

An Epidemiological Analysis of Leishmaniasis in Dhamar Governorate (2011–2013), Northern of Yemen.

تحليل وبائي لداء الليشمانيا في محافظة ذمار (2011-2013)، شمال اليمن

Zalalham Al-Koleeby^{1, 3}, Ateeq Al-Arami², Abdulkarem Alrezaki², Jihad Mawlid³, Maryam Al-Sanea³, Nada Al Mushki³, Amat Alkhalq Al Bukhiti³, Amt Alslam Al Romi³, Amt Aljalil Alkhder³ and Sorour Said³

^{1, 2, 3}Department of Biology, Faculty of Education, Thamar University.

Zalalham2016@tu.edu.ye

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Abstract

المخلص

Over the past few years, Dhamar Governorate in North Yemen has seen an increase in leishmaniasis cases. The current study aims to assess the epidemiological profile, namely the spatiotemporal tracking of all leishmaniasis cases, and provides an epidemiological overview of the local population. This review focuses on leishmaniasis cases that were documented from 2011 to 2013. To analyze the data, Excel software (version 20) was utilized. There were 759 instances of leishmaniasis over a three-year period, from 2011 to 2013, with 94.99% of cases being cutaneous and 5.01% being mucocutaneous. There are between 0.97564276 and 0.05818674 cases of leishmaniasis in the Governorate of Dhamar. For every type of leishmaniasis, the male sex was more affected than the female sex. Cutaneous leishmaniasis had a major effect on all age groups: patients aged 0–10 made up 54.94% of cases, while those aged 11–20 made up 28.15%. Mucocutaneous leishmaniasis has primarily affected aged [0–10] with 86.84% of cases. Geographically, the Anss region recorded the highest number of leishmaniasis cases (107 cases), followed by Maghrib Ans (29 cases) and Utmah (53 cases). Thus, leishmaniasis is a major health risk in Dhamar Governorate. To stop the disease's spread, all concerned parties must move fast to set up a regional control program, and additional research on the dynamics and ecology of sandfly vectors.

Keywords: Leishmaniasis, Mucocutaneous, Cutaneous, Prevalence, Dhamar Governorate, Yemen.

يهدف هذا البحث إلى إظهار حالات داء الليشمانيا على مدى السنوات القليلة الماضية، في محافظة ذمار شمال اليمن نظراً لتفشي حالات داء الليشمانيا، كما تسعى هذه الدراسة إلى تقييم الملف الوبائي، أي تتبعه مكانياً وزمنياً لجميع حالات داء الليشمانيا قصد توفير نظرة وبائية عامة عن السكان المحليين. كما ركزنا على حالات داء الليشمانيا التي تم توثيقها من عام 2011 وحتى عام 2013، وتم استخدام برنامج Excel (الإصدار 20) لتحليل البيانات، إذ كان عدد الحالات 759 حالة من داء الليشمانيا على مدى الثلاث السنوات، إذ جاءت ما نسبته 94.99% من الحالات الجلدية، ونسبة 5.01% من الحالات الجلدية المخاطية. لذا فإنه يوجد ما بين 0.97564276 و 0.05818674 حالة من داء الليشمانيا في محافظة ذمار بالنسبة لكل نوع من أنواع داء الليشمانيا، وقد كان جنس الذكور أكثر تأثراً من جنس الإناث. وكان لداء الليشمانيا الجلدي تأثير كبير على جميع الفئات العمرية فقد شكل المرضى الذين تتراوح أعمارهم ما بين 0-10 سنوات ما نسبته 54.94% من الحالات، في حين شكل المرضى الذين تتراوح أعمارهم ما بين 11-20 سنة ما نسبته 28.15%. بينما أصاب داء الليشمانيا الجلدي المخاطي بشكل أساسي الأشخاص الذين تتراوح أعمارهم ما بين [10-0] فكانت نسبة إصابتهم بداء الليشمانيا الجلدي المخاطي 86.84% من الحالات، وسجلت منطقة عنس أعلى عدد من حالات داء الليشمانيا، إذ وجدت بنسبة (107 حالة)، تليها منطقة مغرب عنس بنسبة (29 حالة)، وعمته بنسبة (53 حالة). وبناء على هذه النتائج، فإن داء الليشمانيا يشكل خطراً صحياً كبيراً في محافظة ذمار. ولوقف انتشار المرض، يجب على جميع الأطراف المعنية التحرك بسرعة لإنشاء برنامج وطني وإقليمي لمكافحة المرض. وإجراء بحوث إضافية حول ديناميكيات وبنة نواقل ذبابة الرمل.

الكلمات المفتاحية: داء الليشمانيا، الجلدي المخاطي، الانتشار، ذمار اليمن.

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Introduction

The parasites that cause leishmaniasis are flagellated protozoa of the *Leishmania* species. When bitten by a female sand fly, humans develop various parasite diseases that are transferred both to animals and humans. There are approximately twenty species of *Leishmania* that are known to be dangerous to humans, and the species (mucocutaneous, cutaneous and visceral) has the greatest influence on the clinical course [1,2,3,4]. Cutaneous leishmaniasis (CL) is a common illness in the Arabian Peninsula and the African continent, which has the highest number of cases globally, including Yemen [5,6,7].

Statements claiming that the disease's actual burden is more than four times higher than indicated are rarely reported to medical organizations [8]. Even while CL is not always deadly it has an important effect on the life and social health of those affected [9,10,11]. Although some statistics have been published, the epidemiological condition of leishmaniasis in Yemen, as well as the distribution of *Leishmania* species, varies by area [12].

According to the literature, certain investigations have revealed that cases of CL in the northwestern, southwestern, and central highlands of Yemen were primarily caused by *L. tropica*, with cases of *L. major* and *L. mucocutaneous* as well. In central Yemen, *L. tropica* is the agent who causes CL cases [13]. In Yemen, where leishmania is prevalent, there is a significant health concern; many variables have contributed to the development of new leishmaniasis outbreaks and an increase in the number of cases.

It's an impoverished nation that has inadequate medical facilities, and Lack of access to healthcare affects mothers and children. [14]. Sarnelli recorded occurrences of MCL in Sanaa as early as 1933. Moreover, Yemen is home to the endemic VL (kala-azar). Most of the time, this diagnosis is overlooked or not made for months or years, and some patients receive care without a diagnosis. [15] Over a century has passed since the first reports of kala-azar in Yemen's northern region, yet the disease is now commonly reported from around the nation on an irregular basis. The Ministry of Health documented about 4047 cases of VL in the ten years leading up to 1988, the majority of which involved young children [16]. Rioux et al reported canine leishmaniasis from a human VL focus in the Taiz Governorate of Yemen [17]. The only agent causing CL cases in the northwest highlands of Hajjah is *L. tropica*, and an outbreak was occurring there, this species and a few cases of *L. infantum* and *L. mucocutaneous* have been isolated together, but *L. tropica* is the sole notable species in the Southwest [18, 19]. Two *Leishmania* species, *Leishmania mucocutaneous* and *Leishmania tropica*, with a prevalence of *L. tropica*, were found in our investigation in the Dhamar, Ans region. 759 instances were reported in the Governorate of Dhamar, out of a total projected yearly incidence of more than 5000 cases of CL. There was no survey conducted to determine the true prevalence; instead, the data utilized for Yemen's epidemiological monitoring were relied on patient attendance records. Determining the clinical and epidemiological features of leishmaniasis disease in Yemen, particularly in Dhamar Governorate, was the aim of the current study.

Materials and Methods

Study Area.

The Governorate of Dhamar covers 7,586 km² (or 2929 square miles) in total. The Governorate of Al Hudaydah borders it on the west, the Governorate of Al Bayda borders it on the east, the Governorate of Ibb borders it on the south, and the Governorate of Sanaa border it on the north (Figure 1). It is located in the middle of Yemen's central highlands in the country's northern central area. The majority of these hilly Governorates are thought to be endemic and the center of human CL[20].

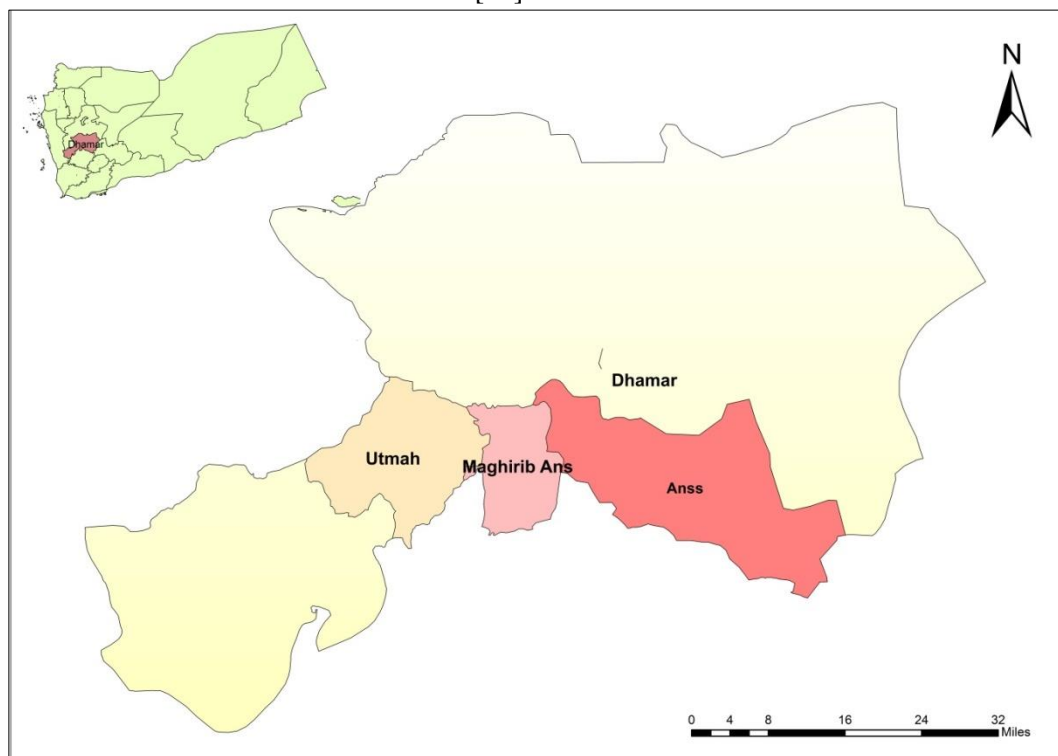


Fig 1: Map of Dhamar Governorate.

In July and December, the highest and lowest mean monthly temperatures were 25°C and 10°C, respectively. The range of summer temperatures is 10 to 19°C (50 to 66°F), while the range of winter temperatures is 8 to -1°C (46 to 30°F). According to the 2004 census, the governorate has 1,329,229 citizens, most of whom reside in its 3,262 villages. The governorate's population is divided into 12 administrative districts. There was 460 to 642 mm of rainfall. The vegetation is distinguished by significant cultivated vegetation. The two most significant industries in the Governorate's economy are agriculture and tourism.

Data Analysis and Cartographies

The governorate is situated 5.200–10.500 feet (1.600–3.200 meters) above sea level. Its terrain consists of highland plains, deep valleys, and mountains. Among the highest summits are Isbil, Al-Lisi, Duran, the two Wusab mountain groups, and the Utamah mountains. Jahran, the largest plain in the governorate, is situated in the north-central area.

Mapping and Data Analysis. The registers of the Dhamar Medical Delegation provided the information. By means of parasitological diagnosis, every CL case reported on the survey questionnaires was confirmed. Patients exhibiting clinical signs of CL were passively admitted to the health center located in the local laboratory of Dhamar Governorate during the study period. Leishmania amastigotes were discovered by direct microscopic examination (Gx100), signifying a positive skin lesion. The pertinent slides were sent to the Sana'a National Reference Laboratory for Leishmaniasis for confirmation and control [21].

Results and Discussion

Distribution of Cases of Leishmaniasis by Age .

Based on data analysis of selected records, the majority of patients were from rural areas in the Ans region. The presenters ranged in age from two months to eighty years. Figure 2 shows the distribution of leishmaniasis cases by patient age groups.

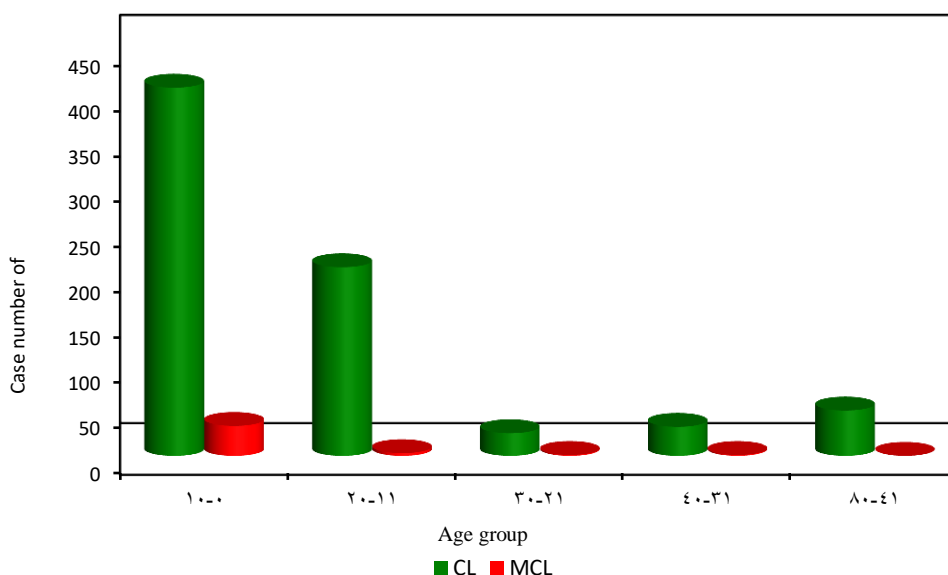


Fig 2: Cases of CL and VL by age group (2011-2013).

Table 1: Prevalence of leishmaniasis by age in Dhamar Governorate from 2011 to 2013 .

Age group (years)	CL	%	MCL	%
0-10	406	56.31	33	86.84
11-20	208	28.85	3	7.89
21-30	25	3.47	1	2.63
31-40	32	4.44	1	2.63
41-80	50	6.93	0	0.00

The two types of leishmaniasis have been shown to exhibit age discrimination, with the age group from 0 to 10 years old reporting the highest proportion of 56,31%, and the age group from 11 to 20 years old reporting the second-highest percentage of 28,85%. Lower percentages of 6,93%, 4,44%, and 3,47%, respectively, were also impacted for the age categories of 21 to 30, 31 to 40, and 41 to 80. A reported percentage of 56,31% for those aged 0 to 10 is consistent with findings from earlier research [22,23,24,25,26]. It was shown that MCL mostly affected the population between the ages of 0 and 10 years, with an incidence rate of 5%. The proportion of patients between the ages of 11 and 30 was quite low (2,63%). According to research conducted at Dhamar (2019)[27], the age group most impacted by CL is that of 0 to 16 years old (39%) Table 1.

The Distribution of Cases of Leishmaniasis by Gender.

The distribution of CL and VL patients by gender is shown in Table 2. There were 435 men (57.31%) and 324 women (42.69%) in the impacted population. It is clear that neither the male nor the female gender has been immune to this leishmaniasis pathology in humans. For both types of cutaneous and mucocutaneous leishmaniasis, we observed a male sex preponderance relative to the female one, depending on the type of leishmaniasis. The results of the analysis of the distribution of leishmaniasis cases by sex indicated that this condition afflicted people of both sexes. As numerous authors have already observed, the sex ratio is in favor of men. A one-to-sex ratio of 0.74 was found by analyzing the number of positive cases in Dhamar Governorate between 2011 and 2013, which showed that men are more likely than women to get cutaneous leishmaniasis (CL), with 56.87% of cases and 43.13% of cases (MCL), respectively. This conclusion is in line with reports from other Yemeni foci, especially Taiz, where men are more affected by CL (19.3% of total cases), though both genders are impacted. The main explanation for this is that males visit hospitals and clinics more frequently, mostly for aesthetic purposes. Remember that the face is typically affected by the illness. In addition, boys are often exposed to exophilic species and leishmaniasis vectors when

playing outside. Moreover, our results align with those of Qhtan Asmaa et al. [28] from Yemen's Nordic provinces, who discovered that CL primarily affects male sex at a rate of 19.3%. The gender ratio for the distribution of VL in the Province of Dhamar was 0.52.

Table 2: Prevalence of leishmaniasis by sex.

Type of leishmaniasis	Sex				Total
	Male	%	Female	%	
Cutaneous leishmaniasis	410	56.87	311	43.13	721
					94.99%
Mucocutaneous leishmaniasis	25	65.79	13	34.21	38
					5.01%

Leishmaniasis Cases Spread Over Time.

The annual distribution of cases of leishmaniasis:

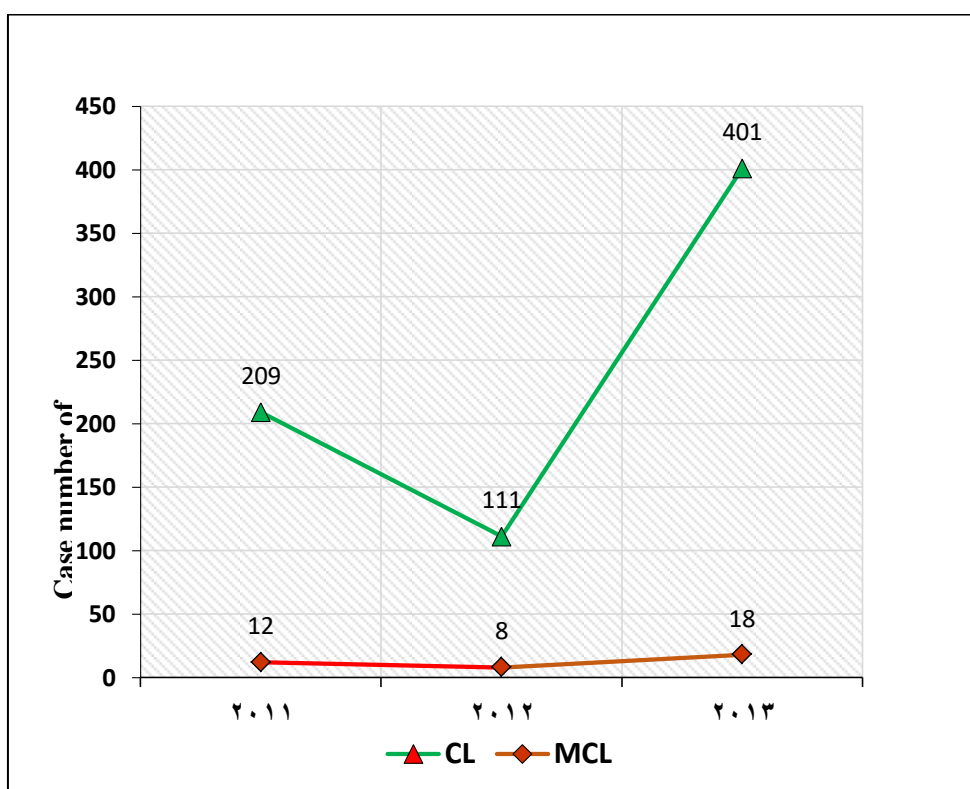


Fig. 3: Variations in the number of cases of leishmaniasis in Dhamar Governorate from 2011 to 2013.

The progression of the number of cases reported between 2011 and 2013 is shown in Figure 3. The Governorate still has leishmaniasis, in general. Leishmaniasis cases ranged from 209 in 2011 to 111 in 2012 and 401 in 2013, with 2012 recording the lowest number of cases and 2013 recording the highest number. There were 38 cases of mucocutaneous leishmaniasis between 2011 and 2013. Nonetheless, there was a sharp increase in instances between 2011 and 2013—from 12 in 2011 to 18 in 2013—as evidenced by the registration of MCL cases, which represented a census of all reported cases.

Leishmaniasis Case Distribution by Month:

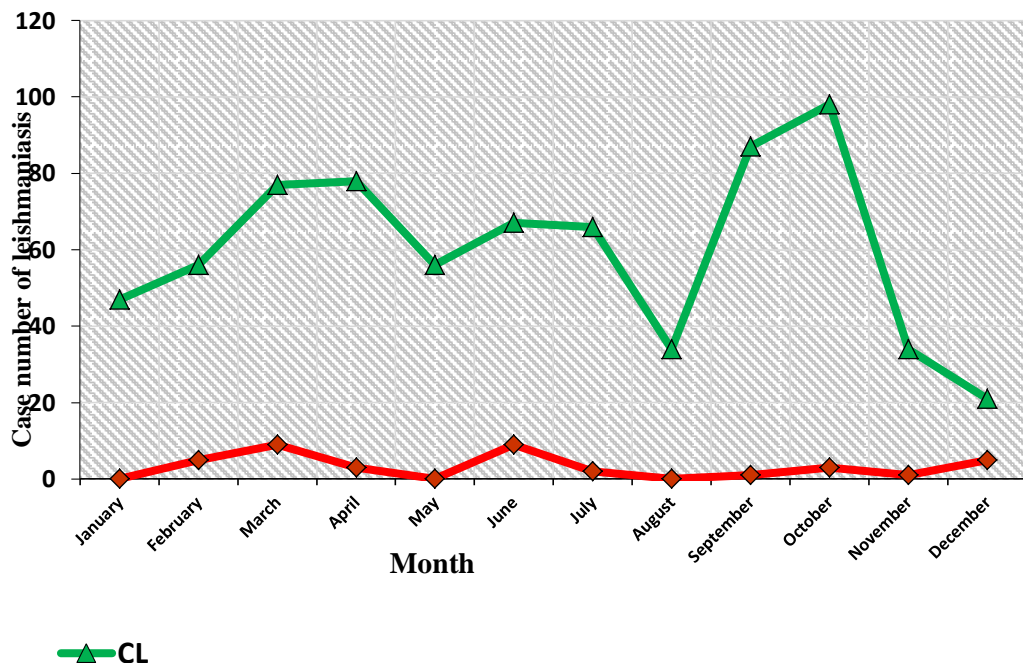


Fig 4: From 2011 to 2013, the monthly distribution of leishmaniasis cases in Dhamar Governorate.

The monthly progression of the CL cases showed two peaks: the second, with 87 cases in September, and the first, with 98 cases in June, which is arguably the most

noteworthy. This may be mostly due to the latent phase that occurs between infection and the requirement for a clinical diagnosis, or it may have to do with the seasonal dynamics of vector populations in specific places. We also found a consistent increase in MCL cases, which increased from 1 case in November to 10 cases in March. However, this increase was only observed in 1 to 9 cases between February and December. Additionally, we saw a drop in MCL cases, which went from 8 in September to 3 in October (Figure 4). Spatial distribution of leishmaniasis. Each commune in the Governorate of Dhamar has a different distribution of leishmaniasis patients from 2011 to 2013. The number of instances in the municipalities of Ans, Utmah, and Maghrib Ans has progressively changed over time. El Hosn (30 cases) was the most prevalent region in 2011 in terms of the spatiotemporal distribution of leishmaniasis cases, followed by AlMnar (21 cases) and AlHanah (5 cases). The other cities are small, some of which are regarded as healthy communities with no documented cases. In 2011, we saw a decline in the number of patients; nevertheless, in 2012, a new outbreak with just 26 cases surfaced in the municipality of Ans. Another outbreak surfaced in 2013 and was associated with AL Manbh (15 cases). No case was filed for Yafa or AL Karabh until 2013. This year's epidemiological picture of leishmaniasis is different, with the urban commune of Ans ranking first with 107 cases, followed by the rural commune of Utmah in second place with 53 cases and Maghrib Ans with 29 cases. Topographically speaking, the relief has been demonstrated to represent a significant ecological component. Furthermore, the Governorate of Dhamar is thought to be an endemic location for human leishmaniasis and is located in the Central Region of North Yemen, in the Middle Mountains. For CL, the following three zones were very common: Ans, Utmah, and Maghrib Ans. The altitude range between 1500 and 2000 meters was home to the largest mean number of CL (Figure 4). Of the forty-three instances of VL that were reported in the Governorate of Dhamar, the municipality of Utmah had twenty cases (46.51%), while the commune of Maghrib Ans had ten cases (23.26%). Similar to the other Yemeni regions, Dhamar Governorate appears to be the usual habitat of CL [38]. The parasite species that have been identified as causing this problem are *L. tropica* and *L. mucocutaneous* [29]. Our study location is situated between 1800 and 2400 meters above sea level in a semiarid region. In fact, Rioux et al.'s 1984 research demonstrated that the primary factor influencing the distribution of different leishmaniasis vector species is climate. At the research area level, the results may be explained by the semiarid microclimate, the type of climate that prevails in this region, and the mountainous areas. *Phlebotomus sergenti* was the most often collected species of sandfly in this area, followed by *Phlebotomus orientalis*. Rioux et al. detected *Phlebotomus sergenti*, a species recognized to be a vector of *L. tropica* in Yemen, at Taiz. Numerous investigations have demonstrated the presence of this species in a variety of bioclimatic phases, but notably in semiarid regions and at elevations between 800 and 1,000 meters [30]. This is consistent with the distribution of CL cases at altitude that focus on the same research region.

Leishmaniasis is associated with a number of risk factors, in addition to environmental bioecological factors and climate change. The presence of slaughterhouses, an accumulation of animal waste, stables, caverns, and environmental factors that support the biological development of sandfly vectors are characteristics of the locations impacted by these plagues.

Conclusion

A retrospective analysis carried out in the Governorate of Dhamar indicates that the number of cases is rising. In addition to encouraging and monitoring scientific research in this area, efforts to combat this disease require continuous monitoring after awareness and information campaigns for at-risk communities. A thorough understanding of the socioeconomic elements influencing the spatiotemporal dynamics of the disease and the distribution of sandfly vectors is essential to mitigating the risk of transmission and spread of leishmaniasis in endemic areas.

Conflicts of Interest

The writers say they have no competing interests.

Authors' Contributions

The manuscript as submitted was approved by all authors.

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