

# The Density of Anopheles Mosquitoes in Correlation to Malaria Cases and Some Environmental Factors in Elnhoud Town

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## Abstract

This work aimed at studying the population density of Anopheles mosquitoes and the incidence of malaria, during July–December 2017 and 2018. The study was conducted in Elnhoud Town. The mean temperature and amount of rain fall were also recorded during this study. The results showed that the Anopheles mosquitoes (Larvae and Adults) were recorded in all available breeding said and resting place. The numbers recorded for this vector species were higher during September, and August than during the other months in Elnhoud town, during 2017. In 2018, the means recorded for this species were higher during September and October than during other months. The species were not recorded during November and December 2018 in all town. The overall mean number of the vector recorded in all town was higher in 2018 than in 2017. The number of malaria cases recorded in the town was highly correlated with the number of vectors recorded and with the environmental factors (means temperature and the amount of rain fall), during 2018, the amount of rainfall was high and this may have led to the increase of the breeding sites, and hence, the malaria cases recorded. During both years the numbers of vectors and of the resulting malaria cases were highly in the town.

## Keywords

Anopheles, Mosquitoes, Elnhoud

## 1. Introduction

Mosquitoes are important vectors of several tropical diseases, and about 100 species act as vectors of human diseases [1] Example of such diseases is malaria; filariasis, Japanese encephalitis and yellow fever [2] and some species may transmit a few arboviruses. Few anopheles species, besides transmitting malaria, they also transmit filariasis [3]. The most important man-biting mosquitoes belong to the genera Anopheles, Culex, Aedes, Mansonia, Haemagogus and Sabethes [4]. The genus Aedes includes important vectors of yellow fever, dengue fever and encephalitis,

viruses, while the genus Mansonia transmits Brugia malyi [5]. However, several other genera are vectors of various arboviruses in central and south America [6]. Other biting species of Anopheles mosquito are nuisance to man [7]. Malaria is a wide spread disease and about 200,000,000 persons in different parts of the World are affected and as a result high mortalities occurred [8]. In the Sudan, malaria is recorded in several areas especially the southern and central States [9]. In the Gezira, malaria is prevalent all the year round and increases during autumn and winter because of the increase of the vector population [6].

The present study aimed at determining the density of Anopheles mosquito which prevails in Elnhoud in relation to

the number of persons who acquire malaria, and mean temperature and the amount of rain fall during autumn months (July-December) of the year 2017 and 2018.

## 2. Materials and Methods

The study area: A cross-sectional study was conducted during the rainy season density of *Anopheles* mosquitoes and the incidence of malaria, in Elnhoud Town during July–December 2017 and 2018. Elnhoud is a town located in the northern part of West Kordofan state in Sudan. It has an average height of 650 meters above sea level and lies about 200 kilometers west of El Obied town and 788 kilometers south-west of Khartoum, the capital. It is one of the largest cities of west Kordofan state. It is also an important crossroads, and commercial and agricultural center prominently. its geographic regions and different climatic and economic: between the desert and semi-desert area, and between savannah zone area dry and wet and between the dry tropics and rainforest areas. Herbal terms are of the earth and the grass lawn and leafy trees, and temperatures rise, especially in the summer, where more than 40 degrees celsius, during this study temperatures rise was 22-37 degrees Celsius.. Sampling of larvae and adult mosquitoes was carried out in all available station at 14 days interval during July– December, 2017 and 2018. Sampling of the larvae: Sampling of the larvae was carried out at all available locations every 14 days, during July – December, 2017 and 2018. In each location, the mosquito larvae were collected from 4 pounds by means of small metal dishes (20 cm. diam.). *Anopheles* larvae were transferred to glass tubes (10 x 10 x 10 cm) containing 70% ethanol alcohol and were kept for identification by using the key for identification of common anophelines in Sudan described by Medical Entomology Section [10]. The number of *A. mosquitoes* larvae collected in both years were recorded for each site. Sampling of the adults: Sampling of the adults was carried out in all locations at 14days interval during July –

December, 2017 and 2018. Ten houses were randomly selected in four location according to the direction, and one room was selected from each house. The floor in each room was covered with a white cloth sheet (4×4m). The cloth was provided by the Malaria Control Management (MCM). The rooms were sprayed with Malathion 75% and the knocked down adult mosquitoes were collected, the numbers of adults/room collected during 2017 and 2018 were recorded. The adults were put in a glass jar containing 70% ethanol alcohol and were kept for identification. The identification was conferred by the Blue Nile Training and Research Institute, Wad Medani. The number of adult *A. mosquitoes* collected from the town was recorded there. Number of malaria cases: The data concerning the number of persons who acquired malaria in Elnhoud town was obtained from Elnhoud health centers. These data were confirmed by the Malaria Control Administration, Elnhoud Locality. Meteorological data: The meteorological data was obtained from the meteorological station, Agricultural Research Corporation (ARC) at Elfula and also from the west Kordofan State Vaccination Administration. Statistical analysis: Analysis for descriptive statistics, presentation of data and correlation analysis were obtained by using Microsoft Excel program so as to conduct the conclusions.

## 3. Results and Discussion

During 2017: The total number of *A. mosquitoes* collected was low at Elnhoud town during July (43), then increased during August (50), and decreased again during September (31). The numbers were low during October (47), November (39) and December (54). The densities of the *Anopheles* population were coincided with the recorded number of malaria cases during these months, as was shown in Tables (1 and 2). The total number of the vector during the respective months at Elnhoud town was 264 and the total number of malaria cases was 771 during the respective months.

**Table 1.** No. of *A. mosquitoes*, No. of Malaria Cases, Temperature (Co) and Rain Fall (mm) at Elnhoud town During July to December 2017. No. of *A. mosquitoes* Environmental Factors (means) Area Months Larvae Adults Total No. Malaria cases Temp. (Co) Rain Fall (mm).

	No. A. Mos	No. of Ma. Ca	No. Adults	No. Larvae	Temp (co)	R. F (mm)
July	29	14	43	19	39	133.7
August	36	14	50	73	37	33.3
Sept.	. 21	10	31	116	36	50.1
October	30	17	47	206	35	5.7
Nov.	. 28	11	39	187	28	0.4
Dec.	. 34	20	54	170	26	0
Total	178	87	264	771	191	223.2

**Table 2.** Correlation Coefficient Analysis for the No. of *A. mosquitoes*, No. of Malaria Cases, Temperature (Co) and Rain Fall (mm) at Elnhoud own during July to December 2017. Larvae Adults Total Malaria cases Temp. (Co).

Adults		0.9959			
Total		0.9995	0.9982		
Malaria cases		0.9605	0.9659	0.9631	
Temp. (Co)	0.9919	0.9858	0.9907	0.9467	
Rain Fall (mm)	0.8177	0.8069	0.8148	0.6719	0.8614

Temperature (Co) and Rain Fall (mm) at Elnhoud town During July to December 2017. The highest records of total number of mosquitoes recorded were during Aug. in Elnhoud town. The highest records of the malaria cases recorded were during Oct. at the town. Although this month was of low rainfall, but the temperature was of 35°C at the town, and the previous months had a higher amount of rainfall. The total records of malaria cases were higher at the town (771 cases).

Table 2, the density of mosquitoes did not correlated strictly to the malaria cases ( $R^2 = 0.67$  at the town), and this finding can be due to other factors that might had contributed to the malaria cases. The results also showed that, there were

a high correlation between the mean temperature and the density of mosquitoes ( $R^2 > 0.98$ ).

During 2018: As was shown in Tables (3 and 4), the total number of mosquitoes or malaria cases recorded in the study areas during July, August, September and October, 2018 were remarkably lower compared to those recorded on the same months during 2017. At the town, there was no abundance of mosquitoes during November and December at all, although that there were some malaria cases. In both years the number of adults and malaria cases coincided with the amount of rainfall which prevailed during these months.

**Table 3.** No. of *A. mosquitoes*, No. of Malaria Cases, Temperature (Co) and Rain Fall (mm) at Elnhoud Town during July to December 2018. No. of *A. mosquitoes* Environmental Factors (means) Area Months Larvae Adults Total No. Malaria cases Temp. (Co) Rain Fall (mm).

	No. A. Mos	No. of Ma. Ca	No. Adults	No. Larvae	Temp (co)	R. F (mm)
July	29	16	45	12	33	53.4
August	40	19	59	36	38	84.3
Sept.	45	17	62	67	36	52.1
October	41	20	61	33	31	16.1
Nov.	0	0	0	25	29	0
Dec.	0	0	0	10	30	0
Total	155	72	227	183	197	205.9

**Table 4.** Correlation Coefficient Analysis for the No. of *A. mosquitoes*, No. of Malaria Cases, Temperature (Co) and Rain Fall (mm) at Elnhoud town During July to December 2018 Larvae Adults Total Malaria cases Temp. (Co).

Adults		0.9968			
Total		0.9997	0.9985		
Malaria cases	0.9607	0.9426	0.9556		
Temp. Co)	0.9456	0.9470	0.9467	0.9581	
Rain Fall (mm)	0.9553	0.956	0.9563	0.9097	0.9212

## 4. Conclusions

The densities of the Anopheles population were coincided with the recorded number of malaria cases during 2018 were remarkably lower compared to those recorded on the same months during 2017 at Elnhoud town.

In both years the number of adults and malaria cases coincided with the amount of rainfall which prevailed during these months at Elnhoud town.

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