AN INVESTIGATION OF THE INFLUENCE OF FLOODED HOUSEHOLD ENVIRONMENTS ON MATERNAL HEALTH OF FLOOD PLAIN DWELLERS IN MAKURDI, CENTRAL NIGERIA

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Abstract: Flooding negatively affects the quality of household environments. Studies indicate that household environments are decisive on health, more so maternal health. Makurdi town located in the Benue valley is experiencing increased seasonal flooding attributed to climate change and anthropogenic factors. This study has investigated the effect of flooded household environments on maternal health of flood plains dwellers in Makurdi. Structured questionnaires were administered on 20 female flood plain dwellers randomly sampled in the residential neighborhoods of Wadata, Akpehe, Idye, Logo, low level and Wurukum, giving a total of 120 respondents. The household environment was assessed using five parameters namely water supply, cooking environment, surrounding environment, household waste disposal and sleeping environment. These parameters were used as variables and tested for correlation with women who have given birth. Results indicate that in the flood plains, 82% of the women have children and one in every four pregnancies is lost. The cooking environment in the flood plain households is classified as fair, human waste disposal environment is classified as average while generated wastes environment is poor. The sleeping environment and water supply environments in the flood plains are classified as good. Women who are having children correlated with the sleep environment shows a positive relationship (+ 0.011). Surrounding environment correlated with women who are producing children shows a positive relationship (+ 0.033). Productive women in the flood plains correlated positively (+0.056) with the cooking environment. With the waste environment there was a negative correlation (-0.098) and the water supply environment correlated with productive women indicates also a positive relationship (+0.68). This research demonstrates that maternal health is compromised in floodplain environments in Makurdi and Improving household environments should be crucial and should be taken into consideration when policy decisions are taken concerning planning for these areas.

Keywords: Cities, Developing Nations, Flooding, Household Environment, Maternal health.

INTRODUCTION

The number of people suffering from natural disasters is expected to reach 2 billion people before 2090 (Lancet. 2007) [1].The most common and widespread of these natural disasters is flooding. This increase has been attributed to global warming, climate change and anthropogenic factors. (Wynn, 2011) [2] Climate change is defined by the United Nations Framework Convention on Climate Change (UNFCCC) in (IPCC.2007) [3], as “a change

of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".

Climate change affects health because it puts at risk the basic determinants of health such as clean air and water, sufficient food and adequate shelter (WHO 2009 [4]. Associated changes from climate change may increase the risk of some infectious diseases, particularly those diseases that appear in warm areas and are spread by vectors such as mosquitoes and other insects. These "vector-borne" diseases include malaria, dengue fever, yellow fever, and encephalitis. Furthermore algal blooms could occur more frequently as temperatures warm — particularly in areas with polluted waters — in which case diseases (such as cholera) that tend to accompany algal blooms could become more frequent .(EPA 2011) [5]

All populations are vulnerable to climate change – but some are more vulnerable than others (WHO 2009) [6]. Densely populated, low lying areas such as large river deltas and small Islands are at the greatest risk of flooding.(Vigran, 2008) [7]. Furthermore, the groups who are likely to bear most of the resulting disease burden from a changing climate are children and the poor, especially women.

The health of women is most compromised in a poor environment because women interact closely with the environment as they manage homes and so are more exposed to harmful environmental hazards. Maternal health is most sensitive to poor environments. It is defined by the World health Organization (WHO 2011) [8] as referring to the health of women during pregnancy, childbirth and the postpartum period.

Globally the WHO (2005) [9], in its World Health Report states that poor maternal conditions account for the fourth leading cause of death for women worldwide, after HIV/AIDS, Malaria, and Tuberculosis. In Nigeria, complications of pregnancy and child birth are leading causes of death among women of reproductive age. According to the Demographic Health Survey NDHS (2008) [10] maternal mortality, in the seven years preceding the survey was 545 per 100,000 live births in Nigeria. Furthermore, maternal mortality ratio varied from 700 to 1,500 per 100,000 live births in 2005 (State of Nigeria Health, 2006) [11].Despite several interventions from the government and many international organizations this trend is still prevalent. In Benue State the picture is not different as maternal mortality rates indicate 807/100, 000. (PATHS, 2003) [12].

Factors that reduce maternal mortality used by countries like china and India include lower pregnancy rates; higher income, which improves nutrition and access to health care; more education for women; and the increasing availability of "skilled birth attendants" — people with training in basic and emergency obstetric care — to help women give birth. Wikipedia Free Encyclopedia (2011) [13].In Nigeria and in Benue State attempts at reducing negative statistics of maternal mortality include training more birth attendants, creating awareness on contraception.(SLGP,2002) [14] Interventions by International bodies like the United Nations have led to actions like distribution of treated nets against mosquitoes and free antenatal care. Core issues like higher incomes and improved environments which guarantee better all-round health or ability to combat illness have not been given priority.Moreso attempts at reducing maternal health risks are often targeted to rural women who are thought to be most vulnerable, yet a very vulnerable population that is hardly considered in decision making are the women living in urban areas. Osinubi, (2003) [15]

Living in the city should reduce vulnerability in several important respects, including lower rates of diseases such as malaria, and often higher individual incomes and better access to health services.(Lancet 2007) [16][1]. However, urban populations, particularly in developing countries of Sub-Saharan Africa, like Nigeria ,still form one of the most deprived groups (World Bank, 1997) as quoted by Osinubi,(2003) [17][15].

Further exacerbating this vulnerability is cities located near coastal or river side locations. This is because these areas are located on the coast, and therefore vulnerable to sea-level rise. They are also exposed to the more frequent severe windstorms and floods that some studies are already linking to past and future climate change (Lancet. 2007)[18][1]

In addition, construction patterns in these cities often result in clearing of large parcels of land for development'. This aids degradation of natural protection; also building on the usually cheaper lands of the floodplains hinders natural drainage courses. In addition flooding is increased on impervious surfaces like roads and pavements that increase run off.

Finally and most importantly, poor economic development characteristic of countries in the developing world like Nigeria, mean slum conditions, poor infrastructure, inadequate urban services and amenities is prevalent in urban areas. This is the situation in Makurdi town of Benue State Central Nigeria. Makurdi has its problems compounded by the fact that it's location in the Benue valley means a very low lying relief and poor physiognomy. In Makurdi, heavy rains often result in intense, seasonal floods. These floods occur every rainy season and in recent years they have been occurring more

frequently and in greater magnitude in terms of height of flood waters and area coverage.

Household environments in these poor environments where women of reproductive age live put their health at risk (World Bank 2000)(UNICEF, 2000) as quoted by Ugal (2007) [19]. Racioppi (2002) as quoted by Ugal (2007) [20][19] observed that a variety of health conditions are made worse by household conditions .The household conditions include those with poor air quality, built with poor building standards, noise, contaminated water, food and toilet facilities These conditions are evident in some household environments. They are very common in urban areas in Nigeria and they undermine the health status of childbearing women.

Several other factors can determine the maternal health status of a woman. Such factors as nutrition, income, education, genetics, age at marriage, age at menarche, polygamy, proximity to health care assistants, pre and post natal care. These factors are often considered in policy decisions in mitigating maternal morbidity and mortality. However, poor household environments which are crucial to maintaining good health are often not addressed in reducing maternal health. Could this be the reason why maternal mortality continues to be high despite several interventions by government and international bodies?

Studies on maternal health have focused on other factors that aggravate poor maternal health. Gaps exist in how urban household environments affect the maternal health of women. As the effects of climate change become more glaring, reducing vulnerabilities and increasing resilience in general will help vulnerable populations cope with the health effects of climate change. Hence this paper is significant as it investigates the implications of poor household environments on the maternal health of women in the flood plains of Makurdi. The research will provide fodder for policy decision on planning flood control, mitigation and adaptation. This paper answers the following questions: (a) What is the status of maternal health of women in the flood plains (b) What is the condition of the household environment of the women in the flood plains (c) Does the household environment affect the maternal health of the women?

The study aims therefore to investigate the effect of the household environment on the maternal health of women living in the flood plains of Makurdi specific objective are (a) To classify the maternal health of women in the flood plain based on number of live births and lost pregnancies (b) To document the quality of household environments in the floodplains in the rainy season in terms of sleeping, cooking, surrounding, water supply and waste disposal environments. (c) To determine a relationship between women and household environment (d) Highlight the planning implications of the results.

STUDY AREA

Makurdi has a population of 297,398 national population census(2006)(14),the ratio of males to female is about 1:1.The town is located in the central region of Nigeria between latitudes $7^0$37'and $7^0$47' north of the equator and longitude $8^0$27' and $8^0$40' East. The River Benue which is the second largest river in Nigeria bisects the town into two parts that is, north and south banks. (See Fig.1 and 2).Makurdi's climate is hot and humid according to Koppens classification AW .High temperatures are experienced especially in the months of March and April. Humidity is high all year round. Rainfall occurs between the months of April and October. With average rainfall amount ranging between 1000mm to 1300mm spread over 5-7 months. Majority of the neighborhoods that make up Makurdi are in the flood plains. They are poorly drained, low-lying and susceptible to floods during the rainy season and heavily developed. Basement complex and sedimentary rock form part of the parent material that makes up the soil in Makurdi .Top soils are mostly clayey this means that a lot of water collects in pools before it slowly infiltrates into the soil. This situation is made worse during the months of the rainy season .These pools of water serves as breeding grounds for disease carrying vectors like mosquitoes, flies and cockroaches.

Development in Makurdi especially the densely populated flood plains is haphazard. The roads are in deplorable state making accessibility and mobility difficult. Urban amenities like water supply and electricity are not supplied consistently. People have to find alternatives for water like boreholes and surface wells and for electricity like generators. These alternatives like generators pollute the air, the surface wells are easily contaminated by the human waste disposal systems in use that infiltrate the wastes into the soil.

METHODS

This paper has investigated the effect of household environment on maternal health of urban women who reside in the floodplains in Makurdi. The study used the survey method where structured questionnaire were administered .The questionnaire were designed based on a pilot study that revealed the salient variables in the household environment that can influence maternal health. Information elicited from the questionnaires include demographic characteristics, maternal health history as evidenced by life births and lost pregnancies and household environment. Six residential neighborhoods in the

floodplains of Makurdi town were adopted as units for data collection and analysis viz : - Wadata, Wurukum, Akpehe, Logo, Low level and Idye. Simple random sampling technique was employed to collect data from 20 households in each of the 6 neighborhoods to give a total of 120 households. Out of the 120 questionnaires administered only 119 were returned. A comparative scale of 1-5 indicating degree of goodness to badness was used to describe household environmental quality using the parameters of surrounding environment, cooking environment, sleeping environment, waste disposal and water source. The value of any one resident was determined on a semantic differential scale modified after the works of (Osgood 1957) and (Leopold 1969) as adopted by (Iorliam2010) [21].

The analytical techniques of frequencies and percentages were used to describe the data collected on demographic information, maternal live births and lost pregnancies. In assessing the neighborhoods the score of each variable is derived by taking a mode of all observations on that variable. (Craik and Zube 1976)in Iorliam (2010)[22][21].These environmental quality index variables are then tested against women who have ever delivered a child, using the Spearman Ranked Product Correlation Coefficient to determine if there are relationships between environmental quality and maternal health.

FINDINGS

Demographic data

Demographic characteristics of the women surveyed reflect their age, marital status, education and occupational diversities. Table 1 indicates that 82.4% of the respondents fall within the age bracket of 10-50 years. The implication on maternal health is that, 82.4% of the respondents are in the reproductive stage of life. This means that they are at an age when they are most fertile and can have children. This increases their risk of maternal morbidity and mortality; as they are interacting with the household environment as managers of homes.

Age is a good indicator of maternal health risk; however, in most countries of Africa Child bearing outside marriage is frowned upon. Table 2 shows information on marital status of the women 59% of women in Makurdi town are married. Barring any unforeseen circumstances like infertility, it then means these female flood plain dwellers should have children. This factor means that they are vulnerable to maternal morbidity and mortality because they are in households which they have to manage. Thus they are exposed to the household environment. Of the female flood plain dwellers in Makurdi, 31.1% are single while 19.29% of the singles have children. These single parents are also vulnerable. Among the flood plain dwellers, 4% are divorced. The divorced are in the productive phase of life .They have children and so are also at risk to compromised maternal health because of exposure to poor household environments.

Vulnerability to environmental contaminants is greatly increased if the people are ignorant of how to protect themselves; this knowledge is linked to the level of education. Table 3 is a distribution of the educational levels of female flood plain dwellers of Makurdi

Findings in Table 3 indicate that, 89.2% of the respondents are educated and are majorly spread among the secondary and tertiary levels of education. This shows that most women who reside in the flood plains of Makurdi are educated. This is possible because of the proximity to many and various types of educational centers which have different programs that can accommodate the special needs of women like, afternoon and nights school programs. Also high educational levels could be because of the need for education in order to fit into the urban society. This factor reduces the vulnerability to contamination from the household environment. This vulnerability is further reduced if the women have an income and can contribute to maintaining better household environments. Table 4 shows the occupational levels of female flood plain dwellers in Makurdi.

Field data indicates that 71.43% of the women are gainfully employed although the majority of 38.66% are engaged in private sector jobs which are highly non regulated in Nigeria and dependent on harsh government policies and so very unstable .This means that incomes among these women are unstable and in most cases poor. Poor incomes increase vulnerability to maternal morbidity and mortality. Also the activities women undertake in the private sector also expose them to household environmental contaminants.

Classification of Household Environments

No matter how much one earns, if the household environment is not clean and sanitary most of that income will go into treating illness, let alone if the income is poor. Table 5 shows field data on the household environment of the female flood plain dwellers observed using five parameters.

The surrounding environment is classified into three categories of impervious surfaces as having the highest grade of (5),plain surroundings without grass as (3) meaning fair and surroundings covered with grass as (1) meaning poor.

Table 1: Age Distribution of female floodplain dwellers in Makurdi

Age	10-30	31-40	41-50	51-60	61-70	Above 70	total
Frequencies	50	26	22	5	11	5	119
Percentages	42.02	21.85	18.49	4.2	9.24	4.2	100

Source: *Authors fieldwork (2011)*

Table 2: Marital Status of female floodplain dwellers in Makurdi

Marital status	Married	Single	Divorced	Single parents	total
frequencies	70	37	6	6	119
Percentages	58.8	31.1	5.05	5.05	100

Source: *Authors fieldwork (2011)*

Table 3: Educational levels of female floodplain dwellers in Makurdi

Educational levels	No education	Primary education	Secondary education	Tertiary education	total
Frequencies	7	5	54	53	119
Percentages	5.83	4.17	45	44.17	100

Source: *Authors fieldwork (2011)*

Table 4: Occupational levels of female floodplain dwellers in Makurdi

Occupation	Farming	Student	House wife	Trading	Civil servant	total
Frequencies	5	8	21	46	39	119
Percentages	4.2	6.72	17.65	38.66	32.77	100

Source: *Authors fieldwork (2011)*

Table 5: Household environment of respondents

Surrounding environment	**5(good)**	**3(fair)**	**1(poor)**	**mode**	**Overall classification**
Impervious surroundings	23				
Plain surroundings		85		85	
Covered with grass			11		fair
Cooking environment					
Kitchen inside the house	54			54	
Kitchen near the house		44			average
Kitchen outside			21		
Waste disposal methods: ***Type of human waste disposal***					
Water Closet	56			56	
Pit latrine		44			poor
bushes			19		
Household generated waste					
Communal dumps	21				
Stream		2			poor
Dust bins			96	96	
Sleeping environment: Cross ventilation in rooms	110				
1 window		6			good
No window			3		
Water supply					
Borehole		21			good
Surface wells/vendors			44		
Pipe borne water	54			54	

Source: *Authors fieldwork (2011)*

Table 6: Maternal health history of respondents showing number of live births

No of Children	0	1	2	3	4	5	6	7	8	9	10	total
Frequencies	32	8	12	15	20	8	10	4	5	3	2	119
Percentages	26.90	6.72	10.08	12.61	16.81	6.72	8.40	3.36	4.20	2.52	1.68	100
No of lost pregnancies												
	yes					no						
frequencies	32					87						119
percentages	26.89					73.11						100

Source: *Authors fieldwork (2011*

Cooking environment is classified as good (5) when kitchens are located inside the house, medium (3) when located near the house and poor (1) when located outside under the sky.

Sleeping environment is classified as good (5) when windows are cross ventilated, medium (3) when there is only one window to the sleeping area and poor (1) where there are no windows to sleeping areas.

Water supply is good (5) if it is supplied from public mains, medium(3) from boreholes and poor(1) from hand dug wells and water vendors.

The waste disposal environment is divided into two human waste and household generated waste disposal environment .Human waste disposal is good(5) if water closet system is used to dispose of human wastes, fair(3) if pit latrine is used and poor(1) if the people defecate in the bushes. Generated waste disposal is classified as good (5) if generated household wastes are disposed in communal dump, fair (3) with disposal in streams and poor (1) when household wastes are disposed in dust bins. Table 5 shows results of household environments of flood plain dwellers.

The data in table 5 indicates that the surrounding environment is more of plain surfaced. This factor increases risk to disease bearing vectors such as mosquitoes and flies. This is because water percolation is slow in Makurdi because of the high clay content of top soils. Impervious surfaces make up 23 household and help in reducing risk because they do not allow water to collect and are easier to keep clean. On the other hand these surfaces increase surface run off and increase flooding.

A mode of 54 of the households has kitchens located inside the houses. This factor reduces risk because the cooking environment can be controlled and kept clean easier and time is saved in commuting to the kitchen. A total of 44 of the households have kitchens located near the houses some on the corridors others in combined kitchens with neighbors in the compound. This factor increases risk as the environment is not easily kept clean. A lot of time is wasted commuting from the kitchen to the house. This time can be invested into something else. The overall cooking environment is therefore classified as fair to poor because the combination of poor and fair outweighs good.

For human waste disposal system 56 of the households have water closet systems. This factor instead of reducing risk increases risk because this type of disposal system requires a lot of water which is not readily available in the homes. In the flood plains of Makurdi, 44 of the household's sampled use pit latrines which although easier to maintain increase risk of contracting infections and pollute the underground water. Therefore they also increase risk of exposure to diseases. A total of 11 of the household surveyed use the bushes for disposal of human waste this factor contaminates the environment and increases risk of exposure to diseases. In classifying the human waste environment in household in the flood plains; average is a reasonable classification because the ratio of good to fair and poor is about 1:1

How the waste generated in the households are disposed of also affects women's exposure to diseases, 92 households sampled, dispose of their refuse in dustbins which are emptied on the roads, in uncompleted buildings and empty plots in the neighborhood this factor increases exposure to diseases because the wastes dumps constitute breeding grounds for disease vectors and rodents. Also, 5 of the households dispose of their household wastes in the nearby stream polluting them. This method is fair because the streams carry away the waste. However; the streams become polluted and dangerous for use in the houses. This also increases the exposure of women who use the streams. Finally, 21 of the households dump their wastes in the designated communal dumps where the wastes are lifted to landfills this reduces risk of exposure form waste. Based on the sample population the overall waste disposal environment in the flood plain household is classified as poor.

Sleeping environment indicates 110 households as having cross ventilation in their sleeping areas .This factor greatly reduces exposure to air borne diseases because the air circulates well with cross ventilation. A total of 6 households have only one window in the sleeping area and 3 have no windows at all. This increases exposure to air borne disease. Hence the sleeping environment in the floodplains of Makurdi is classified as good

The household environment quality variable of Water supply has 54 of the households supplied with water from the public water mains. This water is treated and requires minimal treatment for consumption and cooking. Among the flood plains 45 households depend on boreholes which are sealed and so require minimum treatment. This reduces exposure to water borne diseases.While,34 households use water from hand dug wells and patronize water vendors who source their water wherever water is available not minding how safe the source is .This greatly increases risk of exposure to water borne disease

because these wells are not sealed and open to contamination. Also the proximity of the wells to human waste disposal systems compromises the purity of the water in the wells. Water supply environment is good because majority of households have good and fair water supply out weighing poor.

Maternal Health of Flood Plain Dwellers in Makurdi

Poor environments affect health. A healthy woman should all things being equal be able to deliver safely. Table 6 shows data on number of deliveries which are alive and lost pregnancies. The table shows that 70% of the respondents have children .The most occurring number of children per woman is four children. Of the 119 respondents 26.9% have lost at least one pregnancy. That is one in every 3.5 or 4 pregnancies is lost. This indicates poor maternal health.

The results above indicate that women in the flood plains have children it implies that other factors like increased nutrition, education, income have bearing on high birthrates. Even though many women in the flood plains have children maternal health indicators of number of lost pregnancies show another picture of poor maternal health.

Correlation between Women and Environment

Household environment is correlated with women who have children and still have the potential to have more children. The non parametric test of spearman ranked correlation coefficient is used. The results indicate that the variable of sleeping environment correlated with women shows a positive relationship of +0.011 which is significant at the 0.05 confidence level.This means that improved sleeping areas will improve maternal health.

The surrounding environment sample shows that most of the household have plain surfaces. This variable correlated with women with reproductive potentials indicates a negative correlation of -0.033 .Meaning that improved surrounding environment translates to poor health among women of child bearing age. This result is not normal and could indicate that the sample size is not significant.

The sampled households show kitchen located inside the houses as most frequently occurring type of cooking environment. This variable is then correlated with women of child bearing age revealing a positive correlation+0.056 .This indicates that improving cooking environments mean improving maternal health.

Water supplied by the public mains form the mode in water supply environment .When this mode is correlated with females in the reproductive stage of life; there is a positive relationship of +0.068 .This means improved water supply mean improved maternal health.

Human waste systems with water closet are most occurring in the surveyed area. This variable correlated with women shows a negative relationship.-0.152.

CONCLUSION

An investigation in to the effects of household environment on maternal health of urban women who reside in the floodplains in Makurdi has concluded that the overall cooking environment in the flood plains is classified as fair to poor because the combination of poor and fair outweighs good. .The human waste disposal environment in households in the flood plains is average because the ratio of good to a combination of fair and poor is about 1:1. Generated waste disposal environment in the flood plain household is classified as poor. The sleeping environment of households in the flood plains of Makurdi is good. Water supply environment is good.

Maternal health measured by number of deliveries show that 82% of the women in the floodplains of Makurdi have children. The most frequently occurring number of children per woman is 4 indicating good maternal health, if the premise is that a healthy woman should be able to have children. However the numbers of lost pregnancies show a picture of poor maternal health as one in every four pregnancies or 25% is lost. This is high compared to averages elsewhere of 1:1.hence the overall picture of maternal health is poor because although women are having children, they are also losing pregnancies more than is normal.

Women who have children correlated with the sleeping environment shows a positive relationship indicating that if sleeping environments are good the health of the women of reproductive capacity is good.

Correlation of women with the cooking environment also indicates a positive relationship which if improved upon will mean an improvement in the maternal health of women.

The human waste disposal environment shows a negative relationship with maternal health indicating that poorer human waste environment impacts negatively on maternal health.

Household Generated waste environment shows a negative correlation with women of productive capacity.

Water supply environment correlated with productive age women shows a positive correlation and the surrounding environment correlated with women of productive capacity shows a positive relationship.

RECOMMENDATION

All nations of the earth are endangered by ongoing climate change because infectious diseases that are increasing as a result of climate change variability on weather spread across national and international borders.

This study therefore recommends. Improved environments as the panacea to improved health conditions .International donor agencies should focus on core issues of better environments and incomes instead of attacking symptoms like malaria control. Especially in developing countries .Women should be integrated in planning and policy stages of urban flood management .Urban planning should incorporate information on areas affected by flood and how adaptation strategies can be included in policy and budgeting. Health systems should be strengthened, to include preventive strategies as well as curative ones. Public health planning and decision making should be integrated with urban planning policy so as to shift from focusing on short term risks to the projected long term impacts of climate change.

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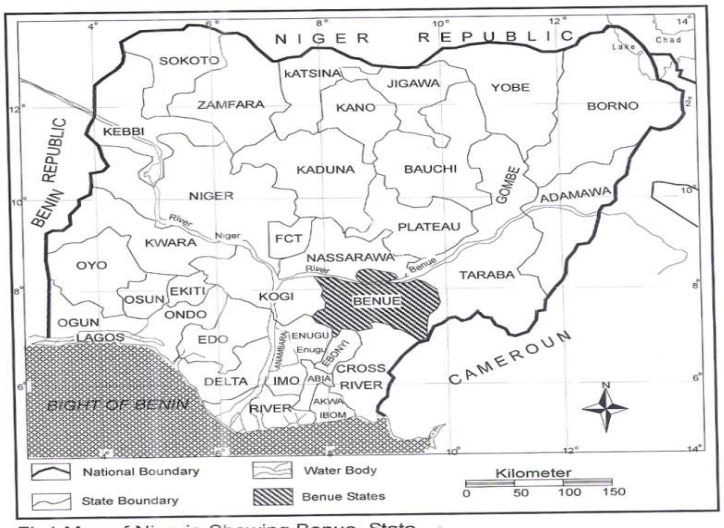

Fig1:Map of Nigeria Showing Benue State.
Source: Longman School Atlas,2003

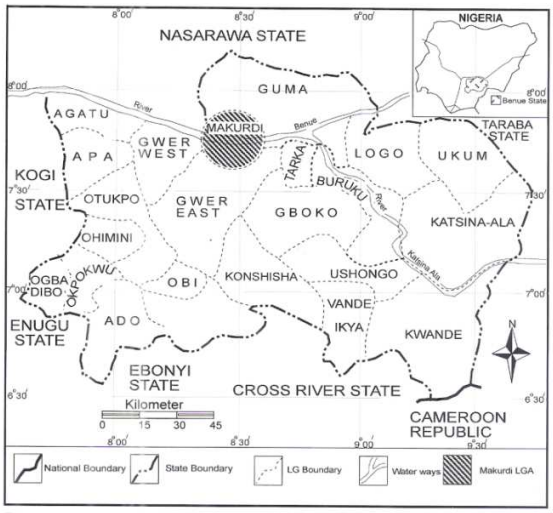

Fig2:Map of Benue State Showing Makurdi Local Government Area
Source: Ministry of Lands and Survey Makurdi (2011).