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COMPARATIVE STUDY ON MALARAIA VECTORS DENSITY AND MALARIA INFECTION IN YOLA-SOUTH L.G.A OF ADAMAWA STATE

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Abstract

Malaria is a parasitic disease caused by plasmodium parasite. This study was conducted to compare malaria vector density and malaria infection in Yola South Local government area of Adamawa State, Nigeria. The result of this study revealed that there was positive correlation between malaria vector density and malaria infection based on sites of location (R=0.007) and based on month (R=0.009). Malaria vector density was observed lowest in Upper Benue Quarters (9.52%) and in the same way the infection was observed lowest (6.72%) in the same site. Relationship based on month revealed that malaria vector density was observed highest in the month of August (40.48%) and in the same way malaria infection was observed highest (33.20%) in the same month. Also, malaria vector density was observed lowest in the month of September (20.83%) and in the same way the infection was observed lowest (19.70%) in the same month. The result of this study revealed that most of the malaria vectors sampled were either blood fed (28.57%); gravid (25.59%) or half gravid (27.38%).This implies high contact between the malaria vectors and human or other animal host. Control of malaria vectors is necessary to reduce the rate of infection.

Key words: Infection, Malaria, Parasite, Transmission, Vector

I. INTRODUCTION

Malaria is a parasitic disease caused by four distinct species of plasmodium parasite, transmitted by mosquitoes of the genus Anopheles, which are most abundant in tropical/subtropical regions, although they are also found in limited numbers in temperate climates. Transmission is associated with changes in temperature, rainfall, humidity as well as level of immunity. The IPCC Special Report on Regional Impacts of Climate Change [3] acknowledges that climate have an impact on vector-borne diseases. Changes in climate affect potential geographical distribution and transmission of vector-borne infectious diseases such as malaria. Several researches have suggests that climate can affect infectious disease patterns because disease agents (viruses, bacteria, and other parasites) and their vectors (such as insects or rodents) are clearly sensitive to temperature, moisture, and other ambient environmental conditions. Studies on the interaction between climate and malaria have focused in recent years on the potential role of climate change in determining recent increases in malaria transmission in highland areas in Africa where temperature rather than rainfall has been the parameter of greatest interest [4] and [6]. The aim of this research work was to investigate the relationship between malaria vectors density and malaria infection in Yola-South Local Government Area of Adamawa State.

II. MATERIALS AND METHOD

1.2.3 Study Area

This study was conducted in Yola-South Local Government Area of Adamawa State, Nigeria. Yola has a geographical coordinates of 9^{o}12’0” North and 12^{o}29’0” East. It is the capital city of Adamawa State, located on the River Benue. It has a population of 194,607 (National Population Commission, 2006). The study area lies within the Sudan savannah zone with marked dry and wet seasons. Yola has an annual rainfall from the months of April to October and a dry season from the month of November to March. Temperature drops in the rainy season especially in the month of July to October. The movement of the inter-tropical discontinuity (I.T.D.), and associated zones of rainfall during the course of the year, is the major factor controlling rainfall and temperature variation in the study area. Temperature rises slightly after the rainfall ceases in the months of March-May and that could reach as high as 41^{o}C. In the months of December-February, the dry harmattan weather characterizes the area, which is cold and dusty. The movement of the wind by December sweeps across the study area and the movement continue eastward. Like most areas in northern Nigeria, the soil of Yola-South are derived from the basement complex rock, however, there is some alluvial soil along the Benue flood plains. The soil of the study area is loamy and it drains easily when it rains. The vegetation of Yola-South consists of short grasses and medium shrubs, more especially in the months of August and September during which the area records higher amount of rainfall. Agriculture is the mainstay of about 70% of the inhabitants of the State. The ecological condition of the state permits cultivation of root crops, cereals and rearing of livestock in large numbers. Majority of the individuals residing within the study sites are farmers, others are civil servants and business men and women. The dominant tribes in the study area are Fulani.

1.2.4 Study Design

Five study sites were selected namely: Mobile barracks, Upper Benue staff quarters, Anguwan Fulani, Rumde-Jabbe and Mbamba Mission. The sites selected were close to each other in other to ease the mosquitoes sampling. Mosquitoes breeding places were created using an artificial container (earthen pots) in some selected houses within the study sites. Two (2) earthen pots were placed in two (2) houses in each of the five (5) selected study sites, each of the two houses selected in each study site were selected using systematic random sampling in which in every five (5) houses one (1) of the middle located house was selected for sampling . The process was repeated four (4) times in a month for a period of three (3) months (July, August and September). At the end of the studies a total of 120 breeding sites were created. Blood sample was collected from individual residing within the study sites from July to September for malaria parasite examination using a simple random sampling in which all the individual have equal chances of participating.

1.2.5 Collection and Identification of Mosquitoes

Mosquitoes' vectors were collected using a hand net from the breeding containers once in a week by covering the breeding containers and spraying insecticide heavily and the pot were relocated to another houses within the study sites for re-sampling of mosquitoes vectors. Sampled mosquitoes were mounted on glass slides and viewed under simple Olympus (dissecting) microscope for identification using relevant taxonomic keys [2]. *Anopheles* mosquitoes were identified by the palp which is as long as the proboscis and pointed and by the number, the length, and arrangement of the dark and pale scales the veins of the wings [2]. Male and female *Anopheles* mosquitoes were identified by examination of antennae, in which those with feathery (plumose) appearance are males and those with only short and inconspicuous antennal hairs (pilose) are females [2]. Other mosquito species identified were *Culex* and *Aedes*. The *Culex* genus has transparent wings while the *Aedes* genus has silvery shining stripes on the head region [2].

1.2.6 Determination of Malaria Vector Density

The malaria vectors density were calculated as:

$$\frac{\text{Total number of malaria vectors (female } \textit{anopheles}\text{) collected}}{\text{Total number of containers}}$$

1.2.7 Examination Malaria Parasite

Blood sample were examined for malaria parasite in all the study sites at the end of each month selected for this research. Rapid diagnostic test strip were used for malaria parasite diagnostic since it is suitable for large sample size. First response malaria Ag. *P. falciparum* (HRP2) card test was employed for the rapid diagnosis of *plasmodium falciparum.*

1.3.8 Statistical Analysis

The data obtained were analyzed using Correlation statistical analysis such that positive R value implies positive correlation while negative R value implies negative correlation and results obtained were represented in tables and graphs.

III. RESULTS

A total of 1806 mosquitoes were sampled to determine the distribution of mosquitoes based on species and sex in the study area. Distribution based sex (Table 1) indicated that there were 1220(67.55%) female mosquitoes and 586(32.45%) male mosquitoes. Distributions of the female mosquitoes based on species indicated that Female *Culex* were 908 (74.43%), Female *Anopheles* 202

(16.56%), and Female *Aedes* were 110 (9.02%). Chi-square statistical analysis shows that there was significance difference in the distribution of mosquitoes based on species and sex in the study area (p=0.020). And a total of 495 persons from different households in the different communities and location within the study area were enrolled in the study for blood sample collection. Rapid diagnostic test card employed for the diagnostic of blood sample collected identified that 134(27.07%) of the samples were positive for malaria parasite. Presence of a line on both the T (test region) and C (control region) on the test card indicates positive results.

Table 1 shows the distribution of malaria vector density and prevalence of malaria infection based on sites of location. The table indicated that Upper Benue staff quarters had the lowest malaria vector density 0.16(9.52%) and also has the lowest prevalence of malaria infection 9(15.50%). However, Chi-square statistical analysis showed that there was no significance difference in the distribution of malaria vector density and prevalence of malaria infection based on location in the study area (p=0.220).

Table 2 shows the distribution of malaria vector density and prevalence of malaria infection based on months. The table indicates that the month of August have the highest malaria vector density 0.68(40.48%) and in the same way have the highest prevalence of malaria infection 62(33.20%). The month of September have the lowest malaria vector density 0.35(20.83%) and also have the lowest prevalence of malaria infection 30(19.70%). Chi-square statistical analysis showed that there was no significance difference in the distribution of malaria vector density and prevalence of malaria infection based on month in the study area (p=0.199).

Table 1: Distribution of Malaria Vector Density and Prevalence of Malaria based on sites of Location

Location	malaria vector density (%)	malaria prevalence (%)
Mbamba Mission	0.47 (27.98)	41 (29.50)
Mopol Barracks	0.37 (22.02)	38 (31.70)
Upper Staff Quarters	0.16 (9.52)	9 (15.50)
Rumde Jabbe	0.33 (20.00)	32 (25.60)
Anguwan Fulani	0.35 (20.83)	14 (32.70)
Total	1.68 (100.00)	134 (27.10)

χ^2=20.00, df=1, P (0.220)

Table 2: Distribution of Malaria Vector Density and Prevalence of Malaria based on Month

Month	malaria vector density (%)	malaria prevalence (%)
July	0.65 (38.69)	42 (26.90)
August	0.68 (40.48)	62 (33.20)
September	0.35 (20.83)	30 (19.70)
Total	1.68 (100.00)	134 (27.10)

χ^2=6.000, df=1, P (0.01)

IV. DISCUSSION

A total of 1806 mosquitoes were sampled from earthen pots and examined under a microscope. Three species namely, *Aedes*, *Culex* and *Anopheles*, were identified. Female Anopheles (Malaria vectors) identified were 202 (16.56%). A total of 495 blood sample were collected from individuals within the study site and were examined for malaria parasite using a rapid diagnostic test strip out of which 134(27.10%) were positive for malaria infection. The result of this study revealed that there was positive correlation between malaria vector density and malaria infection based on sites of location (R=0.007) and based on month (R=0.009). The result of this study showed that malaria vectors breed in all the study locations thus every person in the study location is at risk of malaria attack. Attributes of rate of exposure of the study population to vector bites due to nature of their work and standard of living form a factor in the transmission pattern of the disease. Due to lack of regular supply of pipe-borne water, people resort to storing water fetched from their local streams in earthen pot and containers in and around houses. These provide clear standing water that serve as favourable breeding sites for the malaria vector (female *Anopheles* mosquitoes) in all the study locations. However, malaria vector density was observed lowest in Upper Benue Quarters (9.52%) and in the same way the infection was observed lowest (6.72%) in the same site. The low population density of malaria vector density collected in Upper Benue Staff quarters synchronized with the low malaria prevalence in the area. This is an indicator of the unavailability of good breeding sites for female *Anopheles* mosquitoes (malaria vectors) in the area, which may be due to good sanity behavior of the individuals in this area.

The ecology and behavior of malaria vectors and other mosquitoes populations investigated in this study were greatly influenced by the prevailing months of rainy season. Relationship based on month revealed that malaria vector density was observed highest in the month of August (40.48%) and in the same way malaria infection was observed highest (33.20%) in the same month. Also, malaria vector density was observed lowest in the month of September (20.83%) and in the same way the infection was observed lowest (19.70%) in the same month. The result of this study revealed that most of the malaria vectors sampled were either blood fed (28.57%); gravid (25.59%) or half gravid (27.38%).This implies high contact between the malaria vectors and human or other animal host. High abundance or distribution of malaria vector density in the month of August may be attributed to the proliferation of rain pools, as well as the resultant improved humidity for adult- mosquito survival and dispersal [6]. The significantly higher densities of malaria vectors collected during the rainy season in this study, to a large extent, explains the equally seasonal pattern of clinical cases of malaria, with peak transmission shortly after maximum annual rainfall in Nigeria [5]. The pattern of modal distribution of hourly biting density of the mosquitoes, both indoors and outdoors, varied considerably with rainfall months. This finding indicated that variable weather conditions that characterize different seasons in the Tropics influence anopheline blood feeding activities and, hence, malaria transmission. For example, relative humidity affects mosquito flight activities and blood meal seeking behavior [6].

V. CONCLUSION

The rate of transmission of malaria is correlated with the distribution of malaria vector density. Control of malaria infection will require effective control of the malaria vectors distribution.

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