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Outbreak

An outbreak of cutaneous leishmaniasis in Erbil governorate of Iraqi Kurdistan Region in 2015

Qasim B Abdulla[1], Nazar P Shabila[2], Tariq S Al-Hadithi[2]

[1] Directorate of Health, Erbil, Iraq
[2] Department of Community Medicine, College of Medicine, Hawler Medical University, Erbil, Iraq

Abstract

Introduction: This study aimed to identify the sociodemographic factors associated with the occurrence of an outbreak of cutaneous leishmaniasis in Erbil governorate and to determine the geographical distribution and clinical pattern of the disease during this outbreak.
Methodology: This cross-sectional study involved 234 cutaneous leishmaniasis cases from Erbil governorate. A questionnaire completed in an interview provided data on sociodemographic and clinical characteristics, risk factors, and preventive measures.
Results: About 60% of participants were younger than 35 years; 59.4% were living in urban areas. Most cases (40.2%) were from Maxmur district, while 20.9% were internally displaced persons and 7.7% were refugees. Nearly 70% of the cases had a low socioeconomic status. Cases with multiple lesions constituted 65.5%. Upper limb lesions constituted 44.7%. Most lesions were 1-5 cm in size (64.7%) and were wet (63.6%). Nearly three-quarters of the cases had a history of traveling to endemic areas; most (49.7%) to Maxmur district. Around 80% reported fogging around the houses and 44.4% in the working area. The peak incidence of the cutaneous leishmaniasis cases was in December, with a total of 115 cases.
Conclusions: Cutaneous leishmaniasis was not endemic in Erbil governorate, but it became a public health challenge in 2015. Most of the cases were reported in Maxmur district and among internally displaced people and military personnel deployed there. Control and prevention activities, including fogging and spraying, face important challenges and need strengthening, especially in Maxmur district.

Key words: Epidemiology; cutaneous leishmaniasis; risk factors; Erbil.

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Introduction

Leishmaniasis is caused by an intracellular parasite, which is transmitted to humans by the bite of infected female phlebotomine sandflies. The disease has three main forms: cutaneous leishmaniasis (CL), mucocutaneous leishmaniasis, and visceral leishmaniasis, depending on the species of *Leishmania* parasite involved and the immune response of the host [1].

Cutaneous leishmaniasis is a tropical infection of major public health importance [2]. An estimated 0.7 million to 1.3 million new cases occur worldwide annually. About 95% of CL cases occur in the Americas, the Mediterranean basin, the Middle East and Central Asia. Over two-thirds of new CL cases occur in 6 countries: Afghanistan, Algeria, Brazil, Colombia, Iran, and Syria. The disease affects some of the poorest people on the planet and is associated with malnutrition, population displacement, poor housing, a weak immune system and lack of resources [3].

Iraq is in the high endemic area with a range of 1000-4999 new cases reported in 2013, as are Turkey, Saudi Arabia, and Kuwait, while Iran and Syria reported a higher incidence of more than 5000 new cases [4,5]. Cutaneous leishmaniasis is widespread throughout Iraq, except for the three governorates in the northeast, bordering Turkey and Iran, where cases are rare [6]. Endemicity has been constant since the late eighties of the last century. Then, an outbreak occurred in 1991 which lasted for six years, during which 8000-9000 new cases were reported every year, followed by a gradual decrease in the endemicity of the disease which reached a peak in 2002. After that, there was again a gradual increase in the incidence from 2003 to 2013, reporting 1000-3000 cases per year. Two epidemic outbreaks of CL were reported in the Diwaniya governorate in 2008 with about 300 cases and in Baghdad governorate in 2009 with about 400 cases [7]. The incidence of CL has increased, and the disease has expanded to new foci, potentially because of risk factors such as population growth and displacement,

urbanization, anthropogenic environmental modifications, human behaviors, drug resistance, and new agricultural practices [8,9]. The impact of these risk factors differ markedly depending on the epidemiological entity of CL. Since the CL caused by *Leishmania tropica* has an anthroponotic nature, it has risk factors such as proximity of human settlements to forested areas, pronounced poverty associated with poor housing that allows uncontrolled vector to human contact, lack of bednets, and lack of awareness on CL as a public health problem [10]. On the other hand, CL due to *Leishmania major* is zoonotic, with a rodent reservoir, and its specific risk factors are among young men, farmers, ranchers and military personnel and others traveling to or living in rural and agricultural endemic areas [11].

Data obtained from both the Ministry of Health of Kurdistan region and Erbil Directorate of Health (DOH) revealed that no cases of CL were reported before 2010. The incidence of CL in Erbil governorate was zero in 2008 [6]. In 2010, 15 cases were reported, increasing to 34 in 2011 and then to 88 in 2014. In 2015, up to the 23rd of December, the number of cases reached 228 (*S. Muhyaddin, personal communication, December 29, 2015, Head of Communicable Diseases Control Unit of the Preventive Directorate, Erbil DOH*), indicating an outbreak of CL in Erbil governorate. This study aimed to determine the sociodemographic and environmental factors associated with the occurrence of this outbreak and the geographical distribution of the cases, and to explore the most effective measures applied for control of this outbreak.

Methodology

Study design, study setting and time of study

A cross-sectional study was conducted from the 1st January to the 31st December 2016. Data was collected from the Preventive Health Directorate of Erbil DOH and the affected areas in Erbil governorate, which include the ten administrative districts of Erbil central district, Dashti Hawler, Shaqlawa, Soran, Rawanduz, Xabat, Koya, Mergasor, Choman, and Maxmur.

Study population and sampling

All clinically diagnosed CL cases that occurred in Erbil governorate in 2015 and were registered in the Center for Disease Control of the Preventive Health Department were included in the study. All these cases were diagnosed clinically by dermatologists. Tissue smear microscopy was not done due to lack of facilities and expertise.

Data collection

Data were collected at the start of the study from the Center for Cisease Control of the Preventive Health Department in Erbil DOH. Then, daily visits to the Center for Disease Control were arranged for one week, during which time data were collected from the registration book of CL cases there.. Full contact information was obtained for each case to arrange for a visit and direct interview. A total of 259 cases of CL were reported at the center. Of these, the recorded contact data was insufficient for 21 cases. One person refused to participate in the study. Three cases were lost to to follow-up because of travel abroad.. As a result, 25 cases were excluded leaving a total of 234 cases for the study.. Data were collected during direct interviews lasting about one hour, using a specially designed questionnaire.

The questionnaire was assessed in a pilot study of 5 cases inside Erbil before the start of the study then modified to be more practical, comprehensive and convenient. Physical examination of the cases was also performed at the time of the interview.

The questionnaire

A closed questionnaire was designed and completed during direct interviews. It included five main sections. The first section was on the sociodemographic characteristics (SDC) of the cases. The second section was about the socioeconomic status, which was determined according to the socioeconomic index developed by Omer and Al-Hadithi [12]. The third section covered clinical data, comprising the number, site, size, and type of the lesions and date of the onset of the condition. The fourth section included risk factors such as a history of traveling to endemic areas, a history of contact with domestic animals, the presence of wild animals and rodents near the living or working area, the presence of mosquitoes in the house, and a history of sleeping outside the house. The last section was about preventive measures, such as fogging or rodenticidal programs at the housing area or working area, or the use of mosquito nets.

Ethical considerations

The study protocol was approved by the research ethics committee of the Kurdistan Board of Medical Specialties. Written permission was obtained from Erbil DOH. Verbal consent was obtained from each participant before they were enrolled in the study.

Statistical analysis

Data were analyzed using the statistical package for the social science (SPSS), version 19. Descriptive analysis included calculation of frequencies and percentages of the variables.

Results

The total number of CL cases included in the study was 234; 151 (64.5%) of them were males. The age of the participants ranged from one to 83 years with a mean age ± SD of 30.89 ± 16.84 years. About 60% of participants were younger than 35 years. The most commonly affected age group with CL was 15-34 years, constituting 35.8% of all cases. Married participants constituted nearly 60%. Around 60.0% of the cases were Kurds and 37.6% Arabs. Muslims constituted 94.0% of the cases, and 59.4% of the cases were living in urban areas. Urban and rural areas were classified according to the availability of municipal services. Unskilled manual occupations and semi-skilled manual occupations constituted nearly 90% of cases, and cases among the military (Peshmarga) represented 30.8%. Regarding the education, , 72.6% of the cases had an educational level of high school and below. Nearly 70% of the cases were of low socioeconomic status. Details of the sociodemographic characteristics of the study sample are shown in Table 1.

Most of the cases were from Maxmur district, constituting 40.2 %, followed by Erbil central district (24.8%%) and Dashti Hawler (13.2%) as shown in Table 2. Out of the total sample, 49 (20.9%) were displaced people, and 18 (7.7%) were refugees.

Cases with multiple lesions constituted 65.0%. Upper limb lesions constituted 44.7% of the lesions and face constituted 25.4%; 64.7% of the lesions were 1-5 cm in size, and 63.6% were wet lesions. Details are shown in Table 3.

Nearly three quarters (74.8%) of the cases had a history of traveling to endemic areas; 142 (81.1%) had traveled within the last two months before the occurrence of the skin lesion. Nearly half of the cases had traveled to Maxmur district, while 12 (6.7%) of the cases had traveled abroad, including eight who went to to Syria, three to Iran, and one to Turkey. Around 7% of the cases reported contact with domestic dogs.

Table 1. Sociodemographic characteristics of CL cases in Erbil governorate in 2015 (N = 234).

Sociodemographic characteristics	No. (%)
Gender	
Male	151 (64.5)
Female	83 (35.5)
Age group (years)	
< 15	55 (23.6)
15 – 34	84 (35.8)
35 – 54	72 (30.8)
≥ 55	23 (9.8)
Ethnicity	
Kurds	141 (60.3)
Arabs	88 (37.6)
Turkman	5 (2.1)
Religion	
Muslims	220 (94.0)
Christians and Ezedian[a]	14 (6.0)
Marital status	
Married	138 (59.0)
Single	85 (36.3)
Widowed and divorced[b]	11 (4.7)
Residency	
Urban	139 (59.4)
Rural	95 (40.6)
Socioeconomic status	
Low socioeconomic status	162 (69.2)
Middle socioeconomic status	69 (29.5)
High socioeconomic status	3 (1.3)

[a] Including two Ezedian cases; [b] Including two divorced case.

Table 2. Distribution of the CL cases according to districts in Erbil governorate in 2015.

Districts	No. (%)	No. of quarters and sub-districts
Maxmur	94 (40.2)	8
Erbil (central district)	58 (24.8)	39
Dashti Hawler	31(13.2)	12
Koya	21 (9.0)	6
Shaqlawa	6 (2.6)	4
Xabat	12 (5.1)	1
Soran and Mergasor[a]	12 (5.1)	7
Total	**234 (100.0)**	**77**

[a] Only one case was from Mergasor.

Table 3. Clinical data of CL cases in Erbil governorate in 2015.

Variable	No. (%)
Number of the lesions (n = 234)	
Single lesion	82 (35.0)
Multiple lesions[a]	152 (65.0)
Site of lesion (n = 552)	
Upper limb	247 (44.7)
Face	140 (25.4)
Lower limb	89 (16.2)
Neck	52 (9.4)
Trunk	24 (4.3)
Size of the lesion (n = 552)	
< 1cm	93 (16.8)
1-5cm	357 (64.7)
> 5cm	102 (18.5)
Type of the lesion (n = 552)	
Wet	351 (63.6)
Dry	201 (36.4)

[a] Including 82 cases having two lesions, 25 cases having three lesions and 45 cases having four lesions and more (total number of lesions = 552).

Twelve percent of the cases reported the presence of wild animals (stray dog, fox, and wolf) at the living area. Stray dogs constituted around 90% of the wild animal type in the living area. On the other hand, 20.5% of the cases reported wild animals around their working area. While 17.5% of the cases reported the presence of rodents in their living area, 28% reported rodents in their working area. Details are shown in Table 4.

Around 80% of cases reported fogging around the houses and 44.4% in the working area. Spraying was done in the living area of 19.2% of the cases and in the working area of 39.3%. Rodenticides were used in the living area of 4.3% of the cases, and they in the working areas of 4.7 %.. Details are shown in Table 5.

Concerning the monthly distribution of CL cases in 2015, most cases were recorded in December (115 cases), followed by February (32 cases), March (28 cases), November (21 cases) and October (11 cases).

Discussion

Cutaneous leishmaniasis is not an endemic disease in the Kurdistan region of Iraq, particularly not in Erbil governorate. Due to internal conflicts and immigration of people to the Kurdistan region, the disease has now been reported in Erbil among internally displaced persons, military personnel, and the Erbil indigenous population. In two community-based studies just to the south of the Kurdistan region, the incidence was 2.5 cases/10000 in Tikrit city [13] and 15 cases/10000 in Kirkuk governorate in 2010 [14]. Additionally, in a hospital-based study in Samara [15], the incidence rate was 5.5 cases/10000 in 2009. The incidence of CL in Turkey was 4.6 cases/10000 in 2011in Hatay [16], an area far away from the Iraqi-Turkish border.

A review in 2016in Iraq of CL cases from 2008 through 2015 showed that the mean incidence of CL for the 8-year period was 0.3 cases/10000 cases in Erbil, 4.5/10000 cases in Sulaimaniya, 9.0/10000 cases in Kirkuk and 9.29 cases/10000 in Baghdad Karkh. Salah-

Table 4. Risk factors for the CL cases in Erbil governorate 2015.

Variable	No. (%)
History of traveling to endemic areas	175 (74.8)
The period within which CL patients traveled to endemic area (n = 175)	
< 2 months before the occurrence of the skin lesions	142 (81.1)
2-4 months before the occurrence of the skin lesions	26 (14.9)
> 4 months before the occurrence of the skin lesions	7 (4.0)
Site of traveling (n = 175)	
Makhmur	87 (49.7)
Other governorates of Kurdistan	21 (12.1)
Rest of Iraq	55 (31.4)
Abroad (Outside Iraq)[a]	12 (6.8)
Contact with domestic dogs	16 (6.8)
Presence of wild animals in the living area	28 (12.0)
Presence of wild animals in the working area	48 (20.5)
Type of the wild animal in the living area (n = 28)	
Stray dog	25 (89.3)
Fox and wolf	3 (10.7)
Presence of rodents (mouse) at house	41 (17.5)
Presence of rodents (mouse) at work	66 (28.2)
Presence of mosquitoes in the house	145 (62.0)
Sleeping outside	56 (23.9)

[a] Eight cases traveled to Syria, three cases to Iran and one case to turkey.

Table 5. Preventive measures data of CL cases in Erbil governorate in 2015.

Preventive measures	No. (%)
Fogging at the living area	187 (79.9)
Spraying in the living area	45 (19.2%)
Rodenticide use in the living area	10 (4.3)
Fogging at the working area	104 (44.4)
Spraying in the working area	92 (39.3%)
Rodenticide use at working area	11 (4.7)
Use of mosquito net	20 (8.5)

Eddin governorate had the highest incidence at 24.2/10000 cases. The reported rate in Duhok governorate was zero [17], although 10 cases were reported in 2015 by the Center for Disease Control Baghdad [18]. The low incidence of CL in the Kurdistan region of Iraq is probably due to the low density of the vector, the sandfly, which prefers the tropical and sub-tropical regions [17].

Males were more affected with CL (64.5%) than females, which is constent with reports from Alhaweja district of Kirkuk in Iraq [7], Colombia [19], Iran [20,21], Saudi Arabia [22], Turkey [23], Yemen [24], Palestine [25] and Afghanistan [26]. In Morocco [27] and Turkey [28,29], however, more female cases were reported. This may be attributed to higher exposure of males, taking into consideration that nearly all the military forces (Peshmarga) in Erbil governorate are males, which represent 30.8% of the cases. Other factors include variations in the size of the study population and the study design and climate variations. The higher exposure of males to insect bites is not only among military personnel, but also among other groups such as farm workers.

The most commonly affected age group by CL in this study was 15-34 years. This finding is in agreement with that of another study in Iraq [17], and in contrast with that of a study in Yemen in which the most frequent age group affected was 10-20 years [24]. In Morocco, children were the most commonly affected age group [27] and in Algeria the most frequently affected age group was 10-15 years [30]. The low density of the vector of the disease [21] results in a low incidence of disease in younger age groups, while older individuals may travel more frequently than younger ones to endemic areas; they also constitute most of the military forces and farm workers. Younger and older people may stay indoors more and consequently they are less likely to be bitten by the vector.

In contrast to most of the other studies, the incidence of the CL in this study was higher in urban than in rural areas. In Saudi Arabia [22], Morocco [27] and Turkey [28], the incidence of CL was greater in rural than in urban areas.

Most of the rural areas of Erbil governorate are geographically located far away from the endemic areas, and they are not adjacent to such areas. The majority of the cases reported in Maxmur district were from the central urban quarters of the district. The fact that most Peshmargas are from urban areas may also have contributed to the high proportion of CL cases in urban areas. However, a role for human subjects in spreading CL cannot be confirmed because of the lack of information about the type of *Leishmania* parasite and the type of sandflies in the affected urban areas. Such a role is possible if the CL agent were shown to be *L. tropica* and if high densities of the vector Phlebotomus sergenti were found in the affected urban districts.

The high frequency of CL found in Maxmur district can be investigated from two aspects. First, Maxmur district borders the three governorates of Kirkuk, Salahaddin, and Ninava all of which have endemic CL and are unstably afflicted by war and conflicts with ISIS. Second, the control and prevention programs of CL are no longer undertaken in Maxmur district, as a consequence of the instability in the area.

The proportion of multiple skin lesions in this study was 65.0%, similar to findings of studies done in Iraq [7] and Turkey [28]. However, it is in contrast to results in Yemen [24] and Palestine [25] which reported more solitary skin lesions. This could be related to the variation in the degree of endemicity of CL. About 65% of the skin lesions were 1-5 cm in size. In Yemen, a similar finding was reported in 2016 [22]. Wet skin lesions accounted for about two thirds of clinical cases of CL, and one third were dry type lesions. These observations are in agreement with those reported in Turkey [23] and Afghanistan [26] and in contrast to reports from Yemen [24]. It was previously thought that the high rate of wet skin lesions in Iraq was related to infection with *L. major,* which is the common in rural parts of Iraq [31]. Classically, it was suggested that the lesions caused by *L. major* in rural areas are wet and those caused by *L. tropica* in urban areas are dry. However, these definitions are no longer valid [31-33]. Moreover, there is also the possibility of having lesions caused by *L. infantum*, which is also known to cause CL in Iraq [31].

In this study, a high proportion of the lesions of CL were located on the upper limbs, reaching 45%. A similar observation was reported by Al-Obaidi in Iraq [17]. In a study in Turkey [29], the face was most commonly affected.. As sandflies attack the exposed areas of the body, the lesions most frequently appear on the upper limbs, legs, and face. The differences in the distribution of lesions noted in the studies mentioned above may be explained by the living conditions and social habits of the people. In general, the presence and distribution of lesions depend on exposure and the susceptibility of the host.

New cases of CL tended to increase in October and reach a maximum in December, accounting for around half the cases. The incidence then starts to decline from April and reaches the lowest level in August, when no

cases were reported. Data obtained from the Erbil DOH revealed that the majority of CL patients attending the dermatological clinic in hospitals of Erbil come between September and March (*S. Muhyaddin, personal communication, December 25, 2015*). This finding agrees with the findings reported by AL-Obiadi in Iraq [17], but not with those reported from Iran [24] (January to April) or Afghanistan (March to July) [26]. This variation in seasonal peak could be due to the existence of various dominant reservoir species in each study area. This explanation may be valid regarding the *Leishmania* species involved since *L. major* lesions evolve more quickly, whereas *L. tropica* lesions typically have a longer incubation period of weeks or months.

The high proportion of military personnel (Peshmarga) with CL, 30.7% of cases, might be attributed to their serving in endemic areas bordering Kirkuk and Ninawa governorates. Similarly, military personnel deployed to the endemic areas reported a high incidence of CL infection in South America [34].

In this study, nearly 70% of the cases were of low socioeconomic level, reflecting the predominantly low socioeconomic level of the area. It is well known that CL affects the poor and is associated with population displacement, poor housing and lack of financial resources [3,31].

The finding that about 75% of the cases had a history of travel to endemic areas reflects the fact that traveling increases the contact of the cases with vectors. A study in Mali also reported a high incidence of CL cases among travelers to endemic areas [11].

Fogging was not done in the living areas of 20.1% of the cases; most of them (90%) were from Maxmur district. These areas were not included in the fogging program of Erbil DOH because Maxmur district is administratively a part of Ninawa governorate. On the other hand fogging was not done in working areas of 55.6% of the cases, because most of them are located in military hot areas. Despite the finding that fogging was done in 80% of living area of affected cases in 2015, CL cases still occurred and increased in 2016. This is not surprising, as fogging is not the most effective method to control sand flies. Indoor residual spraying is indicated, at least for the endophilic species such as *P. sergenti*, which is the proven or suspected *Phlebotomus* vector for *L. tropica* in Iraq [31]. Moreover, researchers have noticed that the fogging program was often not applied correctly. The fogging program of the Center for Disease Control started every year in May and continued into October. All quarters of the Erbil central district and the Dashti Hawler district were included in this program. Activities began in early morning hours for the convenience of the teams (*S. Muhyaddin, personal communication, December 29, 2015)*, wherea it is recommended to do so at night (after 9 p.m.) because that peak insect activity time for females seeking blood meals. The density of the flying insects is greater in early night than in early morning. The economic crisis in the Iraqi Kurdistan region also hampered the fogging program. Previously, each area underwent fogging once every 40 days. However, it is now done once a year (*A. Rasul, personal communication, May 24, 2016, Head of the Rodenticide Subunit of the Communicable Cisease Control Uunit, Erbil DOH*). The in correct and inadequate fogging program is a contributing factor to the continuous increase in CL cases in Erbil governorate. Another cause of the increase is that the rodenticide spray was incorrectly and inadequately applied. This program was also not appropriately implemented because of the economic crisis.

This study was limited by the lack of the important information about the etiology of CL in Erbil. Knowledge of the *Leishmania* species causing CL would be of great help in the epidemiological investigation and confirmation of risk factors. This is particularly important to guide vector control in the case of Erbil, which was previously a non-endemic area.

Conclusions and Recommendations

Cutaneous leishmaniasis is not an endemic disease in Erbil governorate, but it became a public health challenge in 2015. Most of the cases were reported in Maxmur district and mostly among those who had visited Maxmur, and among displaced people and military persons in Maxmur district. The majority of cases were among males in the productive age of 15-34 years with a history of traveling to affected endemic areas. Cases are increasingly reported despite control and preventive efforts. Control and prevention programs, including fogging and spraying, need to be appropriately and adequately applied, especially in Maxmur district by DOH Erbil. More coordination with military units may support better and effective control and prevention of CL in the afflicted areas. There is a need to raise the awareness of the health professionals regarding the epidemiological and clinical aspects of CL. Employees at the centers for disease control need more training on the correct methods for fogging and spraying. The DOH should provide informationabout the endemic areas of CL and about how to avoid sandfly bites. Better control also needs information about the *Leishmania* species causing CL in Erbil, through

parasite typing on positive slide smears by the regional reference centers.

References

1. Torres-Guerrero E, Quintanilla-Cedillo MR, Ruiz-Esmenjaud J, Arenas R (2017) Leishmaniasis: a review. F1000Res 6:750.
2. Reithinge R, Dujradin J, Louzir H, Pirmez C, Alexsander B, Brooker S (2007) Cutaneous leishmaniasis. Lancet Infect Dis 7: 581-596.
3. World Health Organization (2017) Leishmaniasis. Fact sheet. No375. Available: http://www.who.int/mediacentre/factsheets/fs375/en/. Accessed 27 February 2018.
4. World Health Organization (2013) Global health observatory data repository. Neglected tropical disease. Leishmaniasis. Status of endemicity of cutaneous leishmaniasis, data by country. Updated 2013 Dec. Available: http://apps.who.int/gho/data/node.main.NTDLEISHCEND?lang=en. Accessed: 11 December 2016.
5. World Health Organization (2015) Leishmaniasis control program. Annual country report, world endemicity of cutaneous leishmaniasis. Available: http://gamapserver.who.int/mapLibrary/Files/Maps/Leishmaniasis_2015_cutaneous leishmaniasis.png. Accessed: 21 November 2016.
6. World Health Organization (2008) Communicable disease toolkit. Iraq Crisis. Available: www.who.int/diseasecontrol_emergencies/toolkits/Iraq_profile_ok.pdf. Accessed: 19 October 2016.
7. AlSamarai AM, AlObaidi HS (2009) Cutaneous leishmaniasis in Iraq. J Infect Dev Ctries 3: 123-129. DOI: https://doi.org/10.3855/jidc.59
8. Khosravi A, Sharifi I, Dortaj E (2013) The present status of cutaneous leishmaniasis in a recently emerged focus in South-west of Kerman Province, Iran. Iran J Public Health.; 42: 182-187.
9. Pour R, Sharifi I, Kazemi B (2011) Identification of non-responsive isolates to glucantime in patients with cutaneous leishmaniasis in Bam. J Kerman Univ Med Sci 18: 123-133.
10. Odiwuor S, Muia A, Magiri C, Maes I, Kirigi G, Dujardin JC, Wasunna M, Mbuchi M, Auwera GV (2012) Identification of *Leishmania tropica* from micro-foci of cutaneous leishmaniasis in the Kenyan Rift Valley. Pathog Glob Health 106: 159-165.
11. Kone AK, Niare DS, Thera AM, Kayentao K, Djimde A, Delaunay P, Kouriba B, Giudice PD, Izri A, Marty P, Doumbo OK (2016) Epidemiology of the outbreak, vectors and reservoirs of cutaneous leishmaniasis in Mali: A systematic review and meta-analysis. Asian Pac J Trop Dis 9: 985-990.
12. Omer W, Al-Hadithi T (2017) Developing a socioeconomic index for health research in Iraq. East Mediterr Health J 23: 670-677.
13. Alaa NH (2008) Epidemiology of skin diseases in Tikrit and vicinity: A community based study. Master's thesis in Community Medicine. Tikrit University, Salah Adin, Iraq. 73 p.
14. Murtada SJ (2010) Epidemiology of skin diseases in Kirkuk. Master's thesis in Community Medicine. Tikrit University, Salah Adin, Iraq. 81 p.
15. Alsamarai AG (2009) Prevalence of skin diseases in Iraq. Int J Dermatol 48: 734-739.
16. Akcali C, Culha G, Inaloz HS (2011) Cutaneous leishmaniasis in Hatay. J Turk Acad Dermatol 1: 1-5.
17. Al-Obaidi MJ, Abdulhusain MY, Al-Saqur IM (2016) Survey study on the prevalence of cutaneous leishmaniasis in Iraq. Iraqi J Sci 57: 2181-2187.
18. CDC Bagdad, Iraq Surveillance section (2016) Monthly morbidity report. Available: https://mail.google.com/mail/u/0/#inbox/154d8e8ef0b7758d. Accessed: 11 February 2017.
19. Ferro C, Lopez M, Fuya P, Lugo L, Cordovez JM, Gonzalez C (2005) Spatial distribution of sand fly vectors and eco-epidemiology of cutaneous leishmaniasis transmission in Colombia. PloS One 10: e0139391.
20. Talari SA, Shajari G, Talaei R (2006) Clinical finding of cutaneous leishmaniasis as a new focus of Iran. Internet J Infec Dis 1: 6-14.
21. Hezari F, Niyyati M, Tabaei SJ, Mohebali M, Vaziri VM, Behniafar H, Azargashb E, Taghipour N (2016) Frequency of cutaneous leishmaniasis and species identification in suspected individuals from Golestan province, Northern Iran in 2014. Iran J Public Health 45: 1348-1354.
22. Haouas N, Amer O, Ishankyty A, Alazmi A, Ishankyty I (2015) Profile geographical distribution of reported cutaneous leishmaniasis cases in Northwestern Saudi Arabia from 2010-2013. Asian Pac J Trop Dis 8: 287-291.
23. Kocarsalan S, Turan E, Ekinci T, Yesilova Y, Apari R (2013) Clinical and histopathological characteristics of cutaneous leishmaniasis in Sanliurfa city of Turkey including Syrian refugees. Indian J Pathol Microbiol 56: 211-215.
24. Muqbil NA, Muqbel AM (2016) Cutaneous leishmaniasis in Al-Sawalha area, Lahj governorate, Yemen. Micromedicine 4: 37-42.
25. Azmi K, Schonian G, Nasereddin A, Schunur LF, Sawalha S, Hamarsheh O, Ereqat S, Amro A, Qaddomi SE, Abdeen Z (2012) Epidemiological and clinical features of cutaneous leishmaniases in Jenin district, Palestine, including characterization of the causative agents in clinical samples. Trans R Soc Trop Med Hyg 106: 554-562.
26. Faulde M, Schrader J, Heyl G, Amirih M (2008) Differences in transmission seasons as an epidemiological tool for characterization of anthroponotic and zoonotic cutaneous leishmaniasis in northern Afghanistan. Acta Tropica 105: 131-138.
27. Alasari A, Almathi Y, Najy M, Alraouat O, Belghyti D (2016) Epidemiology of cutaneous leishmaniasis in Sidi Kacem province, northwestern Morocco (2006–2014). Asian Pac J Trop Dis 6: 783-786.
28. Turhanoglu M, Alperdal S, Bayindir BF (2014) A nine-year evaluation of cutaneous leishmaniasis patients in Diyarbakir training and research hospital, Turkey. Mikrobiyol Bul 48: 335-340.
29. Inci R, Ozturk P, Mulayim MK, Ozyurt k, Alatash ET, Inci MF (2015) Effect of the Syrian civil war on prevalence of cutaneous leishmaniasis in Southeastern Anatolia, Turkey. Med Sci Monit 21: 2100-2104.
30. Khezani B, Bouchimal S (2016) Demographic and spatio-temporal distribution of cutaneous leishmaniasis in the Souf oasis (Eastern South of Algeria). Acta Tropica 166: 74-80.
31. World Health Organization (2010) Control of the leishmaniasis: report of a meeting of the WHO Expert Committee on the Control of Leishmaniases. Available: http://apps.who.int/iris/bitstream/handle/10665/44412/WHO_TRS_949_eng.pdf;jsessionid=F6BC1399FC662F874AF0FEA9BEAE3922?sequence=1. Accessed 20 February 2018.

32. Todd WTA, Lockwood DNJ, Sundar S (2014) Infectious diseases. In Walker BR, Colledge NR, Raliston SH, Penman ID, editors. Davidson's Principles and Practice of Medicine. Edinburgh: Churchill Livingstone Elsevier. 365-367.
33. Jacobson RL (2003) *Leishmania tropica* (*Kinetoplastida: Trypanosomatidae*) – a perplexing parasite. Folia Parasitol 50: 241-250.
34. Oré M, Sáenz E, Cabrera R, Sanchez JF, De Los Santos MB, Lucas CM, Núñez JH, Edgel KA, Sopan J, Fernández J, Carnero AM, Baldeviano GC, Arrasco JC, Graf PC, Lescano AG (2015) Outbreak of cutaneous leishmaniasis in Peruvian military personnel undertaking training activities in the Amazon basin, 2010. Am J Trop Med Hyg 93: 340-346.

Corresponding author
Dr. Nazar P. Shabila, MD. PhD.
Hawler Medical University,
Peshawa Qazi Street 100M, Erbil, Iraq
Phone: 00964-750-4450611
Email: nazarshabila@gmail.com

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