

Situation of Leishmania in Yemen 2021-2023

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حالة داء الليشمانيا في اليمن ٢٠٢١ - ٢٠٢٣

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Abstract: Introduction: Introduction: This study investigated the incidence and distribution of leishmaniasis in Yemen from 2021–2023 using data from the electronic integrated disease early warning system. It aimed to assess overall incidence, compare cutaneous and visceral forms, and analyze demographic and geographic patterns. **Methods:** A retrospective analysis of 1,947 patient records was conducted. Data were classified by governorate, age, gender, and year, and analyzed using SPSS version 26. **Results:** A total of 1,947 cases were reported: 689 in 2021, 659 in 2022, and 599 in 2023. Most cases occurred in Sana'a (28.8%) and Sana'a City (16.4%), followed by Dhamar, Amran, Ibb, Al-Mahweet, and Hajjah. Few cases were reported in Shabwah, Al-Maharah, Abyan, Aden, Lahej, and Hadramout. Cutaneous leishmaniasis predominated (89.2%), while visceral cases accounted for 10.8%. Males were more affected (60.7%) than females (39.3%). The highest burden of cutaneous leishmaniasis was among the 15–25 years age group (55.3%), followed by 5–15 years (31.2%) and 1–5 years (12.9%). Cases in infants, adults over 50, and those aged 25–50 were rare. **Conclusions:** Leishmaniasis remains a significant public health issue in Yemen, with cutaneous forms predominating, affecting mainly young males in central governorates.

Keywords: Leishmaniasis, Incidence, Epidemiology, Yemen.

المخلص: المقدمة: هدفت هذه الدراسة إلى التحقيق في معدل الإصابة وتوزيع داء الليشمانيا في اليمن خلال الفترة من ٢٠٢١ إلى ٢٠٢٣ باستخدام بيانات النظام الإلكتروني المتكامل للإنذار المبكر بالأمراض. سعت الدراسة إلى تقييم معدل الإصابة الكلي، مقارنة الأشكال الجلدية والحشوية، وتحليل الأنماط الديموغرافية والجغرافية. **المنهجية:** أجري تحليل استعادي لـ ١٩٤٧ سجلاً مرضياً. جرى تصنيف البيانات وفقاً للمحافظة، العمر، الجنس، والسنة، وتم تحليلها باستخدام برنامج SPSS الإصدار ٢٦. **النتائج:** بلغ مجموع الحالات المبلغ عنها ١٩٤٧ حالة: ٦٨٩ في عام ٢٠٢١، و٦٥٩ في عام ٢٠٢٢، و٥٩٩ في عام ٢٠٢٣. تركزت معظم الحالات في محافظة صنعاء (٢٨,٨٪) وأمانة العاصمة صنعاء (١٦,٤٪)، تلتها محافظات ذمار، عمران، إب، المحويت، وحجة. بينما سُجلت حالات قليلة في شبوة، المهرة، أبين، عدن، لحج، وحضرموت. شكّل داء الليشمانيا الجلدي النسبة الأكبر (٨٩,٢٪) مقارنة بالليشمانيا الحشوي (١٠,٨٪). كان الذكور أكثر إصابة (٦٠,٧٪) مقارنة بالإناث (٣٩,٣٪). سُجلت أعلى نسبة من الحالات الجلدية في الفئة العمرية ١٥–٢٥ سنة (٥٥,٣٪)، تلتها الفئة ٥–١٥ سنة (٣١,٢٪)، ثم الفئة ١–٥ سنوات (١٢,٩٪). بينما كانت الحالات في الرضع، من هم فوق ٥٠ سنة، والفئة ٢٥–٥٠ سنة نادرة. **الاستنتاجات:** يظل داء الليشمانيا مشكلة صحية عامة بارزة في اليمن، حيث تسود الأشكال الجلدية بشكل رئيسي، وتصيب الذكور الشباب في المحافظات المركزية.

الكلمات المفتاحية: داء الليشمانيا، معدل الإصابة، علم الوبائيات، اليمن.

Introduction

Leishmaniasis, caused by the protozoan parasite *Leishmania*, is a parasitic vector-borne disease endemic in various regions, including the tropics, subtropics, and the Mediterranean basin. It is transmitted to humans through the bite of infected sand flies, with approximately 600 species of sand flies acting as vectors, although only 10% of them are disease vectors [1,2]

Cutaneous leishmaniasis (CL) is an endemic disease in the Middle East and North Africa, including Yemen. Sudan, Egypt, Libya, Jordan, Tunisia, and Palestine are endemic mainly for the zoonotic cutaneous leishmaniasis (ZCL), while Syria, Saudi Arabia, Iraq, and Iran are endemic for both ZCL and anthroponotic cutaneous leishmaniasis (ACL) [3]. In the neighboring countries of Yemen, starting from Saudi Arabia, the recent documented studies reveal that the ACL is the prevalent form of CL in western highland, the same highland that extended through Yemen in the western region, the reported incidence ranging from 0.1% to 0.4%, and the infection is prevalent at escarpment land while the ZCL is prevalent in central and eastern provinces [4-8].

In Yemen, CL has been reported in the northwestern, southwestern, and central highlands [9-11].

Although the first report about CL in Yemen was documented in 1933, little is known about leishmaniasis epidemiology. In the northwestern highlands of Hajjah governorate. In their recent study reported that *L. tropica* was the dominant causative species, accounting for 95% of cases, while *L. donovani* and *L. infantum* represented a low

percentage (4.1%) and (1.9%), respectively, for atypical molecular patterns. In the southwestern highlands of Lahj and Taiz governorates [12]. It was reported that the CL appeared to be endemic, and an outbreak was occurring in the region. In their recent study, [13]. And reported that CL was an endemic disease mainly in the rural regions [14,15]. In the central highlands of Al-Bayda province reported that the CL represented 4.11% of skin diseases [16, 17]. However, it reported that *L. donovani* and *L. infantum* are the causative species for visceral leishmaniasis (VL), and *L. tropica* is the causative agent for CL in Tehama city in Yemen [18].

This study aims to describe the Situation of leishmania in Yemen from 2021-2023 in EIDEWS.

Methods

This study was designed as a retrospective, registry-based, cross-sectional descriptive analysis of patients diagnosed with leishmaniasis in Yemen between 2021 and 2023.

A total of 1,947 cases were identified from the Electronic Integrated Disease Early Warning System (EIDEWS), including individuals who had received treatment or were still undergoing therapy during the study period.

Data were collected and managed directly from the EIDEWS database, classified according to governorate, age, gender, and year of diagnosis, and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.

Ethical approval was obtained from the Ethical Committee of the Faculty of Medicine, University of 21 September, with assurances

that the study’s objectives and benefits were explained to participants and that all information would remain confidential, used solely for research purposes without disclosure of identifiable data.

Results

Between 2021 and 2023, a total of 1,947 leishmaniasis cases were reported in Yemen,

comprising 1,736 cases of CL and 211 cases of VL, representing 89% and 11% of the total, respectively (**Table 1**). The annual case counts showed a gradual decline, with 689 cases in 2021, 659 in 2022, and 599 in 2023. This downward trend may reflect a reduction in transmission or the impact of improved control measures. CL remained the predominant form throughout the study period, underscoring its continued public health significance in endemic regions.

Table 1: Distribution of Leishmaniasis Cases by Type and Year (Yemen, 2021–2023)

Type of Leishmaniasis	2021	2022	2023	Total	Percentage
Cutaneous (CL)	597	585	554	1736	89%
Visceral (VL)	92	74	45	211	11%
Total	689	659	599	1947	100%

Geographically, the distribution of cases revealed a broader burden outside the capital. Of the 1,947 total cases, 320 occurred in Amanat Al-Asimah and 1,627 in other governorates (**Table 2**). CL accounted for most cases in both regions, with 302 cases in the capital and 1,434 elsewhere. Visceral leishmaniasis was less frequent, with 18 cases

in Amanat Al-Asimah and 193 in other governorates. The overall incidence rate was 10 cases per 100,000 population, with CL contributing a rate of 8 and VL a rate of 2. These findings highlight the predominance of cutaneous leishmaniasis and the need for targeted interventions beyond the capital.

Table 2: Distribution of Leishmaniasis Cases by Location (Amanat Al-Asimah vs. Other Governorates, 2021–2023)

Type of Leishmaniasis	Amanat Al-Asimah	Other Governorates	Total	Rate (/100,000)
Cutaneous (CL)	302	1434	1736	8
Visceral (VL)	18	193	211	2
Total	320	1627	1947	10

Analysis by year and gender showed that Yemen recorded 302 cases of CL and 18 cases of VL during the study period, with incidence rates varying across years and between sexes

(**Table 3**). The annual incidence of CL declined from 4 per 100,000 in 2021 to 2 in 2022, with a slight increase to 3 in 2023. VL incidence dropped from 1 to 0.2 per 100,000

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over the same period. Males consistently exhibited higher incidence rates than females for both forms: 2.8 versus 2.2 per 100,000 for CL, and 0.2 versus 0.1 for VL. These patterns suggest a gender-based disparity in exposure or susceptibility, alongside a general reduction in disease burden.

Table 3: Incidence of Cutaneous and Visceral Leishmaniasis by Year and Gender (Yemen, 2021–2023)

Variable	Population	CL Cases	CL Incidence /100,000	VL Cases	VL Incidence /100,000
2021	3,824,175	157	4	11	1
2022	3,994,688	84	2	4	0.3
2023	4,172,804	61	3	3	0.2
Male	2,145,235	209	2.8	12	0.2
Female	1,842,313	93	2.2	6	0.1
Total	3,994,688	302	2.5	18	0.2

Within Amanat Al-Asimah, a total of 320 leishmaniasis cases were reported, including 302 CL and 18 VL cases, with overall incidence rates of 3 and 0.2 per 100,000, respectively (**Table 4**). Bani Al Harith was the most affected directorate, reporting 116 CL and 6 VL cases, followed by Ma'in with 61 CL and 2 VL cases. Other districts, such as Shu'ub, Ath Thawrah, and Azza'al recorded fewer than 25 CL cases each, and VL cases were rare or absent. Notably, As Sab'in was the only directorate to report VL cases without any CL cases, recording 7 VL cases. These findings reveal marked geographic variation within the capital, with Bani Al Harith emerging as a hotspot and VL remaining focal and sporadic.

Table 4: Distribution of Leishmaniasis Cases by Directorate (Amanat Al-Asimah, 2021–2023)

Directorate	Population	CL Cases	CL Incidence /100,000	VL Cases	VL Incidence /100,000
Bani Al Harith	467,560	116	8.3	6	0.4
Ma'in	667,684	61	3	2	0.1
Shu'ub	533,836	22	1.4	1	0.1
Ath Thawrah	426,656	17	1.3	1	0.1
Azaal	291,391	11	1.3	0	0
At Tahrir	163,725	10	2	1	0.2
Al Wehdah	251,477	9	1.2	0	0
As Safiyah	261,833	2	0.3	0	0
Old City	156,714	5	1.1	0	0
As Sab'in	773,811	–	–	7	0.3
Total	3,994,688	302	3	18	0.2

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Age-specific analysis showed that leishmaniasis cases in Amanat Al-Asimah were concentrated among children and young adults (**Table 5**). The highest burden of CL was observed in the 15–25 year age group, which accounted for 167 cases and an incidence rate of 12 per 100,000. Children aged 5–15 years and 1–5 years also experienced notable CL incidence, with 94 and 39 cases, respectively, both at a rate of 2 per 100,000. VL cases were more evenly distributed among younger age groups, with 6 cases each in the 1–5 and 5–15 year brackets, and 5 cases in the 15–25 year group. A minimal disease burden was observed among infants under one year and individuals over 45 years, with only one case of CL and one case of VL reported in total. No cases were recorded in the 25–45 year age group. These results suggest that leishmaniasis disproportionately affects younger populations, particularly in its cutaneous form.

Table 5: Distribution of Leishmaniasis Cases by Directorate (Amanat Al-Asimah, 2021–2023)

Age Group	Population	CL Cases	CL Incidence /100,000	VL Cases	VL Incidence /100,000
<1 year	177,553	1	0	1	0.2
1–5 years	790,468	39	2	6	0.3
5–15 years	1,315,677	94	2	6	0.2
15–25 years	446,247	167	12	5	0.4
25–45 years	858,166	0	0	0	0
>45 years	406,578	1	0	0	0
Total	3,994,688	302	3	18	0.2

Monthly trends revealed consistent year-round transmission of both CL and VL, with seasonal peaks (**Table 6**). CL cases were highest in January (223 cases), May (179), and November (155), indicating increased transmission during cooler months. VL cases peaked in April (21), July (23), and August (23), suggesting heightened activity during mid to late summer. Despite monthly fluctuations, both forms of leishmaniasis maintained a persistent presence throughout the year, emphasizing the need for continuous surveillance and sustained control efforts.

Table 6: Monthly Distribution of Cutaneous and Visceral Leishmaniasis (Yemen, 2021–2023)

Month	CL 2021	CL 2022	CL 2023	CL Total	VL 2021	VL 2022	VL 2023	VL Total
January	70	95	58	223	8	10	6	24
February	68	57	54	179	6	5	5	16
March	67	58	50	175	6	5	1	12
April	39	39	47	125	11	8	2	21
May	45	72	62	179	7	5	2	14
June	42	32	38	112	8	7	3	18
July	29	24	41	94	10	8	5	23
August	55	41	39	135	7	6	10	23
September	33	27	29	89	7	5	2	14
October	44	51	48	143	6	5	3	14
November	64	57	34	155	6	4	2	12
December	41	32	54	127	10	6	4	20
Total	597	585	554	1736	92	74	45	211

Discussion

Leishmaniasis is a highly neglected infection and is substantially underreported in Yemen [19]. This study aimed to document the incidence, geographical distribution, and differences by gender, age, and type of Leishmania, using the data from the electronic integrated disease early warning system database from 2021 to 2023.

In this study, the total incidence of Leishmania in just three years was 1947 individuals. This result shows the high incidence of Leishmania in Yemen. This agrees with a study done in 2016 said in Yemen, Leishmania is endemic and one of the

most prevalent skin infectious diseases [16]. The incidence in 2021 was 689 individuals, in 2022 was 659 individuals, and in 2023 was 599 individuals; no big difference between the three years, but there was a descending pattern in incidence.

This study showed the distribution of Leishmania according Governorate of Yemen from 2021 to 2023 There were 1947 individuals ,with The majority of them were from Sana'a and Sana'a City (n=561, 28.8 %), (n=320, 16.4%) respectively. This could be due to high population number of this areas and Near the hospital from this area, the next group of Governorates were from Dhamar, Amran, Ibb, Al-Mahweet and Hajjah, (n=214, 11%), (n=173, 8.9%), (n=112, 5.8%), (n=90,

4.6%), (n=89, 4.6%) respectively, the next group of Governorates were from Taiz, Al-Jawf, Al-Baida and Raimah, (n=70, 3.6%), (n=66, 3.4%), (n=62, 3.2%), (n=57, 2.9%) respectively, the next group of Governorates were from Al-Dhala'a, Sa'adah, Marib and Al-Hudaidah, (n=36, 1.8%), (n=35, 1.8%), (n=25, 1.3%), (n=25, 1.3%) respectively, the last group of governorates were Hadramout, Lahej, Aden, Abyan, Al-Maharah and Shabwah, (only n=3, 0.15%), (only n=3, 0.15%), (only n=2, 0.1%), (only n=2, 0.1%), (only n=1, 0.05%), (only n=1, 0.05%) respectively .

This group showed a low incidence. This could be due to the far distance from the governorate and EIDEWS. From the current study done by [16].

Leishmania causing CL is endemic across central Yemen, including regions like Taiz and Dhamar governorates [16, 20].

Other reports from Yemen have described the occurrence of CL in Hajjah, Amran, Sadah, Sanaa, Al-Hudeidah, Taiz, Ibb, Mahweet, Raimah, and Al-Jouf governorates in northern, western, and southern Yemen [21].

This study showed the difference between the incidence of CL and VL from 2021 to 2023. The total number of leishmania cases over the three years was 1947 individuals: CL (n=1,736, 89.2%) and VL (n=211, 10.8%). This could be because CL is more endemic in Yemen than VL, aligning with established epidemiological patterns [20, 22]. This agrees with a previous study in 2016 conducted in Al-Byda, which showed that mucocutaneous leishmaniasis was the most prevalent form (49.3%), followed by CL (47.4%), and VL (3.3%) [16].

This study showed the difference between males (n=1182, 60.7%) and females (n=765,

39.3%). This result agrees with a study that reported in the Republic of Azerbaijan, was terms of gender, 55.89% of patients were males, and the rest were females [23]. Disagree with another study reported in Zagora province, southern Morocco, showed that females more than male, were males (57.2%) and males (42.8%) [24].

In our study, most CL cases occurred in the majority of the age group 15-25 years (n=961, 55.3%), followed by children. Very few cases were observed in infants, middle-aged, or older individuals.

This result agrees with other studies performed in Yemen report that the most common age group was between 11 and 20 years [16, 20].

This could be due to this age group having more exposure to sand flies during daily activities, such as tending domestic animals outdoors [25, 26].

Conclusion and Recommendation

Between 2021 and 2023, the Electronic Integrated Disease Early Warning System (EIDEWS) recorded 1,947 cases of leishmaniasis in Yemen, with 689 cases in 2021, 659 in 2022, and 599 in 2023.

The highest incidence was reported in Sana'a, Sana'a City, Dhamar, Amran, Ibb, Al-Mahweet, and Hajjah, while the lowest occurred in Shabwah, Al-Maharah, Abyan, Aden, Lahej, and Hadramout. Cutaneous leishmaniasis predominated (n=1,736; 89.2%) compared to visceral leishmaniasis (n=211; 10.8%). Males were more affected (60.7%) than females (39.3%). Most cutaneous cases occurred in the 15–25 years age group (55.3%), followed by the 5–15 years (31.2%)

and 1–5 years (12.9%) age groups, with other age groups being minimally affected.

The study recommends conducting larger, multi-regional research in Yemen, prioritizing leishmaniasis, and performing genetic analyses to identify predominant leishmania species for improved hospital infection control policies.

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