



RESEARCH ARTICLE

CUTANEOUS LEISHMANIASIS AMONG ATTENDING HOSPITALS AND HEALTH CENTERS IN AMRAN GOVERNORATE, YEMEN

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Abstract

Cutaneous Leishmaniasis (CL) is a broad spectrum of diseases. There is no published data on the epidemiology or risk factors of leishmaniasis in Amran Governorate. This study aimed to scrutinise the prevalence and behavioural risk factors associated with CL among visitors to hospitals and health centres in Amran Governorate. A descriptive cross-sectional study was conducted. Data were collected from 68 patients with lesion clinically suggestive of CL. A pretested questionnaire was used to collect sociodemographic data, risk factors, and influence factors of CL. Sixty-eight cutaneous leishmaniasis were recorded during the month December 20 (29.4%), and the Jabal Yazid District was more infected area with the parasite 14 (20.6%). The majority were from males 45 (26.2%), individuals with age groups of 0–20 years old 34 (50%), single individuals 52 (76.5%), and those who come from rural areas 38 (55.9%), with a significant difference ($P < 0.05$), and the major risk factors were by bite of female sandfly 55 (80.9%), with a significant difference ($P < 0.05$). Cutaneous leishmaniasis was highly prevalent in Amran Governorate among children (0-20). Our study showed that the risk factor associated with cutaneous leishmaniasis could help the ministry of health in the establishment of an effective program.

Keywords: Cutaneous Leishmaniasis, Sand Fly, Risk Factors, Amran, Yemen.

Introduction

Leishmaniasis is a disease that is caused by the parasite *Leishmania*; comprising of at least 20 species that affect humans. The parasite is primarily transmitted by the sand flies that belong to the female sandfly of the genus *Phlebotomus* or *Lutzomyia* genus in the old world and the new world respectively; however, other principal hosts are rodents such as *Rhombomysopimus*, *Tatera indica*, *Meriones hurrianae*, and *Meriones libycus* gerbils, which are of the Zoonotic cutaneous leishmaniasis (ZCL) [1–5].

The clinical manifestations of leishmaniasis can range from subclinical (inapparent), or a self-resolving cutaneous ulcer to a disseminated infection (cutaneous, mucosal, or visceral) and even to a lethal systemic illness [6–10]. *Leishmania* infects some of the poorest people in

the world, and is linked to population displacement, malnutrition, lack of financial resources, and poor housing [5].

Cutaneous leishmaniasis can be observed in all age groups; however, children are a special population affected by this marring disease and are a substantial public health concern [11]. The greater incidence of cutaneous leishmaniasis in young children could be due to a lack of cutaneous leishmaniasis-specific immunity, poverty, peri-domestic anthroponotic transmission, lack of awareness, and access to basic health services [12]. The clinical manifestation starts with a skin lesion at the vector bite site (usually without pain or pruritus) and progressively increases in size to form a rounded nodule that is usually exposed to secondary bacterial or fungal infections. It can then produce purulent and painful ulcers, mainly on the exposed parts of the body, leaving

life-long scars and serious disability or severe social stigma [13–14].

Cutaneous leishmaniasis is predominant in 88 countries, including 77 developing countries; tens of millions of people are at risk of getting this disease, and it is estimated that each year 1–1.5 million new cases appear. CL is endemic in Yemen [15–16]. It has been recognised as a public health problem predominated by infection with the highest burden of leishmaniasis but has not been fully documented; and most of the cases are registered in Hajjah, Abyan, Lahj, Sa'adah, and Taiz Governorates [17].

Yemen is a developing country that lacks strategies and programs to control or prevent the transmission of pathogenic microorganisms among populations [18–20]. To date, there are no published data on the incidence rate and risk factors associated with cutaneous leishmaniasis in Amran Governorate, Yemen. The main purpose of this study was to determine the incidence rate of cutaneous leishmaniasis and its associated risk factors among people attending health centers in Amran Governorate, Yemen. Establishing baseline data and understanding the local epidemiology of cutaneous leishmaniasis would aid in controlling this health problem.

Patients and Methods

Study area and period

This is a cross-sectional study carried out among visitors to hospitals and health centres in Amran Governorate during the period from January 2023 to November 2023. Amran is a small city in western and central Yemen. It is located 50 kilometers north of Sana'a city, between Sana'a governorate and Sa'adah along the central highlands. Amran has a total area of 9,587 km² (3,702 sq mi) and a population of approximately 1,221,908. It is divided into 20 administrative districts [21].

Data collection

We gathered data from each patient using a standard predesigned questionnaire, specifically designed for this study, which included demographic information such as age, gender, and risk factors. Investigators collected participant information through face-to-face interviews and filled out the questionnaire. Additionally, participation was voluntary, and participants completed the consent form. We constructed the questionnaire in Arabic and translated it into English.

Inclusion and exclusion criteria

The patients who were residents in Amran governorate, signed the informed consent, delivered specimens, and non-received any anti-parasitic drugs in the days before sampling were included. Conversely, patients who refuse to sign the informed consent, sample collection, or had

taken anti-parasitic drugs during data collection were excluded from the study.

Specimens collection

Skin lesion samples were obtained from patients exhibiting clinical indications of skin infection. Prior to collection, the cutaneous lesions were cleansed and sterilised using 100% ethanol. The puncture was performed between the thumb and forefinger to treat the lesions. Biopsy samples were obtained from the periphery of the wound using a sterile lancet and left on one side of the slide. A dense coating on one side of the examination slide was created and sustained in 100% methanol for a duration of 30 minutes. A permanent marker was used to label the slides with a serial number [22].

Staining and diagnosis by microscopy

The diagnosis of cutaneous leishmaniasis can be immediately confirmed by directly observing the parasite in impression smears or by examining skin biopsies stained with Giemsa's stain. The process involved immersing dry, thin prepared slides containing skin lesions from infested patients into a staining jar containing Giemsa stain for a duration of 30 minutes. Following the staining process, the slides were allowed to dry naturally and then rinsed delicately with water before being air-dried once more. The slides were examined using a microscope with an oil immersion objective lens (10 x 100 magnifications) to identify the Amastigote form of *Leishmania tropica* [22-23].

Ethical statement

The Research Ethics Review Committee of the Department of Biology, Faculty of Applied Science and Humanities of Amran University approved the study's ethical statement, and the Public Health Office as well as hospitals and health centers in Amran Governorate, granted permission to begin collecting data and specimens from the study area. Further, written informed consent participation was voluntary and participants completed a consent form by participants and investigators.

Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences, SPSS (Version 22, SPSS Inc. Chicago IL USA). Categorical variables were reported as frequencies and percentages in tables and figures. Furthermore, associations between variables and the categorized scores were assessed using Chi-square test (χ^2). Additionally, all probability values were considered statistically significant at P -values < 0.05 .

Results

Sixty-eight cases of cutaneous Leishmaniasis were recorded among visitors to Amran hospitals and health centres; the majority of cutaneous leishmaniasis was in males 45 (66.2%), individuals in the age groups of 0–20 years, 34 (50%), single individuals 52 (76.5%), and those who were come from rural areas 38 (55.9%), primary education 28 (41.2%), with a significant difference ($P < 0.05$), but residence was not significant, as shown in Table 1.

Table 1. The prevalence of cutaneous leishmaniasis according to gender, age group, marital status, residence, and educational level

Variables	Frequency	Rate (%)	χ^2	P-value	
Gender	Male	45	66.2	7.11	0.0079
	Female	23	33.8		
Age group	0–20	34	50	17.32	0.0002
	21–40	27	39.7		
	≥ 41	7	10.3		
Marital status	Single	52	76.5	19.06	0.0001
	Married	16	23.5		
Residence	Urban	30	44.1	0.941	0.332
	Rural	38	55.9		
Educational status	Illiterate	18	26.5	11.882	0.0078
	Primary	28	41.2		
	Secondary	13	19		
	Graduate	9	13.2		

χ^2 = Chi-square test ≥ 3.84 (significant), P value < 0.05 (statistically significant)

The present study included sixty-eight (68) patients; the results showed that Jabal Yazid District was more infected with the parasite 14 (20.6%), and Khamiar was lower infected with the parasite 1 (1.5%). Additionally, the highest infection rate was during the month of December and reached 20 (29.4%), while the lowest infection rate was during the month of October, which reached 5 (7.4%), as shown in Figure 1.

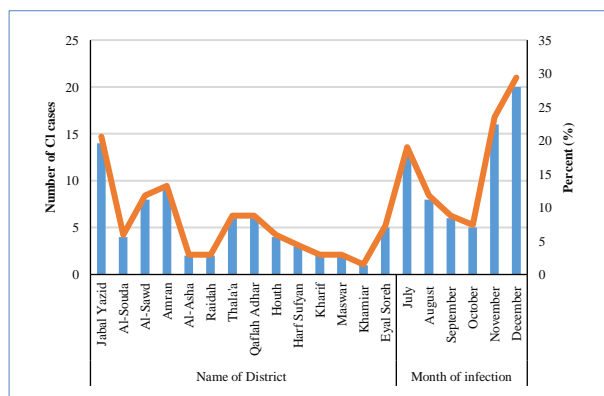


Figure 1. Distribution of cutaneous leishmaniasis according to the district name and month of infection

The present outcomes revealed that infections according to family number were significantly higher among 6-10 (51.5%). A high rate of infection according to the site of infection was reported in the face (58.3%), hands

(23.6%), feet (13.9), back (2.8%), and chest (1.4%), as listed in Table (2).

Table 2. The prevalence of cutaneous leishmaniasis according to number of family number and site of infections

Variables	Frequency	Rate (%)	χ^2	P-value	
Number of family member	0-5	16	23.5	10.088	0.0064
	6-10	35	51.5		
	≥ 11	17	25		
Site of Infections	Faces	42	58.3	77.861	0.0001
	Hands	17	23.6		
	Foots	10	13.9		
	Chest	1	1.4		
	Back	2	2.8		

χ^2 = Chi-square test ≥ 3.84 (significant), P value < 0.05 (statistically significant)

This outcome showed the major influencing factors were the presence of ponds and swaps at 42 (37.2%), cows and sheep at 41 (36.3%), sewage at 19 (16.8%), and immunocompromised patients at 11 (9.7%), with significant differences ($P < 0.05$), as listed in Table 3.

Table 3. The influence factors of leishmania infection

Influencing Factors	No.	(%)	χ^2	P-value
Presence of cows, sheep	41	36.3	26.008	0.000
Presence of ponds, swap	42	37.2		
Presence of sewage	19	16.8		
Immunocompromised	11	9.7		

χ^2 = Chi-square test ≥ 3.84 (significant), P value < 0.05 (statistically significant)

Furthermore, our results revealed that the major risk factors were the bite of a female sandfly at 55 (80.9%), insect bites at 28 (25.5%), needle prick at 17 (15.4%), dog bites at 4 (3.6%), blood transfusions at 4 (3.6%), and transplants at 1 (0.9%), with a significant difference ($P < 0.05$), as shown in Table 4.

Table 4. The major risk factors of leishmania infection

Risk factors	No.	(%)	χ^2	P-value
Bites Sand fly	55	80.9	98.36	0.0001
Blood transfusion	4	3.6		
Insect bites	28	25.5		
Transportation	1	0.9		
Needle prick	17	15.4		
Dogs bites	4	3.6		

χ^2 = Chi-square test ≥ 3.84 (significant), P value < 0.05 (statistically significant)

Discussion

Cutaneous leishmaniasis causes a public health problem worldwide. Leishmaniasis has gradually spread to many governorates of Yemen and is considered an endemic disease [24]. Its prevalence is underestimated due to underreporting, misdiagnosis, or non-diagnosis [25].

Sixty-eight cases of cutaneous leishmaniasis were recorded among visitors to Amran hospitals and health centers; the highest infection rate occurred during December and reached 20 (29.4%). The high prevalence in our study can be attributed to the fact that only clinically suspected patients were included. In addition, the present study recorded a significantly higher prevalence rate in males (66.2%) than in females (33.8%) ($P < 0.05$). This finding is consistent with results reported in Yemen [26], Sri Lanka [27], Iraq [28], Saudi Arabia [29-30].

The rationale for gender differences comes in the fact that males make up the majority of seasonal immigrant workers, who typically wear less clothing than women and operate in open surroundings. As a result, they are likely to have greater exposure to sandflies, particularly in rural societies. Given that the majority of CL cases resided in rural areas and typically worked as farmers, which exposed them to the danger of being bitten by sand flies, it is not surprising that the aforementioned results were obtained.

Regarding the age group, the current study revealed that the highest prevalence rate of cutaneous leishmaniasis in the 0-20 age group (50%), and the lowest in more than 40 years (10.3%). The same results were reported in West Kordofan, Sudan [31], and in Oti Region, Ghana [32]. It's possible that children are more likely to get mosquito bites because they're active and spend a lot of time outside. Additionally, the clothing they wear increases their vulnerability to sandfly bites.

The results showed that 30 (44.1%) participants were from urban areas and 38 (55.9%) were from rural areas. Similarly results have been recorded in by many studies carried in Yemen, Hadhramout and Taiz governorates [17, 33], Iran [34], Iraqi Kurdistan region [35], and Pakistan, Khyber Pakhtunkhwa [36]. The aforementioned results are to be expected, given that most instances of CL were found in rural areas where individuals were engaged in agricultural activities, making them vulnerable to sand fly bites. Moreover, the high occurrence of CL can be ascribed to factors such as low socioeconomic position, substandard housing circumstances, limited knowledge about the disease's source, and inadequate healthcare availability [37].

Regarding the clinical profile of cutaneous leishmaniasis lesions, the most common sites of infection were the faces, hands, feet, chest, and back, with significant differences ($P < 0.0$). The study found an elevated

incidence of leishmaniasis in the facial region, likely due to the face's prominent exposure to sand fly bites. Moreover, several factors may contribute to the elevated occurrence of CL lesions in the nose. Firstly, the nose is a stationary region of the face, making it more susceptible to sand fly bites. Secondly, it is a prominent and exposed area of the face, further increasing its vulnerability. Lastly, the nose lacks protective mechanisms to avoid sand fly bites, making it the most susceptible part of the face [38].

Several risk factors were significant associated with cutaneous leishmaniasis, such as bite sand fly, blood transfusion, insect bites, transplantation, needle prick, and dog bites. These findings were also similar to a study in Brazil [39]. Moreover, ecology, geography, climate change, cultural, gender- and age-specific tasks, urban activities at night, popular treatment methods, illiteracy, overcrowding, the practice of keeping domestic animals indoors, continuous increases in rodent and dog populations, and inadequate diagnosis, treatment, housing, hygiene, and sanitation may contribute to the increase in leishmaniasis [25]. There are various explanations behind Yemen's high prevalence of CL infections, particularly in Amran Governorate. These challenges encompass living situations, economic and environmental factors, a lack of public health awareness, a lack of sanitary facilities and infrastructure, and a lack of access to safe drinking water [40-47].

Conclusion

Cutaneous leishmaniasis was highly prevalent in Amran Governorate among children. It is critical to develop and implement effective and innovative strategies to raise awareness and knowledge towards leishmaniasis, support early diagnosis, and detect and control leishmaniasis in the community. Furthermore, health education, finding the patients and treating them, fighting rodents, improving the environmental condition should be also taken into consideration.

Conflict of Interest

Authors have no conflict of interest.

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Author Contributions

Alshahethi and Al-Hadheq Conceived and designed the experiments. Alshahethi performed the experiments: Alshahethi, Abdullah, and Edrees analyzed the data and wrote the manuscript's first draft. Ahmed contributed to the manuscript's creation. Alshahethi, Al-Hadheq, and Al-Awar concur with the manuscript's findings and conclusions. All authors have read, revised, and approved the final manuscript.

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داء الليشمانيا الجلدية بين المراجعين للمستشفيات والمراكز الصحية في محافظة عمران، اليمن

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المُلخَص

داء الليشمانيا الجلدية هو مجموعة واسعة من الأمراض. لا توجد بيانات منشورة حول الوبائيات أو عوامل الخطر بداء الليشمانيا في محافظة عمران. هدفت هذه الدراسة إلى التدقيق في انتشار وعوامل الخطر السلوكية المرتبطة بداء الليشمانيا الجلدية بين زوار المستشفيات والمراكز الصحية في محافظة عمران. أجريت دراسة مقطعية وصفية. تم جمع البيانات من 68 مريضاً يعانون من آفة توحى سريريًا بداء الليشمانيا الجلدية. تم استخدام استبيان تم اختياره مسبقاً لجمع البيانات الاجتماعية والديموغرافية وعوامل الخطر وعوامل التأثير لداء الليشمانيا الجلدية. تم تسجيل ثمانية وستين حالة لداء الليشمانيا الجلدية خلال شهر ديسمبر 20 (29.4%) وكانت منطقة جبل يزيد أكثر إصابة بالطفيلي 14 (20.6%). كانت الأغلبية من الذكور 45 (26.2%)، والأفراد الذين تتراوح أعمارهم بين 0-20 سنة 34 (50%)، والأفراد العزاب 52 (76.5%)، والذين يأتون من المناطق الريفية 38 (55.9%)، مع وجود فرق ذو دلالة إحصائية ($P < 0.05$)، وكانت عوامل الخطر الرئيسية عن طريق لدغة أنثى ذبابة الرمل 55 (80.9%)، مع وجود فروقات معنوية ($P < 0.05$). كان داء الليشمانيا الجلدية منتشرًا بشكل كبير في محافظة عمران بين الأطفال (0-20). أظهرت دراستنا أن عامل الخطر المرتبط بداء الليشمانيا الجلدية يمكن أن يساعد وزارة الصحة في إنشاء برنامج فعال في مكافحة هذا الداء.

الكلمات المفتاحية: الليشمانيا الجلدية، ذبابة الرمل، عوامل الخطورة، عمران، اليمن.

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