



## Leishmaniasis in the Kingdom of Saudi Arabia: Epidemiological Trends from 2019 to 2021: A Retrospective Study

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### Abstract

**Background:** Leishmaniasis is a vector-borne disease caused by different species belonging to the genus *Leishmania*. Leishmaniasis is endemic in Saudi Arabia with cases reported in many regions. This retrospective study aimed to determine the epidemiological trends of leishmaniasis in the different regions of the Kingdom of Saudi Arabia (KSA) from 2019-2021.

**Methods:** The analyzed data were based on surveillance and registry database of the Saudi Ministry of Health and included the reported regions, patients' age groups, gender and the leishmaniasis clinical forms, their annual and month-by-month recorded patterns. Overall, a total of 2763 confirmed cases of cutaneous leishmaniasis (CL) were reported in KSA; divided as 1096, 1067 and 600 cases in 2019, 2020 and 2021, respectively. In addition, two visceral leishmaniasis (VL) patients only were reported during 2021G, one case recorded in Saudi patient and another one in non-Saudi.

**Results:** The highest number of the cutaneous leishmaniasis (CL) were from Medina region, western region of KSA (N = 655/2763, 23.7%) from 2019 to 2021; (N = 246/2763, 8.9%) in 2019; (N = 262/2763, 9.48%) in 2020 and (N = 147/2763, 5.32%) in 2021, while the lowest number was reported in Makkah region (N = 1 case in 2019). The cutaneous leishmaniasis (CL) were 49.65% Saudis and 50.34% non-Saudi expatriates with a ratio around 1.0: 1.02. The cutaneous leishmaniasis (CL) re-categorized in 2020 to 2021G as (1344/1667; 80.62%) males and (323/1667; 19.37%) females with a ratio of 4.0:1.0. In relation to patients' age group, the majority of the reported cutaneous leishmaniasis cases were in 15-<45 years (1072/1667; 64.3%) and the lowest number (13/1667; 0.77%) was in age group of <1 year during the period of 2020 to 2021.

**Conclusion:** Taken together, the present findings indicate the persistency of leishmaniasis endemicity, particularly cutaneous leishmaniasis, in KSA and Medina region is the most affected one. Thus, sustainable monitoring of leishmaniasis and improving its control measures is warranted

**Keywords:** Leishmaniasis; Epidemiological Trends; Saudi Arabia

## Abbreviations

KSA: Kingdom of Saudi Arabia; WHO: World Health Organization; MOH: Ministry of Health; *L. Leishmania*; CL: Cutaneous leishmaniasis; VL: Visceral Leishmaniasis; MCL: Mucocutaneous leishmaniasis; DCL: Diffused Cutaneous Leishmaniasis; PKDL: Post Kala-Azar Dermal Leishmaniasis; *P. Phlebotomus*; LD: Leishman-Donovan Bodies

## Introduction

Leishmaniasis is an insect-borne disease that is caused by *Leishmania* parasites that are transmitted by the bite of female phlebotomine sand flies [1]. The endemicity of leishmaniasis was reported in 98 countries with a predominant endemicity in the Americas, the Middle East, Central Asia, and the Mediterranean region [2]. The estimated annual world incidence is around 1-1.5 million cases with over 100,000 new cases of CL worldwide are reported to WHO every year [3,4]. Annually, more than 70,000 leishmaniasis-related deaths are estimated to occur worldwide [5] and up to 1 billion people are currently living at risk of infection in their endemic areas [6]. Several factors are linked to leishmaniasis endemicity such as deforestation, building of dams, irrigation schemes and urbanization [3]. The Kingdom of Saudi Arabia (KSA) was announced as one of the top ten countries for CL endemicity in 1996 [7].

Clinically, *Leishmania* species can infect all human ages and present multiple manifestations [8]. Visceral leishmaniasis (VL) is the most severe clinical form that can result in organ failure of bone marrow, spleen and liver. Cutaneous leishmaniasis (CL) is the most common clinical form and has less severity than VL. Based on *Leishmania* species, geographical location and host immunity, CL causes skin lesion sores that can either self-heal or develop into other complicated clinical forms such as mucocutaneous leishmaniasis (MCL) or diffused cutaneous leishmaniasis (DCL) and post kala-azar dermal leishmaniasis (PKDL) [9].

Oldworld cutaneous leishmaniasis (CL), which occurs in Africa, Europe, Middle East, and Asia, is caused by *Leishmania major*, *L. tropica*, and *L. infantum* and is zoonotic with wild rodent/gerbil colonies representing the reservoir host. The estimated annual world incidence is around 1-1.5 million cases with over 100,000 new cases in the eastern Mediterranean region [3].

Visceral leishmaniasis (VL) is the lethal variant of the disease complex can result in organ failure of bone marrow, spleen. *L. donovani* species are responsible for the disease in East Africa, Middle East and the Indian subcontinent, while *L. infantum* species are incriminated in Europe, North Africa and South and Central America [10]. It has been estimated that around 0.2-0.4 million of VL cases occur annually with more than 90% of cases are reported from India, Bangladesh, Sudan, South Sudan, Brazil and Ethiopia [11].

Phlebotomine sandflies, with over fifty species of genus *Phlebotomus* in the old world, and genus *Lutzomyia* in the new world, are the vector of leishmania that transmit disease to humans [12].

The transmission of leishmaniasis was observed to be focally associated with the parasite and the reservoir host distribution, which is in turn dependent on the ecology [3]. Domestication of the transmission cycle, urbanization, as well as introduction of agricultural projects into new areas are part of the environmental changes that can increase leishmaniasis incidence [3,12].

In Saudi Arabia, CL has been known for a long time and was considered of minor importance until 1975 when it was considered by the Saudi Ministry of Health as a disease that requires control [13]. Although declining of CL incidence in AlHassa in the eastern province of Saudi Arabia has been reported, the disease is still endemic in different places of the kingdom including Al-Qaseem, Riyadh, Al-Hassa, Asir, Ha'il, and Medina [1,4,14], and in the past 7 years, over 19,000 cases of CL have been reported [4].

The endemicity of VL has been confined mainly to the Southwest regions, namely Jazan and Aseer regions. *L. donovani* species have been identified as the causative species of VL, while *L. infantum* have been isolated only from dogs in the endemic areas. Many species of sand flies were caught in Southwest, but *P. orientalis* is the probable transmitter of the disease. The black rat (*Rattus rattus*) was found to be contributing to maintenance of the parasite life cycle [15].

The present study was therefore designed to identify the epidemiological trends of leishmaniasis over the past period of 2019 to 2021 in KSA.

## Materials and Methods

### Study design and setting

The present retrospective study was designed to disclose the epidemiological trends of infections with different clinical form of leishmaniasis that were reported among the individuals who were resident in the Kingdom of Saudi Arabia (KSA) during 2019 and 2021. An ethical approval (IRB # TU-077-022-127) was obtained from the Institutional Review Board of Local of Health Affairs, KSA. Patients who were diagnosed as positive cases of leishmaniasis and registered at the General Administration of Statistics and Information of the Ministry of Health, KSA, during the said period were included and analyzed here.

Geographically, KSA is located in Southwest Asia with estimated land area of 2,217,949 km<sup>2</sup> and 36,491,416 million population in 2023; making it the fifth-largest country in Asia, the largest one in Western Asia and the Middle East, and represent 80% of the Arabian Peninsula. KSA is annually attracting millions of visitors (pilgrims) and workers from different nations including those from leishmaniasis endemic regions. Moreover, climate changes, rainfall seasons in different regions (with an average ranging from 9 mm to 12 mm), and abundance of wild herbs and groundwater, make collectively KSA a good environment for the breeding of insects and dissemination of vectors-borne diseases including leishmaniasis (Figure 1) [1].



**Figure 1:** Location map of the of the Kingdom of Saudi Arabia.

<https://www.moh.gov.sa/Ministry/Statistics/book/Documents/public-health-2021-003.xlsx> (accessed on 3 April 2023).

### Study participants, data sources/measurement

In this retrospective study, three-year *Leishmania* data (January 2019 to December 2021) were obtained from the surveillance database of *leishmania* at the Registry of the Ministry of Health (MOH), KSA. The available data included regions, patient's age, clinical form of leishmaniasis, patient's sex and their nationality (Saudis and non-Saudi). However, important data such as treatments were not provided. Notably, there is a Vector-borne Diseases Control Unit at each province of KSA, and its reported cases are constantly raised to be registered in MOH of KSA.

In addition, the diagnosis of CL in KSA, a hospital-based process depends on the clinical features, microscopic examination of aspirate, skin biopsy, or scraping to identify the amastigotes (Leishman-Donovan [LD] bodies) [4]. The classical confirmatory test for diagnose VL cases depends on the clinical features and visualization of parasites in patient tissues obtained by splenic puncture in conjunction with molecular techniques [15].

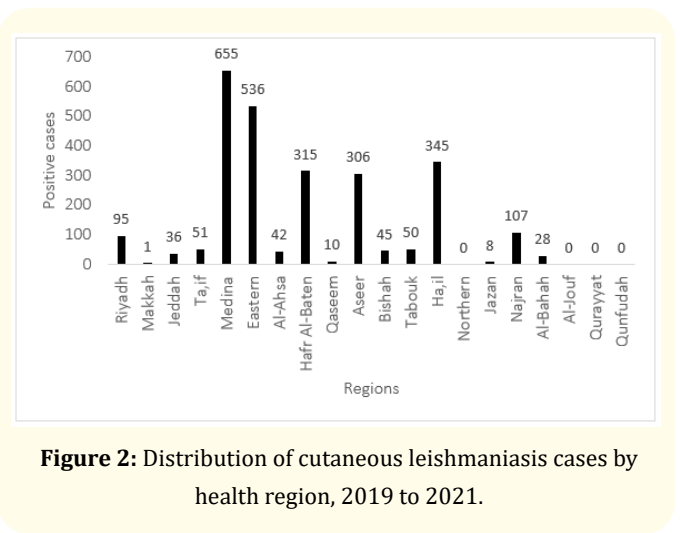
**Statistical analysis**

Data analyses were done using SPSS (Statistics software package version 20.0; SPSS Inc. Chicago, Illinois, USA) and Microsoft Excel 2010. The Chi-square ( $\chi^2$ ) test and Student “t” test or Mann-Whitney test were used for the categorical data and continuous variables as appropriate. P-value of <0.05 was considered statistically significant [16].

**Results and Discussion**

**Results**

Overall, a total of 2763 confirmed cases of cutaneous leishmaniasis (CL) were reported in KSA; divided as 1096, 1067 and 600 cases in 2019, 2020 and 2021, respectively. In addition, two visceral leishmaniasis (VL) patients only were reported during 2021G, one case recorded in Saudi patient and another one in non-Saudi. The highest number of the cutaneous leishmaniasis (CL) were from Medina region through three years of research study (N= 655/2763, 23.7%) from 2019 to 2021, (N = 246/2763, 8.90%) in 2019; (N = 262/2763, 9.48%) in 2020 and (N = 147/2763, 5.32%) in 2021, while the lowest number was reported in Makkah region (N = 1 case in 2019) (Table 1-3,Figure 2).



**Figure 2:** Distribution of cutaneous leishmaniasis cases by health region, 2019 to 2021.

Health Region	2019G						2020G					
	Cutaneous			Visceral			Cutaneous			Visceral		
	Saud.	Non. Saud.	Total	Saud.	Non. Saud.	Total	Saud.	Non. Saud.	Total	Saud.	Non. Saud.	Total
Riyadh	20	20	40	0	0	0	16	22	38	0	0	0
Makkah	1	0	1	0	0	0	0	0	0	0	0	0
Jeddah	10	5	15	0	0	0	3	5	8	0	0	0
Taif	12	4	16	0	0	0	8	6	14	0	0	0
Medina	61	185	246*	0	0	0	43	219	262	0	0	0
Eastern	95	75	170	0	0	0	151	150	301	0	0	0
Al-Ahsa	7	12	19	0	0	0	11	14	25	0	0	0
Hafr Al-Baten	56	90	146	0	0	0	39	62	101	0	0	0
Qaseem	4	4	8	0	0	0	2	0	2	0	0	0
Aseer	109	43	152	0	0	0	71	17	88	0	0	0
Bishah	12	10	22	0	0	0	9	5	14	0	0	0
Tabouk	28	37	65	0	0	0	26	16	42	0	0	0
Hail	72	41	113	0	0	0	82	48	130	0	0	0
Northern	0	0	0	0	0	0	0	0	0	0	0	0

Jazan	8	3	11	0	0	0	2	2	4	0	0	0
Najran	57	9	66	0	0	0	21	4	25	0	0	0
Al-Bahah	4	2	6	0	0	0	9	4	13	0	0	0
Al-Jouf	0	0	0	0	0	0	0	0	0	0	0	0
Qurayyat	0	0	0	0	0	0	0	0	0	0	0	0
Qunfudah	0	0	0	0	0	0	0	0	0	0	0	0
Total	556	540	1,096	0	0	0	493	574	1,067	0	0	0

**Table 1:** Distribution of leishmaniasis cases by health region, nationality, gender and age groups of patients in Saudi Arabia, during 2019-2020.

\* p < 0.5 vs other reported regions.

Health Region	2021G					
	Cutaneous			Visceral		
	Saud.	Non. Saud.	Total	Saud.	Non. Saud.	Total
Riyadh	4	13	17	0	0	0
Makkah	0	0	0	0	0	0
Jeddah	10	3	13	0	0	0
Taif	19	2	21	0	0	0
Medina	65	82	147*	0	0	0
Eastern	29	36	65	0	0	0
Al-Ahsa	0	9	9	0	0	0
Hafr Al-Baten	29	39	68	0	0	0
Qaseem	0	0	0	0	0	0
Aseer	59	7	66	0	0	0
Bishah	5	4	9	0	0	0
Tabouk	14	36	50	0	0	0
Hail	60	42	102	0	0	0
Northern	0	0	0	0	0	0
Jazan	8	0	8	1	1	2
Najran	14	2	16	0	0	0
Al-Bahah	7	2	9	0	0	0
Al-Jouf	0	0	0	0	0	0
Qurayyat	0	0	0	0	0	0
Qunfudah	0	0	0	0	0	0
Total	323	277	600	1	1	2

**Table 2:** Distribution of leishmaniasis cases according to nationality in Saudi Arabia, during, 2021.

\* p < 0.5 vs other reported regions.

Health Region	2019 to 2021G					
	Cutaneous			Visceral		
	Saud.	Non. Saud.	Total	Saud.	Non. Saud.	Total
Riyadh	40	45	95	0	0	0
Makkah	1	0	1	0	0	0
Jeddah	23	13	36	0	0	0
Taif	39	12	51	0	0	0
Medina	169	417	655*	0	0	0
Eastern	275	261	536	0	0	0
Al-Ahsa	18	36	42	0	0	0
Hafr Al-Baten	124	191	315	0	0	0
Qaseem	6	4	10	0	0	0
Aseer	236	67	306	0	0	0
Bishah	26	18	45	0	0	0
Tabouk	71	121	50	0	0	0
Hail	214	131	345	0	0	0
Northern	0	0	0	0	0	0
Jazan	18	5	8	1	1	2
Najran	24	15	107	0	0	0
Al-Bahah	20	8	28	0	0	0
Al-Jouf	0	0	0	0	0	0
Qurayyat	0	0	0	0	0	0
Qunfudah	0	0	0	0	0	0
Total	1372	1341	2763	1	1	2

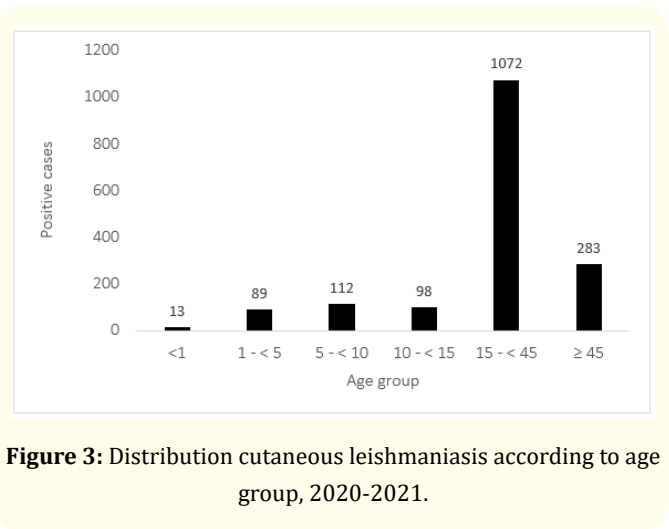
**Table 3:** Distribution of leishmaniasis cases according to health region and nationality, 2019 to 2021.

\* p < 0.5 vs other reported regions.

As demonstrated in table 4, month-by-month distribution variation was also observed here in the annual record of these CL patients whereby their highest numbers were reported in February (230 CL cases) and March (150 CL cases) while the lowest number recorded in May (18 CL cases) during 2020.

The registered 2763 CL patients included 1372 (49.65%) and 1341 (48.53%) Saudis and non-Saudis expatriates, respectively, with a total ratio around 1.02: 1.0. (Table 1-4).

The age group distribution of these CL patients showed that their majority (1072/1667; 64.3%) were in age group of 15-<45 years (p <0.5), and the lowest number (13/1667; 0.77%) was in age group of <1 year (Table 4, 5, Figure 3) during the period of 2020 to 2021.



**Figure 3:** Distribution cutaneous leishmaniasis according to age group, 2020-2021.

Health region	No. of cases	Nationality		Gender		Residence		Age group (years)					
				Male	Female	Resident	Non-Resident	<1	1 - < 5	5 - < 10	10 - < 15	15 - < 45	≥ 45
Jan.	136	66	70	113	23	130	6	2	7	9	10	89	19
Feb.	230*	115	115	189	41	227	3	3	17	11	11	155	33
Mar.	150	56	94	120	30	146	4	3	2	7	9	106	23
Apr.	33	20	13	27	6	33	0	0	2	2	3	21	5
May	18	10	8	12	6	18	0	0	2	0	1	10	5
June	33	14	19	29	4	32	1	0	5	5	1	17	5
July	56	16	40	48	8	54	2	0	2	3	2	38	11
Aug.	73	24	49	65	8	69	4	0	2	5	0	52	14
Sep.	68	39	29	58	10	64	4	0	3	4	11	46	4
Oct.	80	40	40	65	15	79	1	0	2	5	3	51	19
Nov.	109	47	62	90	19	108	1	1	3	10	2	74	19
Dec.	81	46	35	63	18	75	6	0	2	6	7	52	14
Total	1,067	493	574	879**	188	1,035	32	9	49	67	60	711#	171

**Table 4:** Distribution cutaneous leishmaniasis cases according to months, nationality, gender, residence and age group, 2020

\*  $p < 0.5$  vs other reported months; \*\*  $p < 0.5$  vs female; #  $p < 0.5$  vs other age group sets.

Health region	No. of cases	Nationality		Gender		Residence		Age group (years)					
				Male	Female	Resident	Non-Resident	<1	1 - < 5	5 - < 10	10 - < 15	15 - < 45	≥ 45
Riyadh	17	4	13	15	2	13	4	0	0	0	0	15	2
Makkah	0	0	0	0	0	0	0	0	0	0	0	0	0
Jeddah	13	10	3	6	7	0	13	0	3	1	1	3	5
Taif	21	19	2	11	10	21	0	0	1	2	3	9	6
Medina	147*	65	82	133	14	124	23	1	9	9	7	107	14
Eastern	65	29	36	52	13	65	0	1	3	3	3	36	19
Al-Ahsa	9	0	9	8	1	3	6	0	0	0	0	4	5
Hafr Al-Baten	68	29	39	61	7	67	1	0	1	3	7	40	17
Qaseem	0	0	0	0	0	0	0	0	0	0	0	0	0
Aseer	66	59	7	39	27	66	0	0	9	10	6	29	12
Bishah	9	5	4	7	2	9	0	0	1	1	0	6	1
Tabouk	50	14	36	47	3	50	0	0	2	0	0	42	6
Hail	102	60	42	62	40	102	0	2	8	14	8	51	19
Northern	0	0	0	0	0	0	0	0	0	0	0	0	0

Jazan	8	8	0	5	3	8	0	0	1	1	1	3	2
Najran	16	14	2	12	4	13	3	0	1	0	0	11	4
Al-Bahah	9	7	2	7	2	9	0	0	1	1	2	5	0
Al-Jouf	0	0	0	0	0	0	0	0	0	0	0	0	0
Qurayyat	0	0	0	0	0	0	0	0	0	0	0	0	0
Qunfudah	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	600	323	277	465**	135	550	50	4	40	45	38	361#	112

**Table 5:** Distribution cutaneous leishmaniasis cases according to health region, nationality, gender, residence and age group, 2021.

\*  $p < 0.5$  vs other reported regions; \*\*  $p < 0.5$  vs female; #  $p < 0.5$  vs other age group sets.

Only two VL patients, who were resident in KSA, during the period of 2019 to 2021, included one Saudis and one non-Saudis (Table 2,3).

The cutaneous leishmaniasis (CL) re-categorized during 2020 to 2021G as (1344/1667; 80.62%) males and (323/1667; 19.37%) females with a ratio of 4.0:1.0. (Table 4,5).

### Discussion

Cutaneous leishmaniasis (CL); the most common clinical form of leishmanial diseases worldwide [6], is lately classified by the WHO as one of the most neglected tropical diseases for which sustainable epidemiological investigations and monitoring disease trends is a priority [17].

The object of the current research was to explain the epidemiological pattern of reported leishmaniasis in KSA from 2019-2021. The highest number of the cutaneous leishmaniasis (CL) were from Medina region (N = 655/2763, 23.7%) while the lowest number was reported in Makkah region. In support, these findings are constant with the previous and recent reports described the distribution and prevalence patterns of leishmaniasis in KSA thus CL form, continues to be one of the major health problems in many regions of KSA [1,4,18]. While CL is more prevalent in AlQassim and Asir area and least prevalent in Aljouf area [13,14,19].

In addition, influx and immigrants of people from countries with known leishmania endemicity to KSA for either Hajj or for employment might have a role in spectrum of leishmaniasis infection [20].

Regarding the regional distribution, the highest rate of infection was recorded in the Medina. The geography of Medina is composed of three big valleys that join at the northwestern part of the holy city, resulting in provision of good ecological cover for the vector-breeding sites. Moreover, the northern provinces are composed of the major farming areas abundance of stagnant water, groundwater, irrigation schemes, palm trees, and wild herb, that collectively prone it an enriching environment for the breeding and survival of leishmaniasis’s insect-vectors and most of the expatriates there are farmers who spend most of their time outdoors [4].

The registered 2763 CL patients included 1372 (49.65%) and 1341 (48.53%) Saudis and non-Saudis expatriates, respectively, with a total ratio around 1.02: 1.0. In agreement, there was no significant variation in terms of number of CL cases between the Saudis and Non-Saudi expatriates [10,14]. Our results come into agreement with the results of a previous study [13] found in equal percentages between Saudis and nonSaudis. However, other studies from the KSA showed highest infection rate being among Saudis [4,27]. Moreover, a previous study reported higher ratio of infection among Saudis during 2000-2002 which was later on reversed by a higher ratio for non-Saudi nationals, most of which were expatriates [14].

Most of CL-infected patients reported here were those who had 15-<45 years age, while the lowest number was in <1 years age group. These findings are in constancy with those reported in Saudi Arabia [4,14,15,21] and other world countries [20]. While some researchers stated that *Leishmania* tended to invade the younger age < 15 in endemic areas especially those between the ages of one and four years [1,14].



In this study, the most susceptible age group is the age group of 15-45 years and above, this finding is explained by the fact that this age group is the most active population in the community and that most of the labors are of this age group and the most productive and involved in different activities and this in turn may increase their chances for bitten by leishmania infected Phlebotomine sandflies [22,23].

Regarding the season of the highest frequency of CL infection in February/March. This agrees with previous studies from the KSA [1,14] and is thought to be dependent on the vector activity in this period of the year. Similar results of seasonal increased frequency were reported from Iran [22].

The majority of CL reported cases in the current study occurred among males (1344/1667; 80.62%) while in female (323/1667; 19.37%). Our results coincide with research study in KSA [4] as well as different studies from, Ethiopia, Iran, Afghanistan, and Pakistan showed similar results [22,24,25,26]. However, other research studies from the KSA [27] and Burkina, Africa [28] showed similar *Leishmania* infection rate among males and females.

The observed gender-based distribution among the reported CL patients could be attributed to the fact that the males are more exposed to the parasite insect vectors as a result of their occupational activities [29], and the women in Saudi Arabia often have limited time facing to these vectors as they indoors staying for long time and they cover almost their whole body when outdoor [30]. Moreover, CL tends to affect younger age group has also been reported worldwide in leishmaniasis endemic areas.

Lastly, the burden of leishmaniasis, particularly its CL form, continues to be one of the major health problems in many regions of KSA, and the endemicity of the disease was reported in the Eastern, Riyadh, Al-Hassa, Aseer, Al-Qaseem, Ha'il, and Jazan regions of the country [18,30,31]. The Syrian war and its related significant displacement of refugees into several neighboring countries might also led to increased frightening numbers of CL cases across these neighboring countries, including KSA [20].

The present survey included a number of important variables such as the annual and month-by-month distribution of the reported CL patients and variations in terms of their number and

their residency, gender, and specific age group. Nevertheless, it would have been preferable if additional factors were available in the records of leishmaniasis patients and are included here; such as variables related to their general clinical data, occupational hazardous, anatomical distribution and morphological typing (popular, nodular, or ulcerative) of the detected leishmaniasis cases, molecular (PCR) typing of the underlying causative *Leishmania* species, and type and outcome of the applied treatment.

## Conclusions

Data of the present study reveal that despite the efforts exerted for controlling leishmaniasis infection in KSA, it remains endemic and represents a major public health concern in some regions of KSA particularly Medina region during 2019 and 2021, and the 15-45 years age group was the most vulnerable age for leishmaniasis while the lowest number of leishmaniasis cases recorded in <1 year. Further screening implements and continuous epidemiological monitor of the status of leishmaniasis in KSA are thus warranted to improve its controlling activities and eradicate its endemicity in the country.

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## Conflict of Interest

The author declares that there is no conflict of interests. The author also declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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