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Original Article

Trends in Cutaneous Leishmaniasis in Erbil, Iraq: A Retrospective Study

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Abstract

Introduction: Cutaneous leishmaniasis (CL) is a neglected tropical disease caused by protozoan parasites and transmitted to humans through the bite of infected phlebotomine sandflies.

Methodology: This study aimed to assess the trends and distribution of reported human CL cases in Erbil province, Iraq, from 2020 to 2022, and to analyze the impact of demographic factors and potential risk factors on disease distribution.

Results: Among the 136 reported cases of human CL during the study period, the median age at diagnosis was 35 years (range: 0–90 years), with cases equally distributed between males and females. Only 34.65% of cases reported a travel history prior to infection, while the majority acquired the infection locally within the province. The main hotspots were the Center of Erbil and Makhmur districts, accounting for 44.09% and 38.58% of the cases, respectively. An increasing trend in cases was observed over the study period. The number of lesions per patient ranged from 1 to 35, with a median of 2, and was positively associated with age. The hands were the most affected body site (36.57%). Among occupational groups, housewives constituted the largest proportion of cases (34.38%).

Conclusions: Human CL is endemic in Erbil province, Iraq, with an increasing number of reported cases. Health authorities should prioritize control measures in high-risk districts, particularly the Center of Erbil and Makhmur, and implement targeted therapeutic and epidemiological interventions.

Key words: trends; Leishmaniasis; Erbil; Iraq.

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Introduction

Leishmaniasis is a vector-borne disease caused by an intracellular protozoan parasite of the genus *Leishmania*, transmitted to the host through the bite of an infected phlebotomine sandfly. Globally, more than 20 *Leishmania* species are known to be pathogenic to humans. Dogs are considered the primary reservoir hosts for this parasite due to their ability to harbor and maintain the protozoan [1,2].

This neglected tropical disease affects populations in more than 90 countries across Asia, Africa, the Middle East, and Central and South America. Furthermore, it disproportionately impacts low-income communities, where limited resources for research, drug development, and control measures contribute to high morbidity and mortality rates [3].

Leishmaniasis presents in three main clinical forms: cutaneous leishmaniasis (CL), mucosal leishmaniasis (ML), and visceral leishmaniasis (VL). These forms vary depending on the sandfly species, the *Leishmania* species, and the geographic region. CL, the most common form, is characterized by skin lesions that may heal spontaneously but often result in disfiguring scars and social stigma.

The annual global number of new CL cases is estimated to range from 700,000 to 1.2 million cases [4]. In the Middle East, CL is prevalent in all countries, with particularly high occurrences reported in Iran, Saudi Arabia, Syria, and Iraq [5].

Both VL and CL are present in Iraq. VL predominantly occurs in the country's central and southeastern regions. Cases of VL have been reported in 14 of Iraq's 18 provinces, with no reported cases in the four northern provinces: Duhok, Erbil, Sulaimaniya, and Ninevah [6]. In Iraq, *Leishmania donovani* and *Leishmania infantum* are the causative agents of VL [7], while *Leishmania tropica* and *Leishmania major* are responsible for CL cases. Although CL is widespread across Iraq, it was not reported in Erbil province prior to 2008. However, since 2010, an increasing number of CL cases have been documented in the province [8].

This study aims to evaluate the temporal distribution of reported CL cases in Erbil province, northern Iraq, over a three-year period, in order to better understand its epidemiology.

Methodology

Study area

This study involved a retrospective analysis of the collected data. It was conducted in Erbil province, located in the northeastern part of Iraq, between 44° and 45° E longitude and 36° and 37° N latitude, covering a

total area of 14,837 km². Erbil province consists of 10 districts, which are further divided into 42 subdistricts, and has a population of approximately 2.25 million [9] (Figure 1).

Data collection

Epidemiological data were extracted from the CL registry database provided by the Directorate of Preventive Health Affairs. All recorded cases of CL were clinically diagnosed by dermatologists during the three-year period (2020–2022).

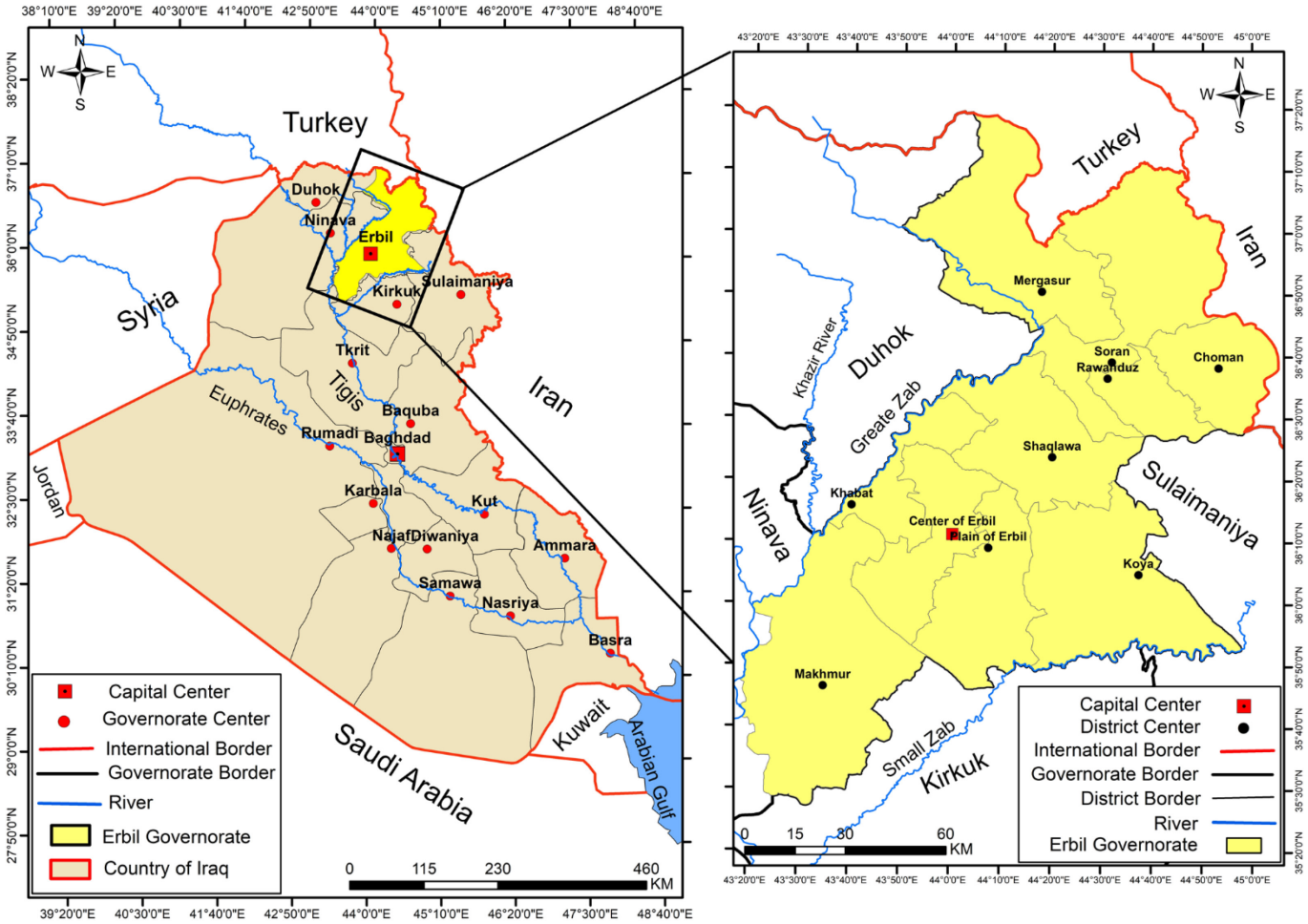
The CL case registration records consisted of four main sections. The first section included demographic information, where available, such as the patient's sex, age at diagnosis, current place of residence, and occupation. The second section described the clinical presentation of CL, including lesion location and number, date of lesion onset, date of case recording, and whether treatment was undertaken. The third section documented associated risk factors, including a history of CL among household members or neighbors, travel to an endemic region within the three months preceding symptom onset (with specification of location), ownership of farm animals and dogs, presence of stray dogs, and proximity of animal waste to the household. The final section addressed preventive and control strategies, such as insecticide spraying and fogging in residential areas, as well as the type of building materials used in housing.

Statistical analysis

The collected data were systematically entered into Microsoft Excel spreadsheets for descriptive analysis. Frequencies, percentages, and median values were calculated for descriptive statistics. The demographic characteristics of CL cases were analyzed by age (grouped into 10-year intervals from 0–9 years to ≥ 80 years), sex, and place of residence.

Statistical analysis was performed using Stata version 12 (StataCorp, College Station, TX, USA). Associations between the dependent and independent variables were evaluated using the chi-square test, and

Figure 1. Map of the study area.



logistic regression was conducted to assess the relationship between age and the number of cutaneous lesions. A $p < 0.05$ was considered statistically significant. CL epidemiological data were entered into ArcGIS 10.8 for spatial analysis.

Ethical considerations

This study was conducted in accordance with the World Medical Association's Declaration of Helsinki, which outlines ethical principles for medical research involving human subjects. As this retrospective study utilized secondary data without patient identifiers, ethical approval was not required.

Results

From 2020 to 2022, a total of 136 CL cases were reported, with a marked increase from 17 cases in 2020 to 54 cases in 2021. The highest number of cases was recorded in 2022 (64 cases), accounting for 50% of the total.

The median age of CL cases was 35 years (range: 0–90), with the most affected age group being 40–49 years (21.48%). This age group was the most affected among males, whereas the 0–9 age group was the most affected among females.

Human cases of CL were nearly equally distributed between males and females, with 68 cases in each group. In 2020, more cases were reported among males (12 cases) than females (5 cases). In 2021, both sexes showed a similar distribution (27 cases each). However, in 2022, the trend shifted, with a higher number of cases reported among females than males (35 and 29 cases, respectively).

Regarding occupation, the majority of cases occurred among housewives (34.38%), followed by laborers (29.69%) and children/students (26.56%). Additionally, the analysis of demographic characteristics showed no significant association between males and females, or among the five occupational categories, throughout the study years. The demographic characteristics of CL cases are summarized in Table 1.

Figure 2. Distribution of cutaneous leishmaniasis cases by district in Erbil province, 2020–2022.

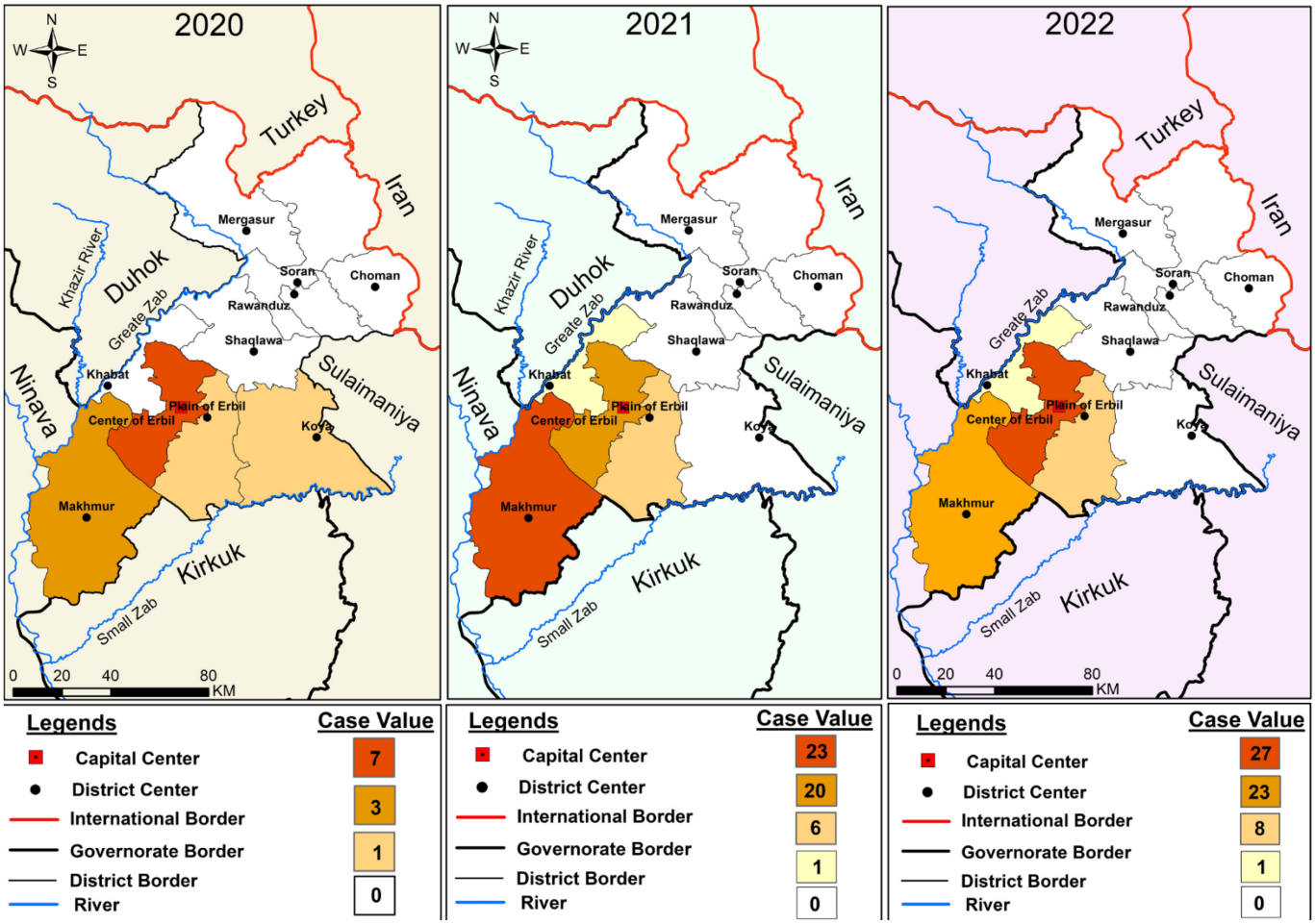


Table 1. Demographic characteristics of cutaneous leishmaniasis (CL) cases in Erbil province, 2020–2022.

Variable	n (%)		%
Sex			
Male	68		50.00
Female	68		50.00
Age group (years)	**Male**	**Female**	
0-9	7 (10.61)	15 (22.39)	17.78
10-19	8 (12.12)	6 (8.96)	10.37
20-29	10 (15.15)	11 (16.42)	15.56
30-39	8 (12.12)	8 (11.94)	11.85
40-49	19 (28.79)	10 (14.93)	21.48
50-59	6 (9.09)	12 (17.91)	13.33
60-69	5 (7.58)	4 (5.97)	6.67
70-79	2 (3.03)	1 (1.49)	2.22
> 80	1 (1.52)		0.74
Occupation			
Child/Student	34		26.56
Housewife	44		34.38
Non-employed	1		0.78
Laborer	38		29.69
Public servant	11		8.59

Two males and one female were excluded from the age group analysis due to missing data. Percentages for age groups are based on the remaining 66 males and 67 females. Statistical analysis over the 3-year study period (2020–2022) showed no significant associations in the distribution of CL cases by sex, age group, or occupation ($p > 0.05$).

Most cases were reported from two districts in Erbil: the Center of Erbil and Makhmur, accounting for 44.09% and 38.58% of cases, respectively. Additionally, four cases were reported from outside Erbil province (Figure 2).

The most common site of lesions was the hands (36.57%), followed by mixed lesions on the upper and lower limbs (16.42%) and the face (14.18%). The number of cutaneous lesions per patient ranged from 1 to 35, with a median of 2. Single lesions were observed in 34 patients (25.95%), two lesions in 33 individuals (25.19%), and three lesions in 17 patients (12.98%), while 26.72% of cases had five or more lesions per person. Treatment was received in 61.11% of CL patients (Table 2).

Regression analysis revealed a significant association between age and the number of cutaneous lesions ($p = 0.004$), indicating a weak positive relationship: lesion count increased slightly with age (Figure 3). However, no significant difference was observed between males and females in the number of lesions. Additionally, no significant associations were found between lesion sites or between cases who received treatment and those who did not throughout the study years.

Approximately 35.34% of cases reported a family member previously infected with CL, while 25.56% reported infected neighbors. Most CL patients (65.35%) had not traveled within the three months prior to the appearance of lesions, whereas 34.65% reported a travel history. Additionally, 37.82% of patients owned

Table 2. Clinical characteristics of cutaneous leishmaniasis (CL) cases in Erbil province, 2020–2022.

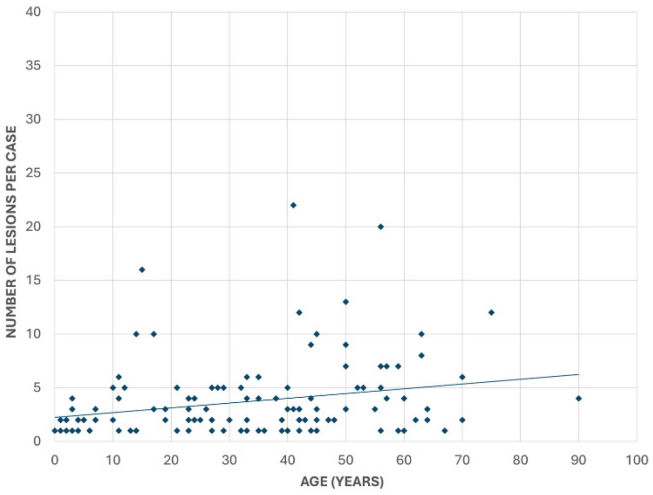
Variable	n	%
Site of lesion		
Face	19	14.18
Foot	15	11.19
Hand	49	36.57
Head	1	0.75
Leg	11	8.21
Neck	1	0.75
Face & abdomen	1	0.75
Face & upper limb	11	8.21
Face & lower limb	2	1.49
Face & upper & lower limbs	1	0.75
Head & Upper limb	1	0.75
Upper & lower limbs	22	16.42
Number of lesions per case		
1	34	25.95
2	33	25.19
3	17	12.98
4	12	9.16
≥ 5	35	26.72
Treatment is taken		
Yes	49	38.89
No	77	61.11

The total count does not sum to 136 due to missing data. Statistical analysis over the 3-year study period (2020–2022) showed no significant associations in the distribution of CL cases by lesion site, number of lesions per case, or treatment received ($p > 0.05$).

farm animals, and 22.96% reported animal waste near their homes. Stray dogs were reported in 55% of residential areas of cases, while 52.08% reported the presence of domestic dogs. Preventive spraying and fogging around houses were reported in only 3.94% and 3.97% of CL cases, respectively (Table 3).

Analysis of risk and environmental factors associated with CL cases across the study years showed no significant associations with travel history, the presence of leishmaniasis in neighboring areas, farm animals, animal waste near houses, insecticide spraying, or mosquito fogging in affected regions.

Figure 3. Association between age and number of cutaneous lesions per case in Erbil province, 2020–2022.



On the other hand, significant associations were found throughout the study years between CL cases with and without a family history of leishmaniasis (p = 0.002), between cases reporting the presence of stray dogs in their residential areas and those who did not (p < 0.001), between cases with and without the presence of domestic dogs (p = 0.008), and between cases according to the types of building materials used in their houses (p < 0.001).

Discussion

This retrospective study analyzed a range of epidemiological variables to identify the main risk factors for CL in Erbil province, Iraq. Our findings indicate that infection rates were similar between males and females after excluding individuals with a travel history to endemic regions. This observation is consistent with findings from several studies [10–12]. However, other studies have reported a higher incidence of CL among males, including a previous study in Erbil province that found males to be more affected than females [8,13].

Although CL affected all age groups, the highest proportion of cases in this study occurred among adults aged 40–49 years, followed by children aged 0–9 years. Males were predominantly affected in the 40–49 age group, whereas females were more affected in the 0–9 age group.

These findings are consistent with a previous study conducted in Erbil province, which reported that individuals aged 35–54 years accounted for the highest proportion of CL cases (42.7%) [13]. Similarly, a study in Italy reported the highest infections of CL among adults aged 20–50 years [14]. This is also consistent with findings from Iraq, where individuals aged ≥16 years accounted for 57% of cases, compared with 43% among those aged ≤15 years [15].

In contrast, other studies conducted in Erbil have reported a higher incidence of CL among individuals aged 15–34 years [8], while studies from other regions, including southern Iraq and Greece, have found the highest rate of CL in the 5–14 age group [2,10].

Differences in infection rates across age groups and sexes may be influenced by factors such as lifestyle, life expectancy, and time spent outdoors during peak vector activity periods, particularly at night, when sandfly activity is highest.

Regarding occupation, housewives constituted the largest proportion of cases (34.38%), followed by laborers (29.69%), while public servants were the least affected. Although outdoor occupations are generally associated with increased exposure to sandfly vectors, our findings suggest that occupation and sex do not significantly influence CL risk. This may be explained by the nocturnal behavior of sandflies, with transmission likely occurring within or around households; therefore, both sexes and all occupational groups are similarly exposed to infected sandfly bites in domestic settings.

Table 3. Risk and environmental factors associated with cutaneous leishmaniasis (CL) cases in Erbil province, 2020–2022.

Risk factors	n	%
Family history of leishmaniasis		
Yes	47	35.34
No	86	64.66
Travel history before infection (within 3 months)		
Yes	44	34.65
No	83	65.35
Leishmaniasis in neighboring areas		
Yes	34	25.56
No	99	74.44
Farm animal		
Presence	45	37.82
Absence	74	62.18
Stray dogs		
Presence	57	55.34
Absence	46	44.66
Domestic dogs		
Presence	25	52.08
Absence	23	47.92
Animal waste near the house		
Presence	31	22.96
Absence	104	77.04
Neighborhood sprayed for insects		
Presence	5	3.94
Absence	122	96.06
Neighborhood fogged for mosquitoes		
Presence	5	3.97
Absence	121	96.03
Building materials of the house		
Cement brick	126	92.65
Clay brick	5	3.68
Mud	2	1.47
Tent	3	2.21

The total count does not sum to 136 due to missing data. Statistical analysis over the 3-year study period (2020–2022) showed no significant associations (p > 0.05) in the distribution of CL cases by the following factors: travel history within 3 months prior to infection, presence of leishmaniasis in neighboring areas, proximity to farm animals, animal waste near the house, insecticide spraying in the neighborhood, and mosquito fogging in the neighborhood. In contrast, significant associations were observed with family history of leishmaniasis (p = 0.002), presence of stray dogs (p < 0.001), presence of domestic dogs (p = 0.008), and house building materials (p < 0.001).

Out of the ten districts in Erbil province, CL cases were reported in only five. The majority of cases were reported in the Center of Erbil district (44.09%), followed by Makhmur district (38.58%). In contrast, a previous study reported that most cases were reported in Makhmur district in 2016 [8].

The higher number of reported cases in the Center of Erbil district may be attributed to its proximity to Makhmur district. This proximity could allow sandfly vectors to expand their habitats from Makhmur to the Center of Erbil, which has a higher population density,

resulting in the observed increase in reported cases in this district.

A previous study on the morphological and molecular identification of sandfly species in Erbil province identified three species within the genus *Phlebotomus*: *Phlebotomus papatasi*, *Phlebotomus sergenti*, and *Phlebotomus alexandri*. Among these, *P. papatasi* was the most prevalent, followed by *P. sergenti* and *P. alexandri*. Sandflies were most abundant in Makhmur district, with Makhmur and Khabat districts exhibiting the highest biodiversity of sandfly species. Conversely, Soran and Shaqlawa districts showed no species diversity, which may explain the absence of CL cases in these areas. Meanwhile, the Center of Erbil district recorded the highest number of sandfly individuals but lower species diversity, which corresponded to a higher number of reported CL cases in the district [16].

In a study conducted in Sulaimaniya province, which borders Erbil province in Iraq, *L. major* DNA was detected in both engorged and non-engorged female *P. papatasi* sandflies using PCR and sequencing. The identified species matched those responsible for CL in humans and dogs in the same endemic area [17].

In the present study, the hands were the most affected body site. Similar findings have been reported in Erbil province [8]. The distribution of lesions is generally influenced by the degree of exposure of body parts and the host's susceptibility. In contrast, a study conducted in Turkey reported a higher proportion of facial lesions [18].

Clinical presentations of CL cases in Erbil province indicate that the majority of patients had multiple lesions, whereas single lesions accounted for only 25.95% of cases. This finding has also been reported previously in the same province [8]. However, studies from Pakistan have reported single lesions as the most common presentation [12].

Only 38.89% of patients received treatment for CL, while many did not seek medical care. This may be explained by the fact that cases are often recorded only when individuals present to healthcare centers for diagnosis and treatment.

Approximately 35.34% of cases reported that a household member had previously been infected with CL, which may reflect shared exposure to sandfly bites within the household.

Only 34.65% of cases reported a history of travel to endemic areas, suggesting that the majority of infections (65.35%) were likely infected locally within Erbil province, most likely through bites from the sandfly vector of leishmaniasis. In contrast, a previous study in the province found that approximately 75% of cases had a travel history to endemic areas, highlighting that travel increases the risk of exposure to the vector. These findings suggest that Erbil province may be becoming increasingly endemic for CL.

The results revealed that only 25.56% of the patients were aware of leishmaniasis cases in neighboring areas. However, this rate may be underestimated, as many individuals may feel stigmatized by the disease and therefore do not disclose it.

Although both *L. tropica* and *L. major* have been reported as causative agents of CL in Iraq [15], there is no evidence of anthroponotic cutaneous leishmaniasis (ACL) in Erbil province, despite the presence of its vector in the region [16]. Further investigation into the *Leishmania* species present in Erbil province is still needed; however, only zoonotic cutaneous leishmaniasis caused by *L. major* has been documented in the province.

Our findings indicate that the risk of CL is not directly associated with household ownership of farm animals, as only 37.82% of cases reported owning such animals. However, this proportion may still contribute to the potential spread of infection. Similarly, previous studies have suggested that the presence of farm animals is not associated with an increased incidence of CL in Morocco [19].

More than half of the cases reported the presence of stray and domestic dogs near their residence. Since dogs are primary reservoirs of CL, several studies have documented the association between the presence of dogs and the risk of CL, including those conducted in Tunisia [20], Greece [2] and Iraq [8].

In Erbil province, cement blocks are the primary construction material. Houses built with cement brick walls were associated with a higher risk of active CL, as 92.65% of infected individuals lived in such dwellings. Similar findings have been reported in Kabul, Afghanistan [21]. This disease is closely associated with poverty, often reflected in housing quality. Previous studies have shown that factors such as mud walls, dampness, and dark environments significantly increase the risk of leishmaniasis transmission [22].

Conclusions

During the study period, cases of CL showed an increasing trend. The findings indicate that CL is endemic in five districts—Center of Erbil, Makhmur, Plain of Erbil, Khabat, and Koya—out of the 10 districts

in Erbil province, Iraq. The most affected age groups were 40–49 years among males and 0–9 years among females. The results suggest that the habitats of CL cases have expanded beyond the focal district of Makhmur to the Center of Erbil, the province's most densely populated district, and may continue to spread to northern districts that were previously unaffected.

Analyzing trends in reported cases improves understanding of the disease's epidemiology and enables the identification of high-risk areas, which is essential for preventing future infections. Further research is needed to determine the factors influencing CL transmission and to develop effective control strategies. In addition, increasing awareness among healthcare workers and improving public knowledge of the disease are critical for mitigation. Education, combined with community engagement, can promote better hygiene practices and improved environmental conditions, ultimately reducing the spread of CL.

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Conflict of interest

No conflict of interest is declared.

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