

# A Five-year retrospective hospital-based study on epidemiological data regarding human Leishmaniasis in West Kordofan state - Sudan

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## Research Article

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# Abstract

## Background

Leishmaniasis is a parasitic zoonotic disease caused by the *Leishmania* parasites genus. The estimation of this disease is very important to inform the health care policymakers and the governments to applied proper health and economic policies. Thus, this study aimed, to find out the frequency and distribution of human leishmaniasis in West Kordofan state, based on sex and age during 5 years- Sudan.

## Methods

Five years retrospective study from 2016 through 2020 was carried out using local hospital records of leishmaniasis patients. The age and gender of each patient were recorded. The collected data were analysed using STATA package version 16.

## Results

A total of 162,443 patient records from 2016 to 2020 were retrieved. Of these, 4.39% were found to be positive for leishmaniasis. The disease has been more common in males (65.3%) than in females (34.7%). The highest reported prevalence (6.58%) was in patients 15-44 years old, which was, and the lowest prevalence (1.95%) was among patients in  $\geq 65$ -year-old.

## Conclusion

The current study indicates that leishmaniasis is endemic in the study area even though the numbers of patients in the five consecutive years were varying. Besides, the disease was common in males and adults.

## 1. Introduction

Leishmaniasis is a parasitic zoonotic disease caused by the *Leishmania* parasites genus (1). The disease is mainly transmitted by the bite of infected female phlebotomine sandflies (2). World health organizations (WHO) classified the disease as a neglected tropical disease (NTD) (2, 3). There are several different forms of human leishmaniasis, and the most common forms are cutaneous leishmaniasis (CL), which causes skin sores, and visceral leishmaniasis (VL), which affects several internal organs (usually spleen, liver, and bone marrow)(4). All forms of the disease have been strongly associated with poor socioeconomic status, population displacement, a weak immune system, and climate change(5-8). Leishmaniasis cases have been reported in almost all continents in about 89 countries, with an estimated 700 000 to 1 million new cases occur annually. Most cases occur in East Africa, Southeast Asia, and

South America(4, 9). Human leishmaniasis outbreaks reported worldwide were from East African countries namely Sudan, South Sudan, and Ethiopia (10-15).

Sudan is a highly leishmaniasis endemic country (both CL and VL). The disease represents a serious health problem that may affect the whole healthcare system(16). The geographical distributions of the disease in Sudan have high relations to the distribution of the vectors. studies revealed that VL is endemic in the savannah area which starts from Gadarif state in the east to the White Nile State in the west, and from Kassala state in the northeast to the Blue Nile State in the south. Also, VL was reported in some scattered foci in the Kordofan states and Darfur states. Moreover, CL is found in a fluctuating pattern mainly in the northern, central, and western parts of the country(17-26).

West Kordofan is the 18th state of Sudan, it was established in July 2013 on the border with the Republic of South Sudan in the east, North Kordofan State in the North, South Darfur State in the west. People of West Kordofan especially the Mesairya tribe continuously moving to and from South Sudan where leishmaniasis disease is endemic(7). The state also, containing many south Sudanese refugees' camps spread almost all over the state. The geographical location together with the high presence of the suspected infected refugees makes the people of West Kordofan state are very vulnerable to leishmaniasis for both CL and VL. A community-based study in two West Kordofan cities, namely Muglad and Babnousa, reported that out of 1781 randomly selected volunteers, 238 persons (13%) tested positive for leishmaniasis(27). Based on that, there is still a need for a deeper look at the epidemiology of the disease in the whole state, in both males and females and all ages groups, to design and imply suitable prevention and eradication programs for the disease at the state level. Thus, this study aimed to find out the frequency and distribution of human leishmaniasis in West Kordofan state, based on sex and age during 5 years.

## **2. Materials And Methods**

The present retrospective study was conducted among patients who were admitted to any hospital in West Kordofan state -Sudan from the 1st January 2016 to the 31st of December 2020. Data of age, gender, and presence of any type of leishmaniasis were retrieved from the medical records department in the ministry of health west Kordofan, with the approval of the ministry ethical committee. The medical record department follows the guidelines of the International Classification of Diseases (ICD)-10 coding.

### **2.1. Statistical analysis**

Descriptive statistics and data analysis were done using STATA package version 16 (Stata Corp LLC, College Station, TX). Z test was applied to compare the proportions between the study groups and if the P-value was less than or equal to 0.05 indicates that there was a significant difference between the proportions of the two groups.

## **3. Results**

A total of 162,443 patient records (87847 females and 74596 males patients) from 2016 to 2020 were retrieved. Of these, 4.39% were found to be positive for leishmaniasis, 34.7% were female and 65.3% were males. The diagnostic prevalence of the infection was first founded to be very low in 2016 (2.57%), and just after one year in 2017 turned to become the highest reported prevalence at 5.83% and then start to decreased (with some fluctuation) to 3.67% in 2020 (Figure 1).

Gender-related differences in leishmaniasis prevalence are presented in Table (1), and the prevalence was significantly higher ( $P \leq 0.05$ ) in males compared to females in the period from 2017 to 2020, while in 2016, it didn't show any significant variation with the sex ( $P > 0.05$ ).

The prevalence of leishmaniasis was relatively increased with participant age in both females and males. The prevalence reached its peak in patients with 15-44 years old, which was 6.58%, then decreased to be the lowest limit of 1.95% among patients in  $\geq 65$ -year-old (Table. 2 &3).

In addition to that in all age groups, males had a higher prevalence of leishmaniasis than females.

## 4. Discussion

Leishmaniasis is an endemic neglected zoonotic disease in Sudan, widespread all over the country from the eastern states to the western states, and from southern states to northern states (16). However, a few data about the epidemiological and demographical distribution of the disease in western states is available in general and especially in west Kordofan, and it seems to be overlooked (20, 24, 25, 27), thus the current study is the first comprehensive attempt to describe the epidemiological and demographical distribution of the disease in the state.

In this study, the data of human leishmaniasis was collected from the annual health statistical reports for 5 years (2016–2020) and analyzed to show the burden of the disease in West Kordofan State, Sudan. The results highlight that a total of 162,443 people were admitted to the hospitals and health care centers in the state. Of these, 7,128 people were infected during this period. In 2016 the prevalence of leishmaniasis was found to be very low at 2.57%, surprisingly it was raised to 5.83% in 2017, and from then it seemed to decrease. The reason could be mainly since the government of Sudan in October 2014 with collaboration with WHO and other related international organizations, has developed diagnostic and control strategies to limit the spread of the disease(28, 29). The first two years 2015 and 2016 were for training the health care professional in the state, on the new diagnostic and prevention methods. That may explain the low prevalence in the first study year because of the use of the low sensitivity diagnostic test, and then after implying the new diagnostic method in 2017 it raised. In line with that after 2017, the prevalence of leishmaniasis is decreasing because of implying the new control strategies.

The current study found that the overall prevalence of leishmaniasis in West Kordofan was lower than that reported by Sharief et al(27) in 2019, this may be due to the difference in sample size and study period which both were bigger and longer respectively in the current study compared with the other study.

Nevertheless, the study area could have a great impact on the result, In their study, Sharief et al (27) were just applied in two districts in the state but the current study collected data from all 14th districts.

Sex-related distribution of human leishmaniasis in the study revealed that males were highly affected compared to females with an overall percentage of 65.3% and 34.7% respectively. This is in line with Ali 2007(30), Ebrahim 2016(25), and Collis et al 2019 (31), and disagrees with Mohammed et al 2018(20). This result might be justified because the majority of males are nomads and they are moving seasonally to the tropic and subtropic areas in South Sudan whereby the exposure to the risk of sandflies bites is high, as well as the same exposure of the males to different agricultural areas may be a contributing factor to the infections. Consequently, males are more vulnerable than females.

Age-wise distribution found that people of age group 15-44 had the highest prevalence among all populations similar results were reported by Ali 2007(30), Osman 2011(24), Ebrahim 2016(25), and Collis et al 2019(31), whose indicated that the adult men and women who aged between (15-44 years) were more affected by the disease compared to the lower and higher age groups. This can be put in the context that this age group is the working-age group in all fields, especially the agricultural field. In contracts that a study conducted by Mohammed et al 2018(20) indicated that the most affected age groups were children between 1 and 5 years old.

## **5. Conclusions**

The current study indicates that leishmaniasis is endemic in the study area even though the numbers of patients in the five consecutive years were varying. Besides, the disease was common in males and adults.

## **Declarations**

### **Acknowledgements**

None.

### **Ethical Considerations**

Individual consent was not required as the data used were secondary, collected from the Ministry of health west Kordofan data center. Ethical approval and permission were obtained from Ministry of health west Kordofan Ethics Review Committee.

### **Competing interests**

The authors declare that they have no competing interests.

### **Availability of data and materials**

The data that support the findings of this study are available at the Ministry of health west Kordofan but restrictions apply to the availability of these data, which were used under license for the current study, and are not publicly available. Data are however available from the authors upon reasonable request and with the permission of the Ministry of health west Kordofan.

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## Tables

**Table 1: Gender distribution of different patients infected with leishmaniasis classified by year**

Years	Female%	Male%	Total%	P. value
<b>2016</b>	244 (1.85%)	405 (3.37%)	649 (2.57%)	0.2277
<b>2017</b>	780 (3.99%)	1322 (7.99%)	2102 (5.83%)	0.0002
<b>2018</b>	621 (3.45%)	1142 (7.49%)	1763 (5.3%)	0.0002
<b>2019</b>	409 (2.36%)	941 (5.83%)	1350 (4.03%)	0.0015
<b>2020</b>	420 (2.12%)	844 (5.77%)	1264 (3.67%)	0.0008
<b>Total</b>	<b>2474 (2.82%)</b>	<b>4654 (6.24%)</b>	<b>7128 (4.39%)</b>	0.0001

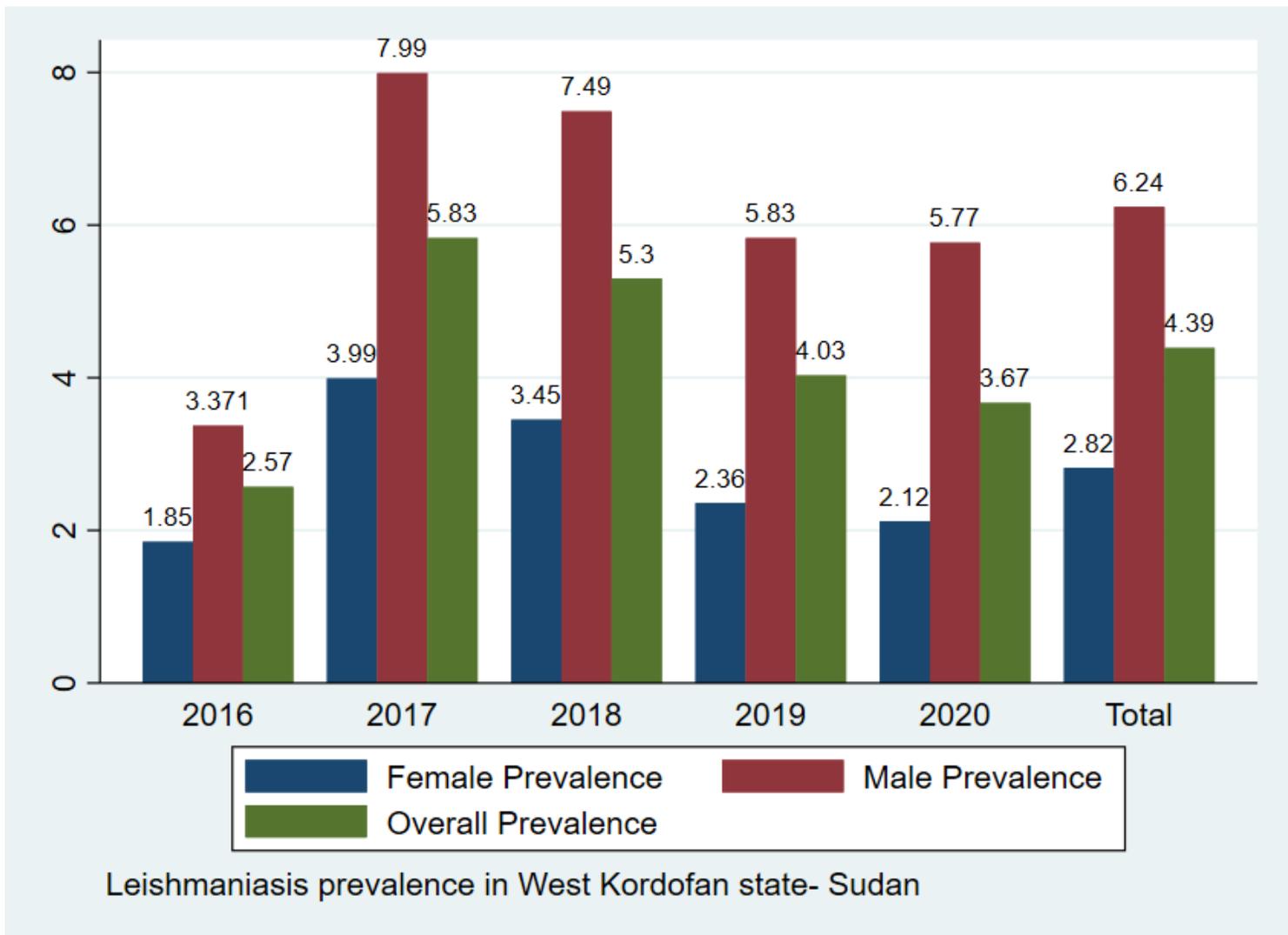
**Table2: Age and gender distribution of patients infected with leishmaniasis**

Age group	Female%	Male%	Total%	P-value
<1 year	2.22	5.05	3.52	0.0001
1-4 year	3.93	4.5	4.19	0.2523
5-14 year	5.47	7.89	6.57	0.0001
15-44 year	5.63	7.68	6.58	0.0001
45-64 year	2.81	4.42	3.55	0.0012
≥65 year	1.73	2.2	1.95	0.3452

Table 3. Comparing the sex-wise proportion of human leishmaniosis reported in each age group

Year	Sex	Age group						
		Females	<1%	1-4%	5-14%	15-44%	45-64%	≥65%
2016			1.19	2.66	4.52	3.51	1.85	1.06
2017			2.16	1.8	6	4.97	2.47	2.01
2018			1.44	3.35	4.97	5.55	2.39	1.55
2019			3.54	3.9	5.54	6.81	2.98	1.77
2020			2.51	4.83	5.98	6.73	4.04	2.03
<b>Total</b>			<b>2.22</b>	<b>3.93</b>	<b>5.47</b>	<b>5.63</b>	<b>2.81</b>	<b>1.73</b>
2016	<b>Males</b>		0.92	3.81	6.59	5.2	2.3	1.19
2017			2.06	5.26	8.3	6.9	3.7	2.35
2018			3.26	3.69	7.64	8.5	3.81	2.08
2019			4.64	3.75	6.9	7.2	5.08	2.12
2020			14.11	5.9	9.84	10.23	6.84	3.14
<b>Total</b>			<b>5.05</b>	<b>4.5</b>	<b>7.89</b>	<b>7.68</b>	<b>4.42</b>	<b>2.2</b>

## Figures



**Figure 1**

Prevalence of leishmaniasis during 2016–2020 according to gender