2024)

Risk factor type	Variables		Control (n=372)	Case (n=372)	OR (95% CI)
Environmental	Are you a native of Mehran city?	No	66 (17.7)	72 (19.4)	Reference
		Yes	306 (82.3)	299 (80.6)	0.86 (0.62–1.30)
Environmental	Do you own cattle or other domestic animals in your home, such as dogs, cats, lambs, or goats?	No	283 (76.1)	260 (69.9)	Reference
		Yes	89 (23.9)	112 (30.1)	1.37 (0.99–1.90)
Environmental	Does your home's yard have any rodent nests or holes and crevices?	No	313 (84.1)	167 (44.9)	Reference
		Yes	59 (15.9)	205 (55.1)	6.51 (4.61–9.20)*
Environmental	Are the house's toilet and bathroom used outside (in the yard, etc.) or inside?	Inside	261 (70.2)	99 (26.6)	Reference
		Outside	111 (29.8)	247 (66.4)	5.88 (4.26–8.07)*
		Both	0 (0)	26 (7)	---
Environmental	Is the kitchen outside the home or inside?	Outside	359 (96.5)	355 (95.4)	Reference
		Inside	13 (3.5)	17 (4.6)	1.32 (0.63–2.76)
Environmental	Are there any gardens or farms close to where you live?	No	316 (84.9)	151 (40.6)	Reference
		Yes	56 (15.1)	221 (59.4)	8.26 (5.81–11.74)*
Environmental	Are there any special plants (trees, bushes, weeds, etc.) in the area around your home?	No	293 (78.8)	139 (37.4)	Reference
		Yes	79 (21.2)	233 (62.6)	6.22 (4.49–8.61)*
Environmental	Have you ever seen any rodents around your house?	No	263 (70.7)	177 (47.6)	Reference
		Yes	109 (29.3)	195 (52.4)	2.66 (1.97–3.60)*
Environmental	Is there a buildup of mud mounds, animal waste, or construction debris (stones, bricks, dirt, etc.) in the vicinity of your home?	No	339 (91.1)	164 (44.1)	Reference
		Yes	33 (8.9)	208 (55.9)	13.03 (8.63–19.70)*
Environmental	Are there moist and shady places inside or near the house? (Bird's nest, barn, barrel storage, firewood, etc.) Are there dirt or mud hills?	No	231 (62.1)	103 (27.7)	Reference
		Yes	141 (37.9)	269 (72.3)	4.30 (3.14–5.83)*
Behavioral	During the coldest times of the year, do you take rests or sleep outside in your yard, terrace, hedge, etc.?	No	264 (71)	70 (18.8)	Reference
		Yes	108 (29)	302 (81.2)	10.55 (7.48–14.86)*
Behavioral	Do you use a mosquito net when sleeping outside?	No	60 (16.1)	320 (86)	Reference
		Yes	312 (83.9)	52 (14)	0.03 (0.02–0.05)*
Behavioral	When you sleep indoors or in enclosed spaces, do you use a mosquito net?	No	190 (51.1)	286 (76.9)	Reference
		Yes	182 (48.9)	86 (23.1)	0.31 (0.23–0.43)*
Behavioral	Do you use sprays, lotions, or other insect repellents when sleeping outdoors and in open places without a roof?	No	151 (40.6)	294 (79)	Reference
		Yes	221 (59.4)	78 (21)	0.18 (0.13–0.25)*
Behavioral	If you sleep indoors (closed and covered), do you use insecticide spray or insect repellent?	No	142 (38.2)	348 (93.5)	Reference
		Yes	230 (61.8)	24 (6.5)	0.04 (0.03–0.07)*
Behavioral	During the cooler months, are the windows and doors open?	No	49 (13.2)	44 (11.8)	Reference
		Yes	323 (86.8)	328 (88.2)	1.13 (0.73–1.75)
Behavioral	Does Windows include an installed net?	No	40 (10.8)	294 (79)	Reference
		Yes	332 (89.2)	78 (21)	0.03 (0.02–0.05)*
Behavioral	Are there nets or curtains at the entrance doors?	No	71 (19.1)	281 (75.5)	Reference
		Yes	301 (80.9)	91 (24.5)	0.08 (0.05–0.11)*
Behavioral	Do your clothes cover you when you sleep? (Appropriate pants and long-sleeved clothing)	No	209 (56.2)	264 (71)	Reference
		Yes	163 (43.8)	108 (29)	0.53 (0.39–0.71)*
Behavioral	Do your clothes cover you when you sleep? (appropriate pants When you leave the house during sand fly bites (evening to sunrise), do you wear proper clothes that cover your entire body?	No	131 (35.2)	242 (65.1)	Reference
		Yes	241 (64.8)	130 (34.9)	0.29 (0.22–0.39)*
Behavioral	Has poison been sprayed on the internal walls of the house during the last year? (by the head of the household or the medical staff)	No	343 (92.2)	341 (91.7)	Reference
		Yes	29 (7.8)	31 (8.3)	1.07 (0.63–1.82)

***: Significant at 0.05**
Data represented by number (percent).
OR: odds ratio

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Discussion

This is the first attempt to clarify the knowledge, attitudes, and practices (KAP) related to CL disease in the southwest Iranian region of the Mehran District, Ilam Province. Although the disease has long been endemic in this area, people's knowledge of both the disease and its vector was poor (3). Regarding cutaneous leishmaniasis, almost 76.6% of responders lacked sufficient knowledge. Only 23.38% of the respondents recognised enough about the cases under investigation to be considered informed, and they were aware the disease was a severe and endemic condition in the region (Mehran District). Of the participants in this group, 46.6% were aware that the disease was transmitted by sand fly bites, and 8.6% had received training. Just 15% of this group understood how to prevent the disease, but 74.1% of them were also aware of its symptoms. Nonetheless, 70.9% of those in the control group, those without the illness, knew that the disease was important and indigenous to the district of Mehran. According to a study conducted in Esfahan, 97.9% of people in the area were informed about CL, but only 28.6% of those questioned were familiar with sand flies (21). In a different survey conducted in Kashan, 55.9% of the residents were aware of CL, which is comparable to the findings of our study (20). In the study of Mazloumi (22), it was found that only 21.2% of individuals believed sand flies were a vector of the disease. It is essential to increase awareness by providing direct, in-person training to mothers, teachers, and students, as these individuals play a major role in influencing the behaviour of young people (21). In summary, enhanced understanding will lead to the advancement of students' attitudes and behaviours, particularly those that prevent leishmaniasis (21). According to the Vahabi et al. study, 47.9% of people were aware of cutaneous leishmaniasis. 37.3 % of respondents were unaware that sand flies were the disease's vector, compared to 39.5% who were aware of this fact (26). All of these findings demonstrate how important it is to provide enough knowledge on cutaneous leishmaniasis and the variables influencing it in disease-endemic areas. More than 76% of the population in a Saudi Arabian study by Amin et al. (31) was aware that cutaneous leishmaniasis is an infectious disease, and there was good knowledge about the disease's clinical features. However, there was very little information available regarding the disease's vector, route of transmission, risk factors, and preventative measures. Living close to rodents' burrows was a major risk factor for CL infection, which is what all people at risk (affected by this disease) have in common. This was established in our study by asking two questions, such as: "Are there rodent burrows in your yard?" as well. Has there ever been rodent activity close to your home?

In the study of Vahabi et al. (26), there was a statistically significant link between awareness and sex, married status, and education level, and attitude and education level. Males scored considerably higher on knowledge, family income, age, and history of cutaneous leishmaniasis in the Amin et al. study (31). In ZCL, control strategies should concentrate on rodents as the main reservoirs and *Ph. papatasi* as the main vector. The high-risk populations need to be made more aware (33). Inadequate waste management in the outer regions of communities in endemic zones for ZCL is creating the perfect environment for *Ph. papatasi* populations to reproduce and rest, which increases the risk of ZCL. Our entomological research led us to the conclusion that an integrated vector management program should include waste management, and educating people to oppose garbage pickup near villages to reduce the risk of ZCL transmission (34). By implementing control measures appropriate to each eco-epidemiological entity, maintaining continuity, modifying these strategies in response to every

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new environmental change, and refining them through targeted research, some risk factors can be reduced. But all parties concerned must make a significant financial and political commitment to this. The prevention and control of key risk factors also depend on effective multidisciplinary cooperation between the health sector and other governmental domains, including education, agriculture, water, forestry, and other natural resources (35). When asked whether they had ever treated their door or window nets in the house with insecticides, only 42.7% of the respondents in the Abdulsalam and Malik (36) study answered positively; the majority answered negatively. In a different study carried out in the Amhara State of Northwest Ethiopia, the majority of the households (more than 90%) had been sprayed with insecticides both indoors and outdoors as a preventive measure (34). Nonetheless, the 2009–2010 malaria prevention and control program conducted in the study area may have had a direct impact on the outstanding level of behaviours seen there (37, 38). Although only 30.9% of respondents used nets to protect themselves, Hosseini et al.'s survey revealed that 70.3% of respondents employed fine nets for windows. Another study carried out in Esfarayen City, Iran, found no significant statistical relationship between the investigated components and other variables, including age, sex, or education level, and between the occupation and knowledge and attitude, as well as the place of residence and the attitude and performance of health professionals (38).

Conclusion

The research identified key risk factors for leishmaniasis in the Mehran District, Ilam Province, revealing that the majority of infected individuals reside in areas where the disease's vectors and reservoirs thrive. These individuals face a considerably higher risk of infection due to limited knowledge about disease transmission and preventive measures, such as the use of insecticide-treated nets, environmental modifications, and insect repellents. Addressing these knowledge gaps and implementing targeted control strategies are essential for reducing the burden of cutaneous leishmaniasis in this endemic region.

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Ethical considerations

Our project was approved by the Tehran University of Medical Sciences (IR. TUMS. SPH. AEC. 1402.017).

Conflict of interest statement

The authors declare that there is no conflict of interest.

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