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Research Article

PREVALENCE AND EPIDEMIOLOGY OF LEISHMANIASIS IN AREAS OF MAYO TSANAGA (CAMEROON)

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ABSTRACT

Leishmaniasis is a tropical and subtropical disease caused by leishmania, humans are infected when they share the same environment with a sand fly vector and reservoir host. Leishmaniasis accounts for a large number of hospitalization and mortality in the areas of Mokolo in Cameroon. With the aim of improving the knowledge of leishmaniasis in Cameroon, we carried out a study on the prevalence and epidemiology of leishmaniasis in Mokolo. This was a retrospective and a prospective study. The descriptive and cross-sectional study covered a period from the 10 of August to 30 November. This study was based on participants in between the age range of 10 to 60 years' old who came for consultation with symptoms. Socio-demographic data were collected were collected using a pre-tested questionnaire. The collected data was analysed using SPSS software and Microsoft excel 2016. The Chi-square and Fischer tests were used to compare categorical variables. P value ≤0.05 at 95% confidence interval was considered statistically significant. 130 patients were involved in this study, with majority of patients within the age range of 10 to 20 years of age. 43% of the study population were males while 57% were females. Most of the study population were students from the university, and 59% of the study population was made up of single partners. Christians (49%) participated more than Muslims and pagan. The prevalence of leishmaniasis in Mokolo was 5%. The prevalence was higher in males (8.5%) than in females (1.4%), The frequency of positive leishmaniasis in males was 83% and 12% females. Gender and all the clinical symptoms were statistically associated with the presence of leishmaniasis. This study confirms the presence of leishmaniasis in Mokolo and the population needs to be sensibilized and practice preventive measures.

Keywords: Leishmaniasis, Prevalence, Epidemiology, Sand-fly.

INTRODUCTION

Leishmaniasis is a disease caused by the species of an obligate intracellular parasite of the genius *Leishmania.* This parasite dwells in cells of the monocytic-phagocytic system of mammals and is transmitted by female sand flies. More than 20 leishmania species are pathogenic to humans, and more than 30 species of sand flies are vectors. It is classified as a neglected tropical disease **(Nilakshi, 2020).**There are 3 main forms of leishmaniasis that is; VL (also known as kala-azar, the most serious form), CL (the most common form) and MCL **(WHO, 2021).**

The disease is endemic in several areas deserts, and rainfall forests in tropical and subtropical regions of Africa, America, and Asia and sub-rural and urban areas in Southern Europe **(Davies *et al.,* 2020; Croft *et al.,* 2006; Rotoureau, 2006; Ready, 2010).** Leishmaniasis affects some of the poorest people in the world **(WHO,2017).** An estimated 350million people worldwide are at risk of being infected, about 12million people are infected, and an annual occurrence is about 1.5- 2 million cases of the cutaneous and 500,000 cases of the visceral form of leishmaniasis **(Croft *et al.,* 2006).** In anthroponotic foci, sand flies transmit parasites from human to human, and in zoonotic foci, sand flies transmit parasites between the usual local hosts and from them to human (**WHO, 2010;Rotoureau, 2006**). Male are normally more affected than females especially in sub-Saharan Africa **(A.ponte-sucre*et al.,* 2013).**

In Cameroon, visceral and cutaneous leishmaniasis cases where reported more than six decades ago and the main circulating vector of leishmaniasis is Phlebotomousduboscqui**(Domche*et al.,* 2021).**

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Moreover, interest in the disease has decreased over time and data on its epidemiology across the country are scanty **(Yemeli*et al.,* 2021).**We also had as hypothesis that due to the presence of Leishmaniasis in Cameroon that account for some number of deaths, it prevalence should be high amongst the individuals in the Mokolo. We chose Mokolo because the first cases of leishmaniasis was reported there **(Djibrilla*et al.,* 1979; Donji, 2001)** and we wanted to have an update about the evolution of the disease.

The general objective of this study was to determination of the prevalence, epidemiology and risk factors of leishmaniasis. More specifically aimed to;

- Perform a survey in other to evaluate the knowledge of the targeted population on leishmaniasis and gather data ontheir daily habits (risky habits).
- Diagnose the active cases of leishmaniasis and establish the severity of clinical signs.
- Identify the involved parasitespecies and determinethe parasite load of infected patients.

MATERIAL AND METHODS

STUDY DESIGN AND SAMPLING METHOD

Place of study

The present study is cross-sectional and descriptive. It was conducted at the Mokolo District Hospital and in 5 other Health Centers there in Mokolo (Ziling, Zamay, MandakaChechem, Vouzod and Magoumaz.

Hospitalised patients were considered as the target population.

Mokolo is the departmental capital and largest city of the Mayo-Tsanaga department, in the Far North Province of Cameroon. It is thefourth largest city in the Far North Province, after Maroua, Yagoua, and Kousséri. It is located in the Mandara Mountains that run along the Cameroonian-Nigerian border. The center of Mokolo is estimated to have a population of 30,000. The Mayo-Tsanaga department is one of the most densely populated departments of Cameroon. Fulfulde, is the predominant language spoken throughout the Mokolo area, and is prevalent in the center of Mokolo. Fulfuldé was brought to the region by the Fulbé peoples (World Gazetteer, 2013). Mafa is widely spoken among the Mafa populations throughout Mokolo. To the southwest of Mokolo, in the direction of the town Rumsiki, Kapsiki is the dominant language (Teri, 2013). French is used by the government and is the language of instruction in government-run schools. The climate of Mokolo is typical of the Sahel- tropical dry. A short rainy season lasts from mid-May to August. Harmattan winds blow South from the Sahara during December and January. A dry, hot season lasts from March to May. Hot season temperatures reach roughly 43.3°C (110 °F). As it is located in the Mandara Mountains at a slightly higher elevation than Maroua, the temperature of Mokolo is usually 5 to 10 degrees cooler than that of Maroua (Jean-Rémy *et al.,*2013).

Study type and period

This was a prospective and a retro prospective study that took place in Mokolo from the 10 August to 30 November in the Mokolo District Hospital.

Inclusion Criteria

All the suspected patients who came for consultation with signs and symptoms of leishmaniasis and leishmania lesions or scars within the period of study and those whose parents gave their consent to participate in the study after completing a consent form.

Exclusion Criteria

- Those who never had any signs or symptoms of leishmaniasis and leishmania lesions or scars.
- Those who refused to sign their consent form.
- Those whose parents refused to give and sign their consent form.

POPULATION SAMPLING METHOD

The participants were recruited through simple consecutive sampling.

Population size statistical consideration

In order to have a representative sample size, we calculated the size using the following Lorentz formula

$$N= \frac{Z\alpha^2 .P .q}{I^2}$$

- N: Sample size
- P: Estimated Leishmaniasis in Cameroon 4%(Dondji, 2001)
- q: 1-P
- Zα: the normal distribution value for which a=0.05 (the standard normal deviate=1.96) 95%, confidence interval;
- a= level of statistical significance (0.05)
- I: degree of precision= level of error we want to accept (D=0.05 for a 95% confidence interval)
  For P=4%, N=95

Definitions of population cases

Suspected case: All people living in an endemic area having CL with a skin lesion without known cause.Probable case: Suspected case with presence of confirmed similar cases in the region or in the family. Confirmed case: suspected or probable case with a positive biological result (MGG, ELISA or PCR)

Sample collection strategy

Any suspected participant present for consultation in the chosen health Centers and at the district hospital involved in the study and fulfilling the inclusion criteria was registered and sampled. Participants with depressed and atrophic scars were noted including the location and numbers of scars. Data concerning patients with cutaneous leishmaniasis were also collected from the laboratory archives. The sample obtained was total blood.

EQUIPMENT AND CONSUMABLES

Screening kits (test device, droppers, buffer), timer, specimen collection containers, lancets (for finger stick whole blood only), computer software, printer, A4 papers, pen, ruler, disposable gloves, printers, transport media.

SAMPLE COLLECTION AND ANALYSIS

The relative sensibility and specificity of the TDR IgG/IgM Leishmania test that we used was 91.2% and 98.3% respectively which is similar to the leishmania OligoC-test which showed a sensibility of 96.4% and a specificity of 88.8% and the NASBA-OC test with a sensitivity and specificity of 79.8% and 100% respectively showed in a recent report from Kenya **(Pankaj *et al.,* 2010).**

ETHICAL CONSIDERATION

We obtained research authorizations from the sanitary and administrative authorities. A copy of the information sheet and consent form were signed by participants

STATISTICAL ANALYSIS

- A printed data collection sheet was designed and used to collect patient's demographic and clinical.
- Proportions were calculated, frequency tables and graphs were made using excel software 2016.
- Statistical data analysis was performed using the SPSS statistics 20 version software.
- Categorical data were presented in a two-way contingency table analysis using Pearson Chi-square tests of independence or Fisher's exact test (when expected frequencies were less than 5).
- A 95% confidence internal was calculated and values of P< 0.05 were considered statistically significant.

RESULTS

SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION

Population distribution according to sex

Overall, our study population was 130 suspected participants constituted of 59 (43%) males and 71 (57%) females thus, giving a sex ratio of 0.8 (figure2).

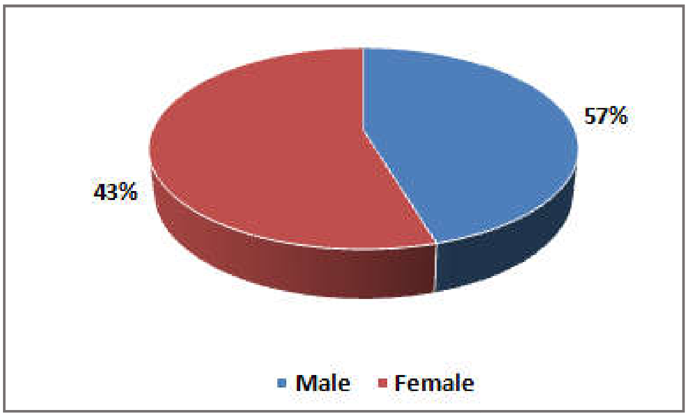

Figure2: *Sex distribution of study population*

Population distribution according to age range

Our study population was divided into 5 groups (figure3). The age range of (10-20) was predominant with a percentage of 36.9%, followed by the (20-30) age group with 28.5%. The least represented population were those whose age ranged between (51-60) with a percentage of 6.2%.

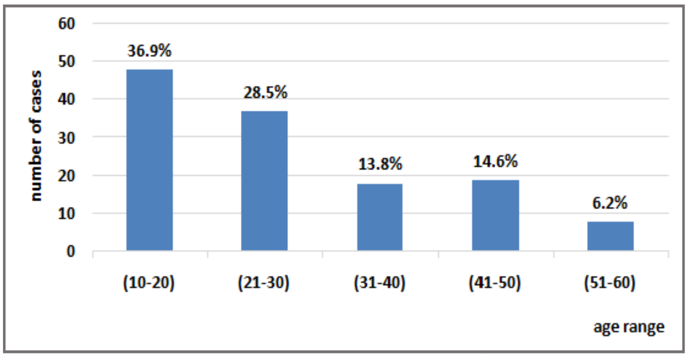

Figure 3: *Age distribution of study population*

Population distribution according to educational level

The repair of the study population according to the level of education is illustrated infigure4. It shows that the major part of the study population was from the university, the secondary level was poorly represented.

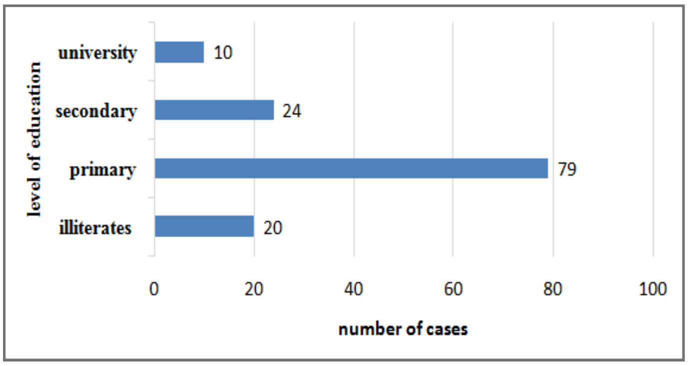

Figure 4: *Educational distribution of study population*

Population distribution according to profession

Figure 5shows that the occupation with the highest study population were students with a total percentage of 45%, followed by farmers (13%). At the bottom of the ranking comes an unemployed and a hunter with 1%.

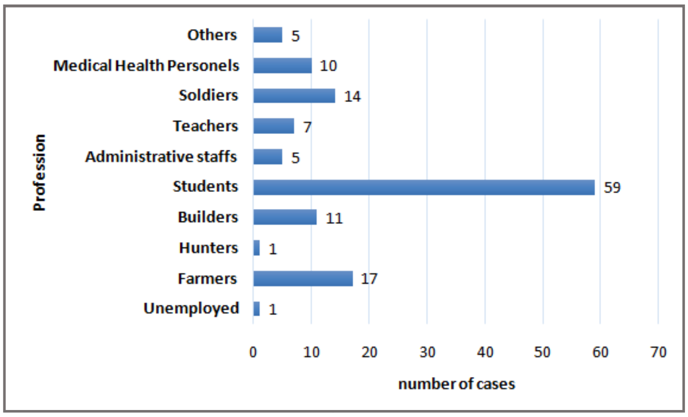

Figure 5: *Distribution of the study population by profession*

Population distribution according to marital status and religion

Analyses showed that there were more single people (59%) as seen in figure 6 and more Christians (49%) as seen in figure 7.

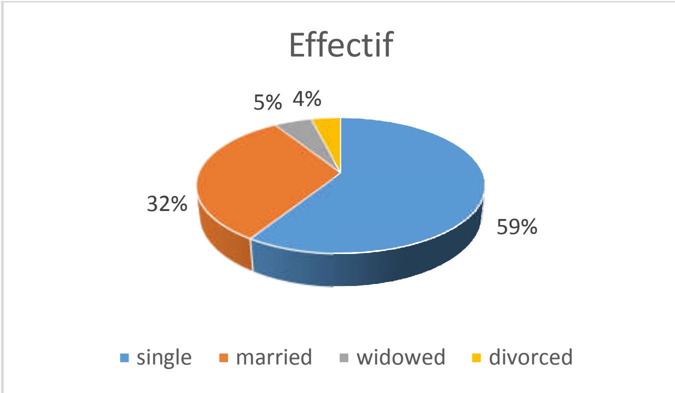

Figure 6: *Marital distribution of study population*

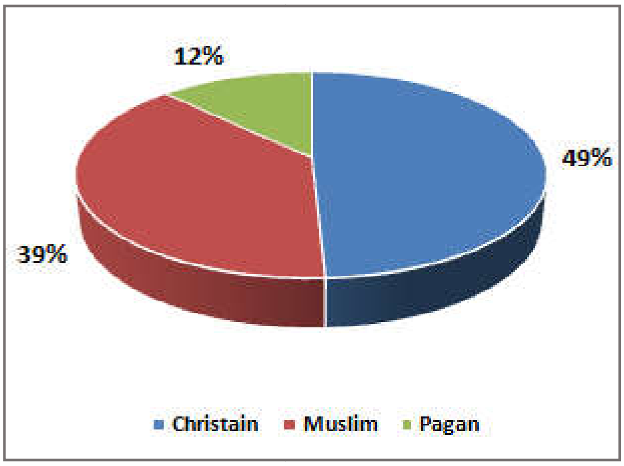

Figure 7: *Distribution of study population by religion*

LEISHMANIASIS PREVALENCE

Out of the 130 people who were tested, 6 (5%) people were tested positive. 4 participants were recorded with 2 leishmania scars and 2 patients with just 1 leishmania scar.

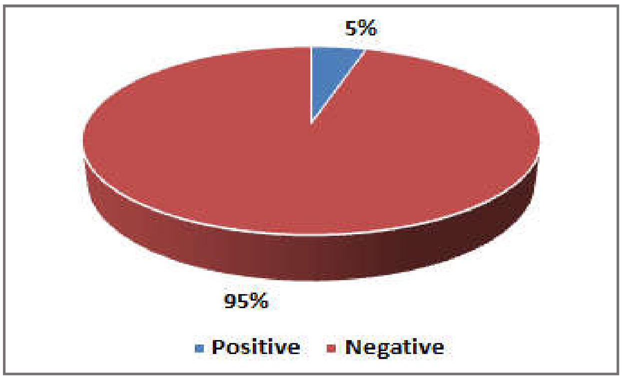

Figure 8: *Leishmaniasis prevalence*

Frequency of Leishmaniasis with respect to sociodemographic variables

Sex distribution for Leishmania positive group

There were more positive males (83%) than females (17%)

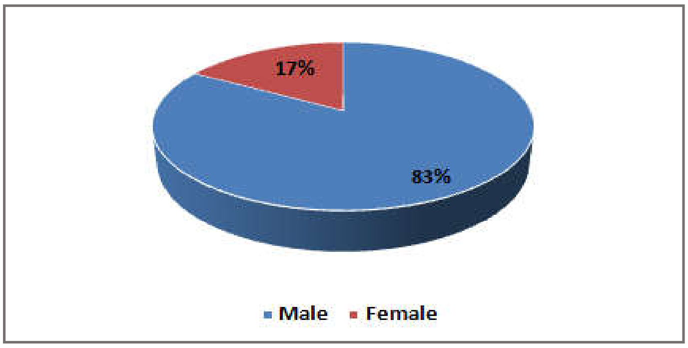

Figure 9: *Sex distribution for Leishmania positive group*

Frequency of Leishmaniasis according to gender

The frequency of leishmaniasis was found to be higher in males 5(8.5%) as compare to females 1(1,4%)with a statistical significant association between gender and the presence of leishmaniasis.

Table 1: Frequency of Leishmaniasis according to gender

Gender	Effective	Leishmania negative		Leishmania positive		p-value
	N (total=130)	N (total=124)	%	N (total=6)	%	
Male	59	54	91.50	5	8.50	0.05
Female	71	70	98.60	1	1.40	

Distribution of Leishmaniasis positivity rate according to age

The great majority of leishmaniasis positive cases with one or two leishmania scars were found within the age range of 10 to 20 years.

Table 2:Frequency of Leishmaniasis according to age

		Effective	Leishmania positive		Leishmania negative		P-value
		N (total=130)	N (total=6)	%	N (total=124)	%	
Age (year)	(10-20)	48	3	6.20	45	93.8	5.5
	(21-30)	37	0	0.00	37	100	
	(31-40)	18	0	0.00	81	100	
	(41-50)	19	2	10.50	17	89.5	
	(51-60)	8	1	12.5	7	87.5	

Frequency of leishmaniasis with respect to risk factors

The table below shows the different risk factors associated with leishmaniasis positivity, we didn't find a significant association between all the risk factors and Leishmania positivity.

Table 3: Frequency of leishmaniasis with respect to risk factors

Epidemiological Criteria		Effective		Negative Leishmania (%)		Positive Leishmania (%)		P Value
		N	%	N	%	N	%	
Type of Habitation	Modern	70	53.8	70	100	0	0.00	0.07
	Traditional	60	46.2	54	90.0	6	10.0	
Source of water	Mineral	44	33.8	43	97.7	1	2.30	0.6
	River	21	16.2	18	85.7	3	14.3	
	Well	65	50.0	63	96.9	2	3.10	
Use of Mosquito net	Yes	73	56.2	73	100	0	0.00	0.5
	No	57	43.8	51	89.5	6	10.50	
Use of insecticides	Yes	42	32.3	42	100	0	0.00	0.8
	No	88	67.7	82	93.1	6	6.90	
Disease awareness	Yes	23	17.7	23	100	0	0.00	0.2
	No	107	82.3	101	94.4	6	5.60	

Frequency of leishmaniasis with respect to clinical symptoms

Table 4summarises the frequency of Leishmaniasis with respect the clinical symptoms. We found a significant association between all the clinical symptoms and leishmaniasis.

Table 4: Leishmaniasis Frequency according to Clinical Symptoms

Clinical Symptoms		Effective		Negative Leishmania(%)		Positive Leishmania (%)		P Value
		N	%	N	%	N	%	
Long Lasting Fever	Yes	12	20.8	7	58.3	5	41.7	0.00
	No	103	79.2	102	99	1	1.0	
Splenomegaly	Yes	21	16.2	15	71.4	6	28.6	0.00
	No	109	83.8	109	100	0	0.00	
Hepatomegaly	Yes	10	7.7	7	70	3	30	0.00
	No	120	92.3	117	97.5	3	2.5	
Weight Loss	Yes	41	31.5	35	85.4	6	14.6	0.00
	No	89	68.5	89	100	0	0.00	
Anemia	Yes	38	29.2	32	84.2	6	15.8	0.00
	No	92	70.8	92	100	0	0.00	
Pallor	Yes	37	28.5	31	83.8	6	16.2	0.00
	No	93	71.5	93	100	0	0.00	

DISCUSSION

A rapid diagnostic serological leishmania test was done on 130 suspectedpeople; this serological rapid test was also done in some previous studies **(Kaptueet *al.*,1992, Dondjiet *al.*, 2001)**. The prevalence of cutaneous Leishmaniasis obtained in this study was

5% which is similar to the cases reported in a previous study inMokolo with a prevalence of 7% **(Yemeli*et al.,* 2010)**.

In this study, we had a total of 59 males and 71 females. 4 patients were found with 2 leishmania scars each mostly found around the face, arm, and legs while 2 patients were with just scar on the hand and legs unlike a previous study in Mokolo where patients were reported with less or more than 3 leishmania scars **(Dondji*et al.,* 2001)**. We found a lower prevalence of Leishmaniasis in females (1.40%) than in males (8.50%).The gender was identified as a significant risk factor for leishmaniasis (P<0.05) in our study in agreement with other published studies **(Guilherme *et al.,* 2020;Dawit*et al.,* 2018)** due to the fact that, a biological sex related differences can likely play an important role in the pathogenesis of leishmaniasis **(Guilherme *et al.,* 2020)**. However, the prediction was not confirmed by the Hosmer-leme show test, which might be because of the small sample size. We found that the great majority of leishmaniasis were present within the age range of 10 to 20 years (48 out of 130) giving a prevalence of 36.9%, even though this age distribution according to leishmaniasis was not statistically significant in multivariate analysis this might be due to poor hygienic environment, non-use of mosquito nets, insecticides and presence of certain illnesses like HIV subsequently leading to a weaker immune system **(JAL Lindoso, 2018).**

Furthermore, we found high frequencies in the risk factors associated with leishmaniasis positivity cases. As for the types of habitation, those who lived in traditional hurts in this rural area had higher frequencies (10%) than those in modern houses which can be explained by the fact that peoplewho live in traditional huts mighthave holes or open spaces in their huts where sandflies can easily pass through and also due to poor housing which increases sandfly breeding. Some of them sleep outside especially when places are hot and are more exposed to the sand fly which is similar to the report in Tunisia **(Kamhawi, 1993).**

Those who drank water from the river had a higher frequency (14.3%) than those who consume well (3.1%) and mineral (2.3%) water sources, which might be because of the presence of the vector in the rural areas which are closed to the bush and farms exposing them to sand flies. Those who drink mineral and well water are less exposed to sandflybitesbecause they don't go to fetch water from the river. People who didn't use impregnated mosquito nets or insecticides maybe because of lack of money to buy insecticides, were at higher (6.9%) than those who useimpregnatedmosquito nets and insecticides, which is similar other previous studies **(Ritmeijere*t al.,* 2007, Elnaieme*t al.,* 1999)**. Those who did not have an awareness about leishmaniasis had a high frequency (5.6%) than those who have an idea about leishmaniasis**(WHO, 2007).** A possible reason for this outcome might be because those who know about the disease find possible ways on how to prevent and protect themselves against leishmaniasis when they go to these endemic zones.

Although we did not find a significant relation between the risk factors and leishmaniasis unlike the results reported in Ethiopia **(Dawit*et al.,* 2018)** and others **(S Yared, 2014, M. Hakkou*et al.,* 2020)** which presented significant relations, this could be explained by the fact that, our sample size was small.

We evaluated the clinical signs and symptoms of leishmaniasis. which were all statistical significant (P>0.05) in a multivariate analysis. A similar finding was reported in Cameroon by **Dondji, 2001 and Mourad *et al.,* 2017** and in Kenya by **Evalyne, 2020**. Cases presented with long lasting fever, hepatomegaly and splenomegaly had the highest frequencies 41.7%, 30.0% and 28.6% respectively. which is similar to cases reported in Kenya **(Kanyina, 2014)**. Cases presented with pallor, anemia and weight loss (16.2%, 15.8%, and 14.6% respectively) presented a low frequency unlike the results reported in Ghana **(Richard *et al.,* 2021).** Allthese signs and symptoms were not confirmed by the Hosmer-Leme show test.

Moreover, another risk factor of leishmaniasis is the presence of the vector in Mokolo and the circulating vector of leishmaniasis is Phlebotomousduboscqui (suspected vector of cutaneous leishmaniasis) this was reported in previous studies **(Dondji*et al.,* 2001**).

CONCLUSION

In brief, our study was aimed to determination of the prevalence and risk factors of cutaneous leishmaniasis in Mokolo Cameroon. This study confirmed the presence of leishmaniasis in Mokolo with a high proportion in males than in females and in between the ages of 10 to 20 years.Our prevalence was 5%, if we take a look at the previous prevalence of leishmaniasis in Mokolo 7% we will note that the evolution of leishmaniasis in Mokolo has decreased over time and an active surveillance ofLeishmaniasis has to be put in place to help eradicate this disease. In addition, we found a higher risk factor of cutaneous leishmaniasis in the following people;those living in traditional huts due to the poor housing which increase sandfly breeding and resting sites as well as their access to humans, those who consume water from the river as they are exposed to sandfly bites when go to fetch water and those don't often use impregnated mosquito and insecticides.

Hence, the data provided by our study indicates that there is a need for continuous efforts in order to broaden our knowledge on the epidemiology, prevalence and circulating vector of leishmaniasis in Cameroon.

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