Bayero Journal of Pure and Applied Sciences, 3(1): 132 - 137
Received: February, 2010
Accepted: May, 2010

TEMPORAL VARIATION OF MALARIA OCCURRENCE IN KANO MUNICIPAL LOCAL GOVERNMENT AREA

Tukur, A. I.
Department of Geography, Kano University of Science and Technology, Wudil, Kano State
aitukur@yahoo.com

ABSTRACT
Malaria is currently affecting more people in the World than any other disease and no single measure of control through the use of drugs seems effective. This study examined the temporal variation in the occurrence of malaria infection in Kano Municipal L.G.A. Secondary sources were used to generate data for the study. Relevant information was extracted from the bed head ticket (case files) of all in-patients of the health institutions in the study area. And information relating to socio demographic characteristics of patients and temporal pattern (i.e. annual, seasonal, and monthly variation) of malaria in the study area were extracted and analyzed, including 16,601 recorded hospital malaria cases of in patients between 2001 and 2005. The disease was found to affect females (54%) more than males (46%) and children in age 0-5 and 6-10 years accounted for 18.6% and 15.1% respectively. Seasonally, the disease was found to be more rampant in dry seasons (mid-September to mid-May) than in the wet season (mid-May to mid-September) accounting for 63.58% and 36.42 % respectively. The result of statistical test shows that there is no significance difference in the occurrence of the disease between dry season and wet season at 5% level of significance (P≤ 0.05). The trend of the occurrence was found to be increasing annually with the highest incidence in the year 2005 constituting 34% followed by the year 2004 and 2002 accounting for 25% and 16% respectively. Casual observation in the study area revealed that, many factors are believed to have contributed to the increasing trend which includes the presence of open gutters, stagnant water in the ponds, improper waste disposal and the congested settlement pattern that facilitates the malaria occurrence and related diseases. It is recommended that keeping the environment clean by maintaining proper sanitation is the best solution, and government should provide mosquito nets and drugs at an affordable price to the general public in order to prevent the disease.

Keywords: Malaria, Epidemiology, Seasons, Temporal Variation, Kano.

INTRODUCTION

Malaria is currently affecting more people in the World than any other disease. It is currently endemic in over 100 countries and is one of the 10 most prevalent and deadly diseases in the world (WHO, 2002). The disease is caused by tropical parasite that kills people more than any other communicable disease except tuberculosis. Between 300 to 500 million clinical cases occur every year with over 1.2 to 2.7 million deaths, of which 90% occur in sub-Saharan Africa (WHO, 2002). Malaria menace has become an economic burden in tropical Africa (BBC, 2003). According to the report of the American Association for the Advancement of Science (AAAS) Washington, D.C 1991 on Malaria and Development in Africa, pregnant women and children under the age of five are at high risk of Malaria morbidity and mortality. The World Health Organization (1994) stated that some 90% of the World's Malaria occurs in Africa because the World wide eradication programme of 1960s which successfully remove Malaria from North America and Europe, exclude sub-Saharan African altogether, due to the lack of technological capability in individual countries and because Malaria was so huge that eradication was considered not feasible. It is also reported that 255 children in Africa die every 2.5 hours, while about 2173 children under the age of 5 die daily in the continent from malaria (WHO, 2002). Indeed the African region lies in areas where the population is at risk of getting malaria since 74% of the population live in highly endemic areas where malaria transmission is intense. These are equatorial tropical forests and Sudanese savanna areas at altitude up to 100 meters above sea level with an average annual rainfall of over 2000mm. It is responsible for about 20-30% infant mortality, 10% of hospitals admissions, and 20-30% out patient case in Africa (WHO, 2002).

In Nigeria alone, 60 million people experience Malaria attack at least twice in a year, with no less than 80% of the population exposed to the disease (WHO, 2002). Scott (2000) ascribed 90% of health problem caused by Malaria to environmental conditions. To corroborate this, Paul, (1997) emphasized the role of temperature on the range, development, timing and intensity of Malaria outbreak. He described mosquito as hot weather insects that have fixed thresholds for survival. For instance, Anopheles mosquito and Falciparum malaria transmission are sustained only where the winter temperature is kept above 16^0 C.

However, the findings of Hay et al (2002), and Olanrewaju, (2006) refute that of Paul (1997) on the effect of temperature on the outbreak of Malaria. Hay et al (2002) examined the role of climate change on the resurgence of Malaria in the East Africa. He observed that P. falciparum transmission was limited by low temperature in areas of high altitude. Olanrewaju (2006) on the other hand find out a strong positive relationship between rainfall and Malaria outbreak (0.737) and a strong negative relationship between temperature and Malaria (-0.789) in Ilorin, Kwara State. In Kano metropolis, a detailed study of 278 households made up of 3071 individuals that inhabit around ten (10) non-water outlet ponds from various segments of the metropolis revealed that Malaria is the most common sickness among them. On the average about two members of a household suffered from malaria fever monthly, with females and children having high frequencies of and vulnerable to malaria attack (Maigari, 2005). A number of factors determine the prevalence of Malaria risk namely: rainfall, temperature, stagnant pond water, open gutters, waste and many more. A descriptive study of Environmental Factors as Determinants of Malaria risk at the Northern Coast of Peru showed that for a person living in these coastal regions of the North of Peru, the risk of malaria was related to three major factors namely: the seasons of the year, the location of the village within the area, and the location of houses within a village. The result suggested that the presence of stagnant ponds for irrigation played a significant role in determining malaria risk (Guthman et-al, 2002).

Thus, considering the general effects of climatic controls on the anophline mosquitoes breeding and activity being the career of the disease and variation in rainfall and temperature conditions around Kano Metropolis, this study investigated the temporal variation of Malaria occurrence in Kano Municipal LGA through Hospitals records. This study is aimed at examining the temporal variation in the occurrence of Malaria infection in Kano Municipal L.G.A. The specific objectives to achieve the main aim are:

i. To determine the prevalence of malaria infection in the study area through hospital records.
ii. To examine the temporal variation in the infection based on (1) above

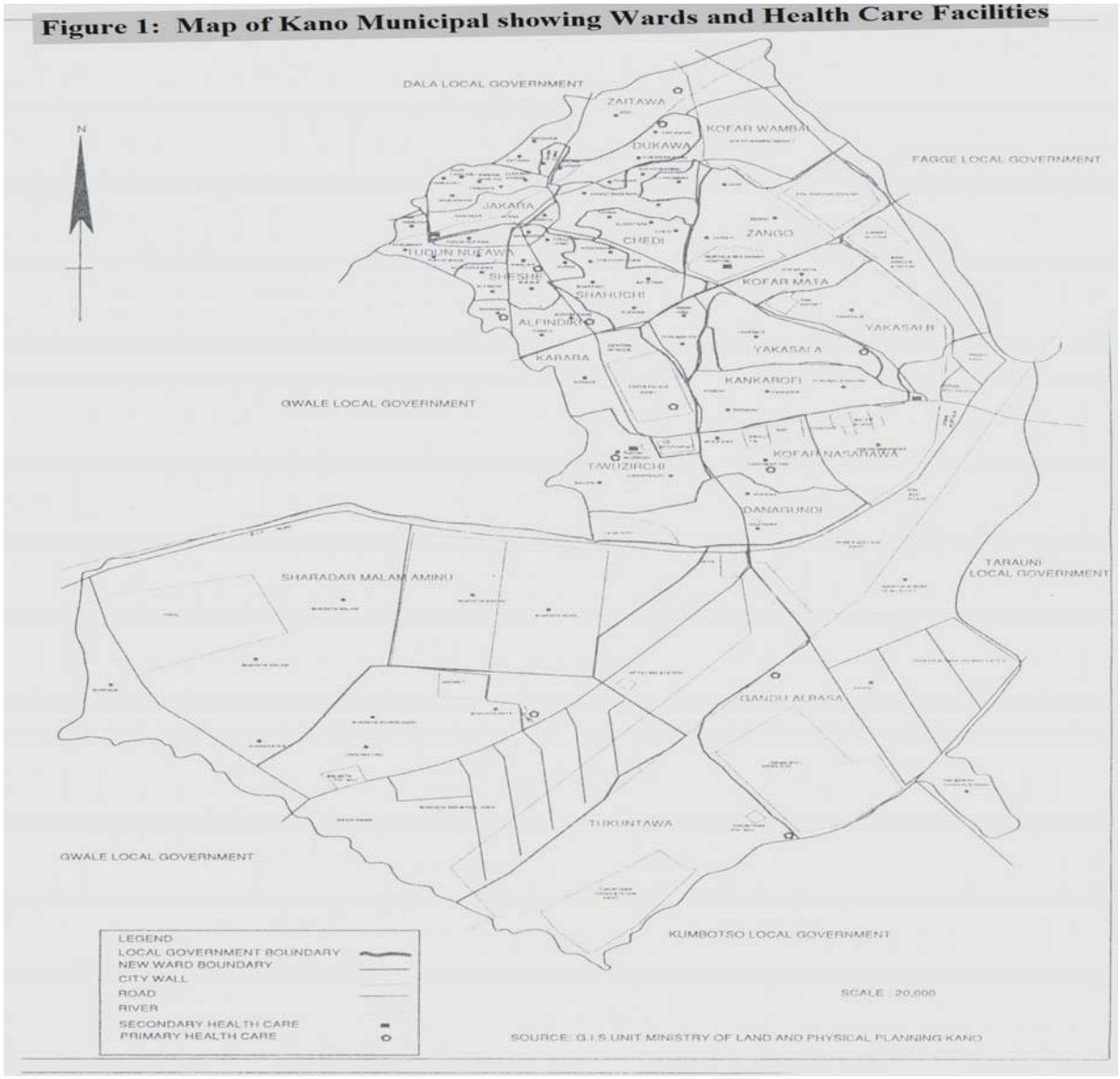
Malaria occurrence does not significantly vary with seasons in the study area.

The Study Area

Kano Municipal LGA is located between latitude 12^0 25' N to 12^0 40' N and Longitude 8^0 35' E to 45' East of the green which meridian, that is relatively at the centre of Kano State. It has an area of about 50km^2 and is made up of 13 wards. The climate of the area is the tropical dry and wet climate. The average annual rainfall is 884.4mm as recorded at the Malam Aminu Kano International Airport, and the predominant period of rainfall is from June to September. Almost 40% of the annual rainfall comes in August which is the peak of the wet season. The temperature regime is warm to hot throughout the year, even though there is slightly cool period between November to February. The mean annual temperature is about 22 ^{0}C in the coolest months (December or January) and 31 ^{0}C in the hottest months (April or May). The mean annual potential evaporation, transpiration, sunshine, and relative humidity are about 1,772mm, 8.5 hours per day, and 50% respectively (Olofin, 1987). The natural vegetation of the area and indeed most of the Kano region is Sudan savanna. The area has a large population density while the settlement pattern falls into the first category classified as high to medium density settlements. It is located within the old city of Kano which is the most densely populated area in the metropolis. The pattern of the settlement is nucleated in nature. It is common to find a market next to hospitals and houses, motor park station next to hospitals and schools. Sanitation is poor with inadequate waste management. Observation made in the study area revealed that sanitation is poor with heaps of solid waste disfigure the landscape every where, poorly open dumps and illegal roadside dumping from residential and commercial areas remain a problem. Most of the ditches have turned into solid waste disposal places. The drainage channels are full of solid waste, though nowadays government is putting effort in sanitation, but yet malaria, cholera, and other diseases have a history of serious epidemics in the study area, and they are yet to be controlled.

MATERIALS AND METHODS

Both primary and secondary data were collected and used in the study. Primary data was collected using field observation in the study area. Secondary data on the other hand was collected from the Statistical Record Departments of the following health institution namely; Murtala Muhammad Specialist Hospital, Sabo Bakin-Zuwo Maternity Hospital, and Hasiya Bayero Pediatric Hospital (Zone 2). Relevant information was extracted from the bed head ticket (case files) of all in-patients of these health institutions. And information relating to socio demographic characteristics of patients and temporal pattern (i.e. annual, seasonal, and monthly variation) of malaria in the study area were extracted and analyzed. In all there were 16,601 cases of malaria recorded from 2001 to 2005. All malaria patients that were not admitted in the hospital were excluded. Certain information such as addresses of the patients was not available due to the incomplete medical records in the hospital. Items with no available data were not included in the analysis. The process of collecting the data was made with the assistance of medical record personal. Descriptive statistics was used to analyze the data such as totals, means, percentages and bar graphs, while T-test analysis of the mean was the only inferential statistic used in testing the formulated hypothesis.



RESULTS AND DISCUSSION

Age and Sex Distribution of Malaria Infection

The age and sex distribution of patients who were admitted and treated for the years under study are summarized in Table 1. For age group 0-5, males accounted for 41.20% of the cases while females accounted for 58.80%. Thus, females and children suffer more in this group that constitutes 18% of all infection. In consistence with W.H.O report 2002, malaria cases mostly affect children below five years old. At age 6-10, 11-15, and 16-20 males accounted for 42.15%, 43.39%, and 48.64% of the cases for that group respectively, while females accounted for 57.86%, 56.61%, and 51.36% respectively. This also shows that females have high incidence of infection than their counter-part in this group that constitutes 15.1%, 13.9%, and 11.9% of all infection respectively.

Morever, at age 21-25 and 31-35 males account for 46.71%, 49.78% and 47.78% of the total cases of that group respectively. While females constitutes 55.29% and 52.22% respectively. Thus, females also suffer more in this group that constitutes 11.1%, 12.6%, and 10.2% respectively. This is because male adults usually resort to self-medication using drugs such as chloroquine tablets or local herbs. While females particularly pregnant women usually lose their resistance when they become pregnant. However, for age group 36-40, males have 596 cases or 50.68% which is greater than the females that accounted for 580 cases or 49.32% in this group that constitutes 7.1% of all infection.

Table 1: Age And Sex Distribution of Malaria Infection in Kano (2001-2005)

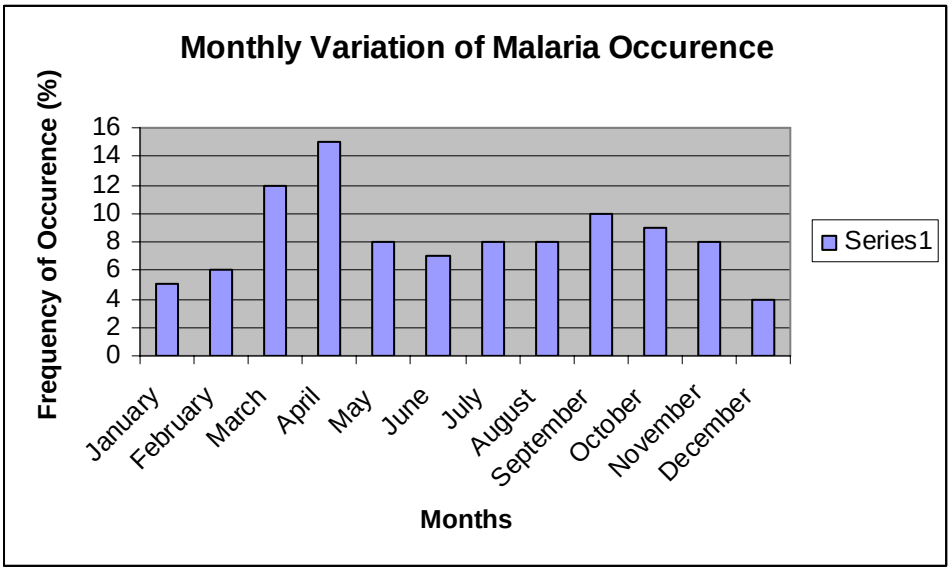
Age Group	No. of Males	%	No. of Females	%	Total	%
0-5	1233	41.20	1760	58.80	2993	18.0
6-10	1060	42.15	1455	57.86	2515	15.1
11-15	1004	43.39	1310	56.61	2314	13.9
16-20	965	48.64	1019	51.36	1984	11.9
21-25	858	46.71	979	55.22	1837	11.1
26-30	1041	49.78	1050	50.22	2091	12.6
31-35	808	47.78	883	52.22	1691	10.2
26-40	596	50.68	580	49.32	1176	7.1
Total	**7565**	**45.57**	**9036**	**54.43**	**16,601**	**100**

Source: Hospital Records, 2006.

Monthly Distribution of Malaria Incidents

Figure 1 shows that the month of April recorded the highest incidence with 2440 cases or 12%. It is believed that the incidence is so high in the months of April and March in the study area, because these are the hottest months when temperature could reach 31 ^{0}C. It is known that the female adult mosquito requires a minimum of 20 ^{0}C, and also the plasmodia show no sporogany activity (Incubation) at a temperature below 16 ^{0}C. Consequently, the warmer the condition, the better for the mosquito. Also the area is very congested with many blind alleys and inadequate waste management as well as open gutters that provide suitable breeding sites for the mosquitoes. Furthermore, the month of December recorded the least frequency with 731 cases accounting for 4% of the total cases. This is followed by the month of January and February accounting for 5% respectively; simply because they are the coolest months of the year with the temperature at about 21 ^{0}C.

The month of May, June, July, August, September, and October with 8%, 7%, 8%, 10%, and 9% respectively, recorded the medium incidence in the disease. Despite the availability of rainfall and ponds. This may be attributed to the fact that most of the months fell within the season characterized by the lowest diurnal and monthly ranges of temperature of the year (Olofin, 1987). However, the availability of rainfall usually makes water to accumulate in open spaces such as ponds, gutters, etc, which is congenial to the reproduction of the anopheles vector.



Source: Hospital Records, 2006.

Figure 1: Monthly Variation of Malaria Occurrence in Kano.

Seasonal Distribution of Malaria Incidents

In terms of seasons, two distinctive seasons were observed to have affected the occurrence of the disease in the study area viz: Dry season and Wet season shown in table 2. The table shows that in the year 2001 dry season had high incidence constituting 1029 cases or 61.99% than the wet season, which accounts for 631 cases or 38.01%. In the year 2002, dry season also has high incidence accounted for about 1709 cases or 64.51% than the wet season which constitutes 940 cases or 35.49%. However, in the year 2003 the occurrence decreased to 2440 cases which is lower than the 2002 cases and still the dry season with 1598 cases or 65.49% dominated the wet season that has 842 cases or 34.51%. Moreover, in the year 2004, dry season also has high incidence constituting 3140 cases or 74.61% than the wet season that has 1064 cases or 25.31. Similarly in the year 2005, the dry season constituted 3125 cases or 55.33% which is higher than the wet season that had 2523 cases or 44.6%.

Finally, it was observed that the dry season over the years which have a relatively higher incidence in the disease occurrence, constituting 10601 cases accounting for about 63.58% of the total cases under the study. Meanwhile the wet season characterized by warm and fairly steady temperature has relatively moderate or low incidence than the hottest season of the year with the air temperature reaching up to 40^0C in the study area. So this atmospheric condition favors and contributes to high occurrence of the disease. The result was used to test the hypothesis, which stated that there is no significance difference in the occurrence of malaria infection between dry and wet season. After the hypothesis was tested using the T-test, the result showed that there is no significance difference in the occurrence of the disease between dry season and wet season at 5% level of significance, where the calculated **t** was less than the critical **t.** However, at 10% level of significance under the same degree of freedom, the result shows that there is significance difference. Where the calculated **t** is greater than the critical **t.** This implies that as time goes on when the occurrence continue increasing, there will be a clear significance difference even at 5% level. In contrast to the findings of Olanrewaju (2006) that there is a strong positive relationship between rainfall and Malaria outbreak (0.737) and a strong negative relationship between temperature and Malaria (-0.789) in Ilorin, Kwara State

Table 2: Seasonal Variation of Malaria Occurrence

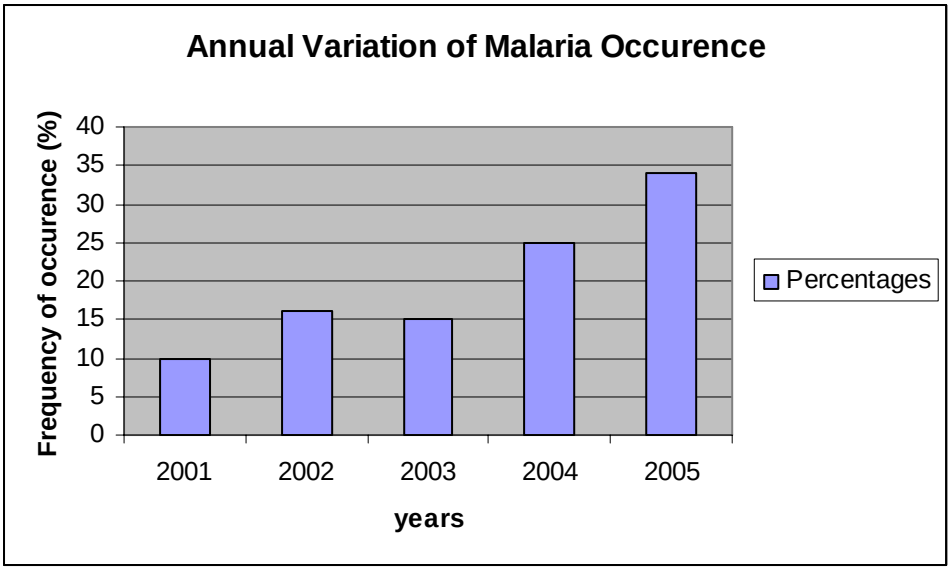
YEARS		DRY SEASON		WET SEASON	
	FREQUENCY	Frequency	Percentage	Frequency	Percentage
2001	1660	1029	61.99	631	38.01
2002	2649	1709	64.51	940	35.19
2003	2440	1598	65.49	842	34.51
2004	4204	3140	74.69	1064	25.31
2005	5648	3125	55.33	2523	44.67
TOTAL	**16,601**	**10601**	**63.58**	**6000**	**36.42**

Source: Hospital Records, 2006.

Annual Variation of Malaria Occurrence

The annual variation in the occurrence of the disease was analyzed in order to find out whether the trend is increasing or decreasing annually. The number of malaria cases has been increasing, with the highest incidence recorded in 2005 constituting 34%, followed by 2004 with 2404 cases accounting for 25%. While the year 2002 recorded 2649 cases or 16% which could be considered as moderate. However, in the year 2003 the incidence decreased to 2440 cases accounting for 15%, and lastly the year 2001 recorded the least incidence with 1660 case or 10% of the total cases under the study. This shows that the trend has increased annually.

Many factors are believed to have contributed to the increasing trend. These include; open gutters every where that facilitates the reproduction of new vectors; stagnant water in ponds that gives room for mosquitoes to breed; and the congested settlement pattern that facilitates malaria problems and related diseases.



Source: Hospital Records, 2006.

Figure 2. Annual Variation of Malaria Occurrence in Kano.

Conclusion and Recommendation

The result of the study showed that, generally malaria disease affect children mostly below 10 years old. The disease was found to affect females (54%) more than males (46%), and children in age (0-5 and 6-10 years), accounted for 33.1%. Seasonally, the disease was observed to be more rampant during the dry season (mid-September to mid-May) than the wet season (mid-May to mid-September) Despite the rainfall in the wet season that favors the breeding of mosquitoes, the result of statistical test shows that there is no significance difference in the occurrence of the disease between dry season and wet season at 5% level of significance ($P \leq 0.05$)**.** It is believed that, this is due to the high temperature, high congestion and improper waste disposal. The presence of stagnant water in the ponds and open gutters also contributed in the breeding of mosquitoes. The study also reveals that the trend has increased annually.

Based on the findings, the study recommends the followings;

- There should be the provision of adequate and essential drugs and mosquito nets at affordable prices for the public.
- Use of insecticides across the room to kill mosquitoes.
- Avoiding dark colored cloth as it attract mosquito and covering arms and legs in the evening
- Adequate sewage and drainage system should be provided by covering those that are open and improving on the existing ones.

REFERENCES

American Association for the Advancement of Science (AAAS), Washington, DC. 1991

BBC -360 Environmental Controls of Mosquitoes to Abate Malaria. Pp 1-5, Wed 13/8/03

Guthman et-al (2002), *A Descriptive Study on the Environmental Factors as Determinants of Malaria at the Northern Coast of Peru*, Journal of the Tropical Medicine and International Health.Vol. 7, Pp 518-525.

Hay, I.S, Cox J., Rogers, D.J., Randolphs, S., Stem, D.I., Shanks, G.D., Myers, M.F and Snow, R.M. (2002) *Climate Change and the Resurgence of Malaria in the East Africa Highland*. Nature, Vol.415, Pp 21.

Maigari A.I. (2005), *Surface Water Resources Management Strategies in the Metropolitan Kano,* Wa'adallah Environmental Consults (WADEC), Kano-Nigeria.Pp 82

Malaria-Full information. *Http;//www.nevdgp.org.au/travel/dismal.htm* . W.H.O Year Book 2002.Pp 96 www.who.int\ith\chapter 07 0.1 html

Olarenwaju, R.M (2006). *Climate and Malaria: A Geographer's View Point*. *Confluence Journal of Environmental Studies,* Vol 1, Number 2, Pp 90-96

Olofin E.A. (1987), *Some Aspect of the Physical Geography of Kano and Related Human Responses.* Departmental lecture series No. 1. Department of Geography, Bayero University, Kano. Nigeria.

Scott, C.R et al (2002). *Attaining Global Health: challenges and Opportunities*. Population Bulletin. Vol. 55, No. 1, Pp 25-28

World Health Organization (W.H.O) (1994) *Year Book.* Pp 88.