

Correlation between *Loa Loa* Infestation Prevalence and Eosinophil Rate among Population of Obout, Centre Region of Cameroon

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ABSTRACT

Background: Loiasis remains a major public health concern in sub-Saharan Africa (SSA) such as Cameroon. In Cameroon, the prevalence of loiasis varies from one geographical area to another. This study aimed to assess the correlation between *Loa loa* infestation prevalence and eosinophil rate among population of Obout, centre region of Cameroon.

Methods: A cross-sectional and correlational study was conducted in Obout locality situated in Centre region of Cameroon from June to July 2022. Data were collected using a face-to-face interview questionnaire from participants attending the Christ Roi Medical Centre of Obout (CRMCO). In each participant, a venous blood sample was taken in an EDTA tube after informed consent was obtained. A Full blood count (FBC) and a blood smear were performed on each blood sample. The collected data were recorded in an Excel version 2016 sheet and analysed by statistical package for the social sciences (SPSS) v. 24 software. For any value of $p < 0.05$, the results were considered statistically significant.

Results: A total of 65 participants were enrolled in this study with a median age of 35 years (Interquartile Range [IQR]: 18-52). The prevalence of *Loa loa* infestation was 15.38% (95%CI: 7.63%–26.48%) with a high prevalence for males (33.33%) versus (vs.) 2.63% for females (OR= 18.50; 95%IC: 2.17–157.46, $p=0.002$). Similarly, a high prevalence of *Loa loa* infestation in participants aged ≥ 35 years or 27.27% (OR=0.08; 95%IC: 0.01–0.72, $p=0.01$). Concerning the duration in the locality, the participants with ≥ 10 years in the locality were more infested with 8.33% for those less than 10 years ($p=0.15$). Furthermore, the current study shows a positive correlation but weak between eosinophil rate and intensity of *Loa loa* infestation ($r=0.3406$; $p=0.3$).

Conclusion: This study reported a high prevalence of *Loa loa* microfilaria in Obout locality with statistically significant differences for gender and age. However, no association was found between eosinophil and microfilarial load. Despite the low participation rate, Obout locality remains an area of high endemicity for *Loa loa* microfilaria.

Keywords: Eosinophil rate, infestation, *Loa loa*, prevalence.

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I. INTRODUCTION

Loa loa infestation or loiasis, identified as African eye worm, is a parasitic disease found in sub-Saharan Africa (SSA) especially in forest areas of Central and West Africa. [1], [2]. This neglected tropical disease (NTD) is transmitted to humans by the bite of a nematode vector, belonging to the group of tabanids, genus *Chrysops* with *Chrysops dimidiata* and *Chrysops silacea*, the main anthrophilic vector species found mainly in Africa [3]. Estimated that approximately 14.4 million people live in areas at high risk for *Loa loa* [1], [2]. Thus, in these areas of high endemicity, people who harbor high microfilarial loads (ML) of *Loa loa* are at risk of developing serious adverse effects, even serious encephalopathies and even encephalopathies after treatment with ivermectin. [4], [5]. Although most cases of loiasis are asymptomatic, the most striking clinical manifestations of this filarial infection are migration of the adult worm under the bulbar conjunctiva, and migration of the insect under the bulbar conjunctiva, and transient migratory edema transient edemas called “Calabar swellings”. Moreover, loiasis is ranked as the second or third reason for medical consultation after malaria and lung diseases in central Africa, particularly in Congo, Gabon and Cameroon [6]–[8]. Once infested, filarial worms can live for up to 25 years in the human body where both male and female worms live entwined with each other, laying, and regularly producing microfilariae [9].

Loa loa is known to be highly endemic in the rainforest of central Africa such as Cameroon [1]. Several studies have reported prevalences of 27.3% (95% CI: 22.3–32.9) and 23% respectively in the localities of Mbalmayo and Akonolinga in the centre region [10], [11]. Furthermore, the study carried out by Takougang *et al.*, [12] observed a prevalence of *Loa loa* (20%) in the East region of Cameroon. Despite the establishment of the filariasis control program in Cameroon, the prevalence of loiasis remains high in view of the studies cited above and continues to claim many victims. Several studies have only focused on the prevalence of loiasis but very few on the correlation between ML and the rate of polymorphonuclear eosinophils. This study was conducted to assess the correlation between the prevalence of *Loa loa* infestation and the eosinophil rate among the population of Obout in Centre region of Cameroon.

A. Study Objectives

The objectives of this study were:

- 1) To determine the prevalence of *Loa loa* infestation and the eosinophil rate among population of Obout,
- 2) To assess the correlation between *Loa loa* Infestation prevalence and eosinophil rate among population of Obout, Centre region of Cameroon.

II. MATERIALS AND METHODS

A. Study Area

From April 18th to May 9th, 2022, a cross-sectional and correlational quantitative study was conducted at the CRMCO. The CRMCO is located about 40 kilometers from the town of Mbalmayo. Obout is located in the Mettet subdivision and the Nyong-et-So’o division, Centre region of Cameroon. Obout is a cosmopolitan village with about 1000

inhabitants and the population consists mainly of Beti. The vegetation of this locality is the equatorial tropical forest. The main activities of the people of Obout are agriculture, hunting and fishing. In addition, the study area is known to be endemic to loiasis [2], [13], [14].

B. Ethics Approval and Consent to Participate

The study proposal was evaluated and accepted by the Institutional Review Board (IRB) Committee of School of Health Sciences of the Catholic University of Central Africa and ethical clearance was obtained (Reference N° 2022/020127/CEIRSH/ESS/LAM from 26th April 2022). A parent, tutor or legal guardian provided written informed consent. The participation in the study was voluntary and each study participant who decides to withdraw from the study has the right to do so. In addition, the confidentiality of the study participants was also strictly maintained.

C. Study Population

The present study was conducted among 65 participants of both genders living in the locality of Obout consulting at the CRMCO. Voluntary participants were recruited consecutively through a face-to-face interview after obtaining written informed consent from adults and parent or guardian for minor children. Data were collected using a well-structured questionnaire including dependent and independent variables.

D. Laboratory Procedure

A total of four milliliters (4ml) of whole blood was collected aseptically by veno-puncture into a tube under anticoagulant including ethylene diamine tetra acetic (EDTA) between 10h–14h. A full blood count (FBC) on the Mindray BC-5300 and a fresh state on a new slide were performed. For each positive sample in the fresh state, a thick calibrated drop of 50 µl of blood and a blood smear were made on both ends of a new slide, labeled with the participant's identification code. Thick and smeared blood smears were dried at room laboratory temperature for 15–30 min. Smear slides were first stained with Maygrünwald solution for 3 min. Subsequently, the smear and thick film slides were stained with a Giemsa solution diluted to 1/10^{ème} for 10min–15min. The preparations stained were dried at laboratory temperature (25°C) and then examined with the x10 and x 100 objectives (immersion oil) of the binocular optical microscope for research, identification, counting of *Loa loa* microfilariae and polymorphonuclear eosinophils simultaneously.

E. Data Collection and Statistics

Data collected by a questionnaire and the results obtained after analysis of the samples were reported in a MS Excel version 2016 spreadsheet. Then transported into and analyzed with SPSS software v. 24. Statistical association between dependent and independent variables were performed using chi-square, Fisher’s exact test and correlation test. p-values were significant for all p<0.05.

III. RESULTS

A. Characteristics of Study Population

A total of 65 participants recruited consecutively at the

CRMCO was included in the present study. Both sexes were represented with the majority being females (58.46%) versus (vs) 41.54% for males. The age of the participants ranged from 1 to 83 years with a median age of 35 years (Interquartile Range [IQR]: 18–52). With regard to age, a slight majority was observed among participants whose age was ≥ 35 years (50.77%) vs. 49.23% for those aged < 35 (Table I).

TABLE I: CHARACTERISTICS OF STUDY POPULATION

Variables	Category	Total	Percentage (%)
Gender	Female	38	58.46
	Male	27	41.54
Age, median: 35 years (IQR: 18–52)	< 35 years	32	49.23
	≥ 35 years	33	50.77
	Duration in the locality		
	< 10 years	36	55.38
	≥ 10 years	29	44.62

IQR: Interquartile Range.

B. Prevalence of *Loa loa* among study population

Of the 65 participants recruited, 15.38% (95% CI: 7.63%–26.48%) were infested vs 84.62% (95% CI: 73.52%–92.37%) for those non infested (Fig. 1).

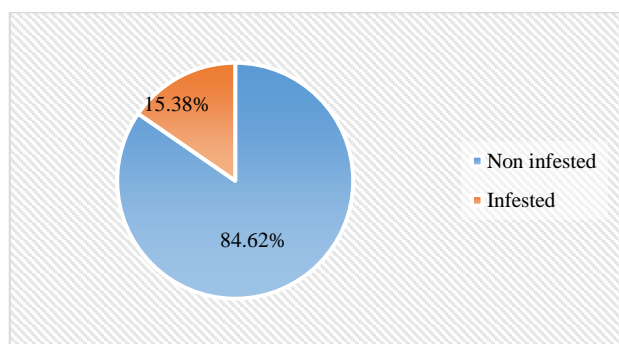


Fig. 1. Prevalence of *Loa loa* among study population.

C. Characteristics of the Study Population According to *Loa loa* Infestation

It appears from this distribution that the males were more infested with 33.33% vs 2.63% for the females with a significant difference (OR=18.50; 95% CI: 2.17%–157.46%, $p=0.002$) (Table II). Similarly, a statistically significant difference was found between age and *Loa loa* infestation with high prevalence in participants aged ≥ 35 years with 27.27% vs 3.13% for those aged < 35 years (OR=0.08; 95% CI: 0.01%–0.72%, $p=0.01$). Concerning the duration in the locality, no association was found between the duration of residence in the locality and *Loa loa* infestation (Table II). However, the participants with 10 years and more in the locality were more infested with 8.33% for those less than 10 years ($p=0.15$).

D. Repartition of Study Population According to Eosinophil Rate and the Microfilarial Load (ML)

Of the 10 infested participants, the median of the absolute values of polymorphonuclear eosinophils was 1960 (IQR: 1450–3360). The minimum was 1450 and the maximum was 6360. The ML in *Loa loa* infested participant was low and varied between 12 and 32 microfilariae/ml (mf/ml) with an average of 22.4 mf/ml. Table III show that, mean of eosinophil rate and ML were elevated in males, in participants aged ≥ 35 years, and in those who lived ≥ 10 years in the locality of Obout ($p>0.05$).

TABLE II: REPARTITION OF STUDY POPULATION ACCORDING TO PREVALENCE OF *LOA LOA*

Variables	Total N=65	Infested 10 (%)	Non infested 55 (%)	Odds Ratio (OR) 95% CI**	P-value
Gender					
Female	38	1(2.63)	37 (97.37)	18.50 (2.17–157.46)	0.002
Male	27	9(33.33)	18 (66.67)		
Age, median: 35 years (IQR: 18–52)					
< 35 years	32	1(3.13)	31 (96.87)	0.08 (0.01–0.72)	0.01
≥ 35 years	33	9(27.27)	24 (72.73)		
Duration in the locality					
< 10 years	36	3(8.33)	33 (91.67)	0.28 (0.06–1.22)	0.15
≥ 10 years	29	7(24.14)	22 (75.86)		

CI**: Confidence Interval.

TABLE III: REPARTITION OF STUDY POPULATION ACCORDING TO EOSINOPHIL RATE AND INTENSITY OF *LOA LOA* INFESTATION

Variable	Number of participants infested (N=10)	Eosinophil rate Mean	ML *** Mean	p-value
Gender				
Female	1 (10.0%)	1640	12	0.9
Male	9 (90.0%)	3011	24	
Age, median: 35 years (IQR: 18–52)				
< 35 years	1 (10.0%)	1910	18	0.63
≥ 35 years	9 (90.0%)	2981	23	
Duration in the locality				
< 10 years	3 (30.0%)	2150	21	0.4
≥ 10 years	7 (70.0%)	3184	23	
ML***: Microfilarial Load				

E. Relationship between eosinophil rate and intensity of *Loa loa* infestation

Fig. 2 shows that, correlation between the eosinophil rate and intensity of *Loa loa* infestation was positive but weak ($r=0.3406$; $p=0.3$).

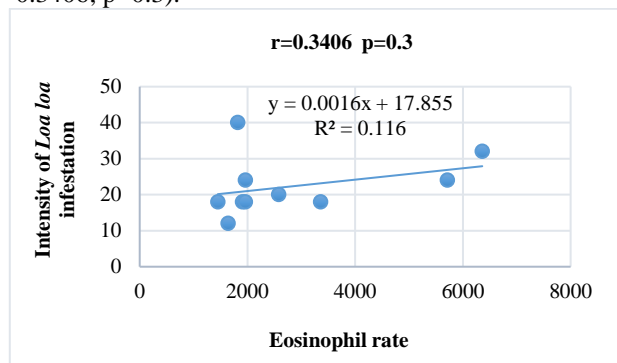


Fig. 2: Correlation between eosinophil rate and intensity of *Loa loa* infestation.

IV. DISCUSSION

This study aimed to assess the correlation between the prevalence of *Loa loa* infestation and the eosinophil rate among the population of Obout. A total of 65 participants of both sexes and of all ages were consecutively enrolled in the study. This study reported a majority of females (58.46%) vs 41.54% for males. This result reflects the socio-demographic situation in Cameroon, which stipulates that female are more represented than male [15]. This low representation of the males could be justified by the absence of some males at the time of the survey due to professional activities and field work. The overall prevalence of *Loa loa* was 15.38% (95% CI: 7.63–26.48). This prevalence observed in our series is low from those obtained by Mogoung-Wafo *et al.* [10] and Tatuene *et al.* [11] who reported a prevalence of 27.3% (95% CI: 22.3–32.9) and 23% in the localities of Mbalmayo and Akonolinga respectively, located near Obout. However, it is high to that found by Beng *et al.* [16] who observed a prevalence of 12.5%. The prevalence obtained in this study could be justified by our small sample size, the diagnostic technique used and the nature of the blood sample (venous blood vs capillary blood). This result agrees with several studies carried out by Takougang *et al.* [12], by Thomson *et al.* [17] and Zouré *et al.* [2] who found high prevalence of loiasis in the eastern region of Cameroon (20%), in some villages in Cameroon (23%) and in Central Africa (40%) respectively. Additionally, a previous study found a high prevalence in the central region indicating that this region is highly endemic for African eye worm [18]. This could be explained by environmental similarities between Central and Eastern Cameroon. Indeed, in the forest regions of Cameroon, vegetation has been degraded due to urbanization and logging according to Tatuene *et al.* [11]. Despite this prevalence observed in our study compared to the prevalence of the studies cited above, the fact remains that the prevalence of *Loa loa* filariasis remains high in certain departments of the central region. In addition, these findings show a variability in the prevalence of loiasis in Cameroon and particularly in the central region.

Regarding the socio-demographic characteristics, the study showed that the males was more infested than the females with 33.33% vs 2.63% (OR=18.50; 95% CI: 2.17–157.46; $p=0.002$). This finding shows that males had a high chance of 18 times be exposed to *Loa loa* filariasis than females. Our results are consistent with those reported by Tatuene *et al.* [11] who obtained a significantly higher prevalence of *Loa loa* in men (32.3%) than in women (17.2%). Several studies found similar results in Congo by (Noireau *et al.* [19], in Cameroon in 2004 by (Pion *et al.* [20], in 2005 by Pion *et al.* [21] and in 2020 by Beng *et al.* [16]. Similarly, a statistically significant difference was found between age and *Loa loa* infestation with a high prevalence in participants aged ≥ 35 years with 27.27% (9/33) vs 3.13% (1/32) for those aged < 35 ($p=0.01$). The study conducted by Mogoung-Wafo *et al.* [10] also found that the prevalence of *Loa loa* and the intensity of infection increased with age ($p=0.007$) with maximum ML in individuals aged 35–49 years. In his argument, these results could indicate that exposure to loiasis could increase with age and the disease would appear to accumulate in infected individuals. This age group and the male gender associated with the infestation could be justified by the activities of men in this locality. So, men in this age group are more involved in forestry work than women and could therefore be exposed to repetitive bites from the vector agent of *Loa loa* (chrysops). This argument is consistent with that of Pion *et al.* [20] who suggested that the rate of infestation in men could probably be due to uneven exposure to Chrysops bites during daily activity. Moreover, in the event of accumulation of the parasite following new infective bites by the vector, one would have expected an increase in the prevalence and intensity of the infection over time, particularly in the absence of any intervention targeting either the parasite or the vector.

Concerning the duration in the locality, no association was found between the duration of residence in the locality and the *Loa loa* infestation. This result could be explained by the very small size of our sample. However, our results reveal that participants who lived ≥ 10 years were more infested, with 24.14% vs 8.33% for those who lived to 10 years ($p=0.17$). This result could be explained by the continued presence of microfilaria in the area.

In this study, the ML was very low with an arithmetic mean of 22.4 mf/ml varying from 12 to 32 mf/ml. This average ML was not significantly associated with the average eosinophil rate. However, these averages were higher for male than for female. The study carried out by Tatuene *et al.* [11] found that the arithmetic mean of the ML was high with 2666.3 mf/ml (95% CI: 2088.2–3244.4) and this mean was higher in men (3574.8) than in women (2092.4) ($p<0.001$). This observed difference could be justified by the small size of our sample and the type of blood sample collected. It is noted that in case of low microfilaraemia, the parasites can only be found after performing a concentration of leucocyte. Thus, about 40% of people whose infection is proven (subconjunctival passage of *Loa loa*), have a particular immune profile that means they do not have microfilariae (occult filariasis). In the case of tropical eosinophilic lung, there are also no circulating microfilariae [22].

V. CONCLUSION

The study aimed to assess the correlation between the prevalence of *Loa loa* infestation and the eosinophil rate among the population of Obout. The study reported a high prevalence of *Loa loa* microfilariae in the locality of Obout with statistically significant frequencies for sex and age. No association was found between time in locality and infestation. Furthermore, the current study shows a positive correlation but weak between the eosinophil rate and intensity of *Loa loa* infestation. Despite the low participation rate due to the duration of the study, the locality of Obout remains an area of high endemicity for blood microfilariae, in particular *Loa loa*.

RECOMMENDATION

The locality of Obout situated in the central region, is an area of high endemicity for loiasis. Despite the small sample size, studies can be conducted on a larger population with the implementation of deeper diagnostic techniques for the detection of occult microfilariae.

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CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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