GLOBAL JOURNAL OF ENVIRONMENTAL SCIENCES VOL. 5, NO. 1, 2006: 61 - 63
COPYRIGHT (C) BACHUDO SCIENCE CO. LTD. PRINTED IN NIGERIA. ISSN 1596 - 6194

CLIMATIC VARIABILITY AND INCIDENCE OF MALARIA IN YOLA, ADAMAWA STATE

A. S. UMAR

(Received 14 December, 2005; Revision Accepted 20 January, 2006)

ABSTRACT

The influence of Temperature, rainfall and relative humidity on seasonal variation of out break of malaria in Yola, Nigeria were examined. Data on monthly maximum and minimum temperature, rainfall and relative humidity and the reported cases of the diseases for a period of 5 years were collected and analysed. The result shows that the reported cases of the disease is high between the month of May - October when minimum temperature and rainfall are increasing. Correlation analysis indicates that the reported case of the diseases is positively and significantly related to minimum temperature, rainfall and relation humidity. The result also show a weak and negative correlation of maximum temperature with malaria cases. Regression analysis suggests that 97%, 67% and 66% of the variation in the outbreak of Malaria in Yola can be attributed to rainfall, relative humidity and minimum temperature respectively. Environmental condition (sanitation) in the area and housing conditions also aggravates the incidence of malaria in the area. Appropriate measures were suggested to minimize the increasing incidence of malaria disease in the area.

KEYWORD: Rainfall, Humidity, Temperature, Malaria.

INTRODUCTION

Climate variability is the degree of the divergence or changes existing among climate variables – Temperature, Rainfall, Humidity etc over area in a particular time or season Ayoade (1997). In many places in the world, climatic variability is seen to have exerted a profound influence on the incidence and the transmission of diseases especially the communicable diseases such as malaria, Yellow fever measles, meningitis etc.

Malaria is a parasites disease transmitted from person to person through the bite of a female Anopheles mosquito. The transmission of this type of diseases is rampant in many part of the world today, W. H. O. (2000). The World Bank further reported that 300 million to 500 million clinical cases and more than 1 million death are recorded each year in the world. In some other part of the word, the report also revealed that more than 80% of the malaria death are recorded in Africa (approximating, 3000 deaths per day). This is especially among children younger than five (5) years of age and also among pregnant women in the malaria endemic areas. These areas because are partly supported by regional climate which promotes the development of the vectors that transmit malaria and partly by the relaxed attitudes of the inhabitants toward their immediate environment.

However, in the tropical Africa, including Nigeria, where climate variability is greatly felt, it is estimated to account for more than 70% of all the malaria cases in the world W.H.O (2004). This is because the tropical region is characterized by high temperature, humidity and high rainfall which are also seasonally variable in nature, which to large extent influence the incidences and transmission of the disease.

The influence can be investigated in two major ways, first climate variability affects the resistance of the human body to some diseases. Second, climatic variation influence the growth, propagation and spread of some disease organism or their carriers Ayoade, (1982). In addition to climate variables, environmental conditions such as hygiene, socio-economic status (e.g in and out house sanitation and the income levels) of the population are also among the factors that can affect the Oral Interviews among households were conducted to ascertain the causes, periods or seasons of the occurrence of the disease in the area.

A survey of sampled households in all the wards were carried out to map and draw out strategies for the incidence and transmission of malaria and other heat related diseases (e.g meningitis, measles etc).

However, man's effort to control the incidence of diseases is only felt by his ability to manufacture drugs and manage his environment. While climate control, still remain above the scope of his ability. Consequently, it is against this background that this study examined how climatic variability influence incidence and transmission of malaria in Yola and its environs.

MATERIALS AND METHODS

Description of the study area.

Yola is located on latitude $9^{0}14$ and longitude $12^{0}28$ Adebayo, (2000). It lies within the Benue trough at an altitude of 185m above sea level. Yola falls within the tropical savanna climate with distinct wet and dry seasons. Dry season last for above six month (November, to April) while the wet seasons spans from May to October. The means of climatic elements (2000 – 2004) in Yola are presented in Table 1. Temperature in Yola is high throughout the year but there is usually a seasonal change. There is gradual increase in temperature from January to April. The maximum seasonal temperature usually occurs in March or April. There is a distinct drop in temperature with the onset of rains. A slight increase after the cessation of rains (October – November) is common before the onset of harmattan in December when the temperature drops further.

Procedure

Data on the reported cases of malaria (both out and in-patient) cases were collected for the period 2000 2004 from the Epidemiological Unit, Adamawa State Ministry of Health/UNICEF, Yola and Federal Medical Center, Yola. The hospital is a referral center, which keeps daily record of reported cases of all diseases.

Monthly maximum and minimum temperature, relative humidity and rainfall data were collected from the Meteorological station, upper Benue River Basins Development Authority, and from the metrological station Yola Airport for the same period of time.

A. S. Umar, Department of Geography, Federa; University of Technology, Yola, Adamawa State, Nigeria.

Table I: Average Mean Monthly climatic elements in Yola (2000 – 2004).

Months / Climatic Elements	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max. Temp. (°C)	31.5	41.8	44.2	43.6	436.	37.0	35.0	33.8	38.8	36.8	39.0	37.4
Min. Temp. (C)	16.0	16.8	21.6	21.6	22.7	21.7	21.4	22.2	23.6	21.6	17.4	15.3
Mean Temp. (°C).	23.8	29.3	33.1	32.6	33.2	29.4	28.2	28.0	31.2	29.2	28.2	26.4
Rainfall (mm).	0	0	0	17	92	16.1	14.5	16.2	192	53	3	0
Relative Humidity (%).	34.2	32.2	26.2	53.8	59.0	71.2	71.2	78.6	71.4	74.8	46	37

Source: UBRBDA, Yola 2004.

administration of the questionnaires. The study area is made up of 22 council Wards, with eleven (11) each from both Yola and Jimeta – two major towns that formed the municipal. Five wards each from the council wards, and six households each from the selected wards were picked randomly without prejudice for administration of the questionnaires. A total number of 480 questionnaires were administered. The head of the households or his representative provided information required for this study.

Data analysis includes the computation of means and percentages and the use of correlation and regression analysis to examine the relationship between temperature, rainfall and humidity with outbreak of the disease.

RESULTS AND DISCUSSIONS

The monthly distribution of reported cases of malaria incidence in Yola for the period of 5 years are presented in Table II.

The distributional pattern follows a seasonal variation of climatic element. Although malaria cases occur all year round, there is general increase in the outbreak in the rainy season between the Months of May - October. This increase is attributed to the fact that rainy season provides conducive breeding conditions such as availability of stagnant surface water created by rains and vegetation cover. The numbers of cases start falling from the month of October when the rains begins to decline in the area.

Table II. Average monthly distributions of malaria cases in Yola, (2000–2004).

Year / Month	No of cases 2000	No of cases 2001	No of cases 2002	No of cases 2003	No of cases 2004	Total No of cases 2000-04	Total aver. No of cases 2000-04	% of cases 2000-04.
Jan.	416	592	353	534	620	2515	503.0	3.878
Feb.	521	612	442	626	802	3003	600.6	4.631
Mar.	810	676	749	766	517	3518	703.6	5.425
Apr.	952	568	860	977	813	4170	834.0	6.431
May	2747	929	1302	1288	1319	7585	1517	11.697
Jun.	1330	1140	1761	1876	1631	7738	1547.6	11.933
Jul.	1522	1146	1203	1952	1773	7596	1519.2	11.714
Aug.	1793	1217	1304	1610	1416	9664	1532.8	11.819
Sep.	3058	1516	1522	1406	1740	9278	1855.6	14.308
Oct.	1248	910	792	1137	1214	5301	1060.2	8.175
Nov.	617	781	572	690	1309	3969	793.8	6.121
Dec.	520	531	405	539	511	2506	501.2	3.865
Total	15534	10662	11265	13401	13665	64843	12968.6	100%

Source: Epidemiological Unit, Adamawa State Ministry of Health, Yola.

Similarly, There is a positive significance correlation between relative humidity with Malaria cases, (Table III). Although the relationship is not strong as that of the rainfall, this indicates that the higher the relative humidity, the higher the malaria cases in Yola.

The seasonal variation of the case of malaria incidence in Yola Under period reviewed follows the seasonal march of temperature (Table II). The incidence of the diseases is higher between the months of May and October when temperature increases at minimum level. In Contrast, at the maximum temperature levels between the months of February and April, cases of malaria is low (Table II). This is because

Table III: Correlation Analysis of climatic elements with malaria cases in Yola.

S/No	Elements	Correlation	Interpretation
1	Max. Temp. (°C)	-0.11	Insignificant
2	Min. Temp. (°C)	0.82	Positively significant
3	Rainfall (mm)	0.96	Positively significant
4	Relative Hum. (%)	0.86	Positively significant

r = 1%

temperature at maximum level may be too harsh for the diseases causative agents to survive, coupled with the fact that the area is devoid of moisture (inform of rain) as onset of rainfall in the area in most cases is in the month of May, Adebayo (1997). The incidence of the disease is low during the harmattern period (November – January of the following year).

The diseases show a positive and significant correlation relationship with minimum temperature, Relative humidity and rainfall. Indicating that the higher the rainfall, humidity with minimum temperature conditions, the higher the outbreak of the disease (Table III). The table further shows that there is a insignificant weak negative correlation relationship between maximum temperature and reported cases of malaria in Yola for the study periods. This means that malaria outbreak in Yola cannot be associated with very high temperature conditions. Table (IV) further depicts that 92.7% and 96.2% of the cases of malaria incidence can be attributed to high rainfall and minimum temperature condition respectively.

Table IV: Partial model regression analysis of rainfall and minimum temperature with malaria cases.

Variables	Partial R^2	Model R^2	Remark
Rainfall	92.65	92.65	Significant
Min. Temp.	3.52	96.17	Significant

r = 0.70 is significant at 5%.

The regression equation of malaria – y =-158 + 4.88x 1 +44.8x2 predict that for every 1mm increase in rainfall, and for every 1^{0}C increase in minimum temperature, there will be an increase in cases of malaria incidences by 5% and 45% respectively.

The situation however, is being aggravated by some housing and environmental condition in the area. This finding is ascertained by Adebayo (2001) who pointed out that poor sanitary conditions, ventilations, over crowding and poor buildings and street Layout design are among the characteristics of houses in the area.

CONCLUSION

In order to minimize the effects of climates variables on the incidence of malaria in the study area, the following measures are suggested.

Deforestation should be checked and discouraged. While a forestation be encouraged by both government and individuals. This will help reduced the heart insurgence experience during heat period which can also cause climate change.

Adequate sanitation laws should be enforced by the government to ensure proper cleanliness of the in and out house, especially refuse dump, sites. Weekly evacuation of refuse dumps by authorities concerned should be adopted.

Proper drainages system and other water way should be well constructed and maintained to allow free flow of excess surface water from rains. And mosquito control programme and other related Public health care programme should be reactivated and enforced by the government to ensure that water logging areas where mosquito lives are sprayed with chemicals to abate its proliferation. Finally. Since lay out of streets affects intra-urban circulation of air, hence rainfall pattern Adebayo (1997), It is recommended that the direction of wind should be taken into consideration in the planning of house and street in the area.

REFERENCES

Adebayo, A.A., 1997. Climatic information for Environmental monitoring: A case study of Adamawa State, Nigeria. Nigerian Geog. Assoc. 1: 29-36.

Adebayo A.A., 2001. Temperature variability and outbreak of Meningitis in Yola, Nigeria. Global Journal of Pure and Applied Sciences, 7 (1): 133-135

Ayoade J. O., 1982. Introduction to Climatology for the tropics. John Wiley & Sons, New York, 258pp.

Ayoade J.O., 2003. Climate change: A synopsis of its nature, causes, effects and Management. Vantage Publisher, Ibadan, pp 5-7.

UBRBDA, 2004. Upper Benue River Basins Authority, Yola.

WHO, 2004. World malaria situation: A World health stat. Q 45 pp 257 –266.