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Prevalence of Diabetes Mellitus, malaria and co-morbidity in three Selected Hospitals in Imo State, Nigeria.

Nwoke EA[1]*, Ezeh PA[1], Ibe S.N.O[1]
1. Federal University of Technology Owerri, Imo State, Nigeria

ABSTRACT

This study was carried out to determine the prevalence of diabetes mellitus, malaria and co-morbidity in three selected hospitals in Imo State, Nigeria. It was designed to ascertain the distribution of the cases among the variables, patient's age, occupation, and gender. Also management of diabetes and malaria by patients were considered. **A** descriptive survey research design was used. The study was carried out in Imo State between August 2016 and November 2016. The study was conducted in three selected hospitals from three geopolitical zones in Imo State. They are Mercy Hospital Umulogho Obowo L.G.A, Holy Rosary Hospital Emekuku Owerri North L.G.A and Trinity Hospital Umuaka Njaba L.G.A. Two hundred and ninety-six (296) patients were tested for diabetes, malaria and co-morbidity of the diseases. Blood samples were collected with 5mls syringes via the vein. The blood samples were tested with glucometer for diabetes and after were also tested for malaria using WHO guideline. Analysis was done using descriptive statistics and chi-square (X^2). The **r**esult showed that out of the 296 patients sampled, 230 (77.7%) were positive for either diabetes, malaria or co-morbidity while 66(22.3%) had no diabetes nor malaria. Also 81(35.2%) had diabetes only, 119 (51.7%) had malaria only, 30 (13.0%) patients had co-morbidity (both diabetes and malaria). The Prevalence of diabetes mellitus (11.1%), malaria (15.2%) and co-morbidity (4.7%) were higher in Holy Rosary hospital Emekuku than in other hospitals, distribution of diabetes mellitus, malaria and co-morbidity by age indicated that age brackets 40-49years had the highest prevalence of diabetes and malaria 8.3% and 13%, while age range 50-59 and 60-69 had the highest prevalence in co-morbidity (3.9%), P>0.05. On occupation, self employed patients had the highest prevalence of diabetes 13.9%, malaria 20.4% and co-morbidity 5.7%, P>0.05. The distribution of cases of diabetes mellitus, malaria and co-morbidity based on gender, showed that Females in the three hospitals had higher prevalence of diabetes, malaria and co-morbidity than males P<0.05. Most patients 22.5% used blood glucose monitor (glucometer) and oral hypoglycemic agents and drug therapy/use of ITN 31.3% was highest for malaria control. Diabetes, malaria and co-morbidity of the diseases are major global health problems and continuous awareness creation, education and funding for prevention and control is of paramount importance.

Keywords: Diabetes Mellitus, oral hypoglycemic agents

*Corresponding Author Email: eunnynwoks@yahoo.com
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INTRODUCTION

Co-morbidity is the simultaneous presence of two or more diseases or conditions in a patient. This study focuses on Prevalence of Diabetes Mellitus, Malaria and co-morbidity of the two cases. Diabetes Mellitus, one of the common non communicable diseases is caused by absolute or relative insulin deficiency (Crook, 2006)[1]. According to Smith (2004)[2], Diabetes Mellitus is a metabolic disorder characterized by decreased ability or inability of the body to utilize carbohydrates. Diabetes Mellitus is an alarming public health problem in Nigeria.

WHO (2009)[3] defines diabetes as a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrates, fat and protein metabolism that results from defects in insulin secretion, insulin action or both. It is associated with reduced life expectancy. No one is certain on the causes of diabetes but scientists believe genes and environmental factors cause diabetes.

According to American Diabetic Association (2003)[4], there are many types of diabetes which includes Type 1 diabetes, Type 2 diabetes, Gestational diabetes, Impaired glucose tolerant, Neonatal diabetes, Maturity onset diabetes of the young (MODY). Of these diabetes, Type 1 diabetes and type 2 diabetes are the major types of diabetes. Type1 diabetes (T1DM) is previously known as insulin dependent diabetes because it often begins in childhood. It develops in children and young adults. The cause is not known but it occurs when the body is unable to produce insulin. It accounts for about 10% of all adults with diabetes and it is treated by daily insulin injections, a healthy diet and regular physical activity. Type 2 diabetes, known as non-insulin dependent diabetes mellitus (NIDDM) is the commonest variety worldwide accounting for about 70-90% of the diabetic cases (Manoji, 2001)[5] and usually affects people over the age of 40 years (Knowler *et al;* 2002)[6]. The increase in incidence of diabetes in developing countries equally follows the trend of urbanization and life style changes, most importantly western style "diet''(Gautier, 2001)[7]. Gestational diabetes is a type of diabetes that arises during pregnancy usually during the second and third trimester. In some women, gestational diabetes occurs because the body cannot produce enough insulin to meet the extra need of the pregnancy.

It usually stops after the baby is born. During pregnancy, the placenta which connects the baby to the blood supply provides high levels of various other hormones such as oestrogen, progesterone and human placental lactogen (HPL). The purpose of this hormonal effect is to allow the extra glucose and nutrients in the blood to pass to the foetus so that the baby can grow and develop. But these hormones also block the action of the mothers insulin in her body which is called insulin resistance and because of this, the need for insulin in pregnancy is 2 to 3 times higher than normal. If the person already have insulin resistance the body may

not be able to cope with the extra demand for insulin production and blood glucose (sugar) level will be higher resulting to gestational diabetes. As the baby grows, the placenta produces more insulin-blocking hormones. The placental hormones provoke a rise in blood sugar to a level that can affect the growth and welfare of the baby. It is discovered by testing or measuring the glucose level in a woman's blood at her first antenatal visit and again at the 28th week of pregnancy.

Evahart *et al.*, (2009)[8] reported that the degree as well as duration of obesity appears to be major influencing factors to type 2 diabetes.

Vanltallic, (2002)[9] also stated that studies have shown that overweight and obesity significantly increase the risk of developing type 2 diabetes. Shaltout *et al.*, (2009)[10] stated that some environmental factors act on genetically susceptible individual example sedentary lifestyle to be important risk factor for the development of type 2 diabetes. The clinical manifestations of diabetes include Polyuria (increased Urination), Polydipsia (increased thirst), Polyphagia (increased appetite or excessive hunger). Others are genital itching, Slow healing of cuts or wounds, blurred vision and weight loss. The organs mainly affected by Diabetes mellitus are the Eye, Heart, Kidney, Feet and Nerves.

There can be long term complications of diabetes in terms of health. According to Center for Disease Control (2002)[11], diabetics are more likely to suffer from narrowing of the large arteries, leading to heart attacks, strokes and gangrene. Sometimes, there are problems in the blood vessels behind the eye, leading to retinopathy and sometimes blindness and the kidney may progress to renal failure. It has also been reported that diabetes can affect various systems which can lead to a loss of sensation to the feet and injury to the feet that could lead to long term problem like diabetic foot ulcer resulting to amputation of the leg. The patient also losses weight and shape.

There are several aspects of management of diabetes each with a very important role. Stanley and Mathew (2009)[12] stated that the mainstay of diabetes treatment are diabetic medications, insulin injection, diabetic diet, (healthy diet) and physical activity. When you do regular exercise, it helps your body use insulin more effectively, blood glucose level monitoring using glucometer is also very necessary. Sussan and Smeltzer (2004)[13] pointed out that the main aim of management of diabetes is to establish and maintain metabolic control in order that treatment may save life, alleviate symptoms and prevent long term complications.

Malaria is the most commonest vector bone parasitic disease of the globe (WHO, 2009)[3] and a major health problem in more than 100 countries around the globe with more than 222.5 billion people at risk causing 1 to 3 million deaths annually. Malaria is caused by a protozoa parasite known as Plasmodium and it is transmitted by a vector, female anopheles mosquito

through bite. It can also be transmitted through Blood transmission and Congenital transmission which is transmission of the disease from mother to child (new born). It occurs in new born aged less than 7days (Ezechukwu *et al.*,2004)[14].

In the United States, steps have been taken to prevent this type of transmission. People who have been in a malaria endemic area are prohibited from donating blood for a year after returning from such area, or three years if they have been treated for malaria from global malaria prevention and treatment foundation.

There are four species of malaria parasite which includes *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malaria*e. The major etiological agent of malaria is *Plasmodium falciparum*. It is responsible for the most widespread and lethal form of malaria. So much effort has been put in the past to combat malaria especially in Africa where it has resulted in so much death across all age groups. In regions where malaria is present, people may have the disease but due to immunity, they have few or no symptoms. The severity of malaria symptoms can also vary depending on general health, what kind of malaria parasite are involved and spleen function.

The common symptoms of malaria at the early stage are sometimes similar to those of many other infections caused by bacteria, viruses, or parasites. (Center for Disease Control, 2002)[11]. Symptoms include Fever, Headache, Nausea, Vomiting and Chills. The management of malaria depends not only on the severity of the disease but also on the strain of Plasmodium involved and the degree of resistance that it exhibits. There are actually several effective strategies for controlling malaria, many of which have been successful of reducing the burden of the diseases. These include the use of long-lasting insecticide treated bed nets which prevent people from being bitten by infected mosquitoes as they sleep at night, awareness of risk, use of chemoprophylaxis, diagnosis made promptly with early treatment and appropriate administration of medication. There is some evidence that a person with diabetes has a higher chance of contracting malaria (Center for Disease Control, 2002)[11]. Malaria parasites interfere with three (3) organs in the body namely, the Brain, the Kidney and the Liver.

The invasion of malaria parasite can cause organ congestion, sinusoidal blockage and cellular inflammation (Jarike *et al.*, 2006)[15]. So much effort has been put to combat malaria especially in Africa where it has resulted in so much death across all age groups. Looking at the distribution and occurrence of Diabetes and Malaria worldwide, one will notice that it has been a major problem. The American Diabetic Association estimates that 10million people may have it, which is undiagnosed because the individual has none of the common symptoms.

Uncontrolled diabetes is a major contributory cause of blindness, heart attacks, amputation, stroke and kidney failures (Stanley and Mathew, 2009)[12], and thus remains a significant universal health problem (Mshelia *et al.*, 2007)[16].

The developing world is estimated to experience the biggest increase by the year 2025, The International Diabetes Federation (IDF) then estimated that there would be a 98% increase in the number of adults with Diabetes Mellitus on the African continent with those affected reaching 23.9 million in 2030. Maduka, (2005)[17] reported that about 5% of Nigerians over 18years have diabetes. Diabetes is now considered to be epidemic with devastating consequences to the extent that some epidemiologists predict that economic impacts of diabetes as well as the consequence will surpass the ravages of HIV and AIDS in the near future. The malaria situation worldwide is also deteriorating (Center for Disease Control, 2010).

According to Hall *et al.*, (2011)[18] there is some evidence that people with diabetes mellitus have higher chances of contracting malaria. The occurrence of malaria in people with diabetes could result from immune dysfunction or impaired immunity. Furthermore, multivariate model, showed that each mmol/L increase in blood glucose, increase the risk for plasmodium by 5% and plasmodium parasites fully depend on glucose as energy source (Hall et al; 2011)[18].

Recently, the researchers have observed increase in the occurrence of diabetes and malaria co-morbidity in hospitals and diabetes and malaria care are costly and complex and most patients with diabetes are at special risk due to high cost of medication, the general low income of most patients, traditional beliefs about the disease, certain cultural attitudes and practices. Thus the researchers decided to work on the prevalence of diabetes mellitus, malaria and co-morbidity in three selected hospitals Imo State. The study was guided by the following objectives; to ascertain the prevalence of Diabetes Mellitus, Malaria and co-morbidity in three selected hospitals in Imo State; determine the distribution of Diabetes Mellitus, Malaria and co-morbidity of malaria and diabetes in the three selected hospitals in Imo State based on the patients age; Occupation and gender as well as the pattern of management of Diabetes and Malaria by patients in the study area. Formulated hypotheses were also tested.

MATERIALS AND METHOD

A Descriptive Survey research design was used. The Study Population comprised of 592 patients aged 20 to 70 years and above who attended the three hospitals for four months duration of the study (August, 2016 to November, 2016) and were sent for diabetes test. The sample size was 296 patients randomly drawn out of 592 patients. Three hospitals were

randomly selected from each of the three zones in Imo State, and 50% of the sample size from each hospital were randomly sampled for the test. From Umulogho Mercy Hospital in Okigwe zone 100 patients were sampled out of the 200 patients that attended the hospital, from Owerri zone, Holy Rosary Hospital Emekuku, 121 were sampled out of 242 patients and in Orlu zone, Trinity Hospital Umuaka, 75 patients were sampled from 150 patients totally 296.

Blood sample was collected with 5mls syringes through the vein from patients who were referred to Chemical pathology Department for fasting blood sugar test. They were screened using glucometer and their blood sugar levels recorded. After the samples were taken to Microbiology Department with an EDTA bottle for malaria test where blood smear was made and stained with leishman stain for 10 minutes, air dried and viewed under the microscope with X100 Objective lens. A validated and reliable questionnaire (r = 0.82) was used to collect socio-demogaphic variables. The data was analyzed using Statistical Package for Social Science (SPSS) Software version 20, Simple frequency distribution tables/charts were used as well as Chi-Square at 0.05 significant level.

RESULTS AND DISCUSSION

Table 1: Socio-Demographic Characteristics of Patients.

Variables	Frequency	Percentage (%)
Age		
20-29	31	10.5
30-39	35	11.8
40-49	83	28.0
50-59	63	21.3
60-69	56	18.9
70 & above	28	9.5
Total	**296**	**100**
Gender		
Males	170	57.4
Females	126	42.6
Total	**296**	**100**
Marital Status		
Married	205	69.3
Single	91	30.7
Total	**296**	**100**
Occupation		
Students	26	8.8
Civil Servants	79	26.7
Applicant	33	11.1
Clergy	16	5.41
Self employed	113	38.2
Retirees	29	9.8
Total	**296**	**100**

The result in table 1 showed the Socio-demographic characteristics of patients by age, gender, marital status and occupation. This revealed that 31(10.5%) of the patients were between the ages of 20-29years, 35 (11.8%) were between the ages of 30- 39years, 83(28%) were between the ages of 40-49years, 63(21.3%) of them were between the ages of 50-59years, 56 (18.9%) were between the ages of 60-69years and 28(9.5%) were 70 years and above. In regards to gender, 170(57.4%) were Males and 126 (42.4%) were Females. Also 205(69.3%) patients were married and 91(30.7%) patients were single. Twenty six (8.8%) were Students, 79 (26.7%) of them were Civil Servants, 33(11.1%) were applicants, 16 (5.4%) were Clergy, 113(38.2%) were Self Employed, and 29 (9.8%) were retirees.

Table 2: Prevalence of diabetes, malaria and co-morbidity in the three selected hospitals in Imo State.

Hospitals used	No of patients that attended hospital	No of patients screened	No of patients with diabetes	No of patients with malaria	No of patients with co-morbidity	No of patients without diabetes or malaria	Total
Mercy hospital Umulogho Obowo LGA	200	100	24(8.1)	39(13.2)	10(3.4)	27(9.1)	100(33.8)
Holy Rosary hospital Emekukwu Owerri North LGA	242	121	33(11.1)	45(15.2)	14(4.7%)	29(9.7)	121(40.9)
Trinity hospital Umuaka Njaba LGA	150	75	24(8.1)	35(11.8)	6(2.0)	10(3.4)	75(25.3)
Total	592	296		119(40.2)	30(10.1)	66(22.3)	296 (100)

X^2 =7.4579, P-Value 0.88 4

The result in table 2 showed that in Mercy hospital Umulogho Obowo, 200 patients were in attendance, 100 sampled, 24(8.1%) had diabetes, 39(13.2%) had malaria , 10(3.4%) had co-morbidity of the diseases while 27(9.1%) had none of the diseases. In Holy Rosary Hospital Emekukwu 242 patients were in attendance, 121 sampled, 33(11.1%) had diabetes, 45(15.2%) had malaria, 14(4.7%) had co-morbidity of the diseases while 29(9.7%) had neither diabetes nor malaria. In Trinity hospital Umuaka Njaba LGA, 150 patients were in attendance, 75 were sampled, 24(8.1%) had diabetes, 35(11.8%) had malaria, 6(2.0%) had co-morbidity of the diseases while 10(3.4%) had none of the diseases. Generally, 592 patients were in attendance in the three hospitals, 296 were sampled, 230(77.7%) patients were positive for either diabetes, malaria or co-morbidity. 81(27.4%) had diabetes, 119(40.2%) had malaria , 30(10.1%) had co-morbidity of the diseases while 66(22.3%) had none of the diseases. There was no significant difference in the prevalence of diabetes, malaria and co-morbidity when put to test, $X^2 = 7.4579$, P value = 0.884 thus P> 0.05

Table 3: Distribution of cases of diabetes, malaria and co-morbidity based on age and occupation of the patients in the three selected hospitals in Imo State.

Variables	No of people with diabetes only	No of people malaria only	No of people with Co-morbidity	Total
Age Group				
20-29	2 (0.9%)	15 (6.5%)	----	17 (7.4%)
30-39	15 (6.5%)	26 (11.3%)	1(0.4%)	42 (18.3%)
40-49	19 (8.3%)	30 (13.0%)	4 (1.7%)	53 (23%)
50-59	16 (7.0%)	19 (8.3%)	9 (3.9%)	44 (19.1%)
60-69	17 (7.4%)	16 (7.0%)	9 (3.9%)	42 (18.3%)
70 & above	12 (5.2%)	13 (5.7%)	7 (3.0%)	32 (13.9%)
Total	**81 (35.2%)**	**119 (51.7%)**	**30 (13.0%)**	**230 (100)**
Occupation				
Student	5 (2.2%)	8 (3.5%)	1 (0.4%)	14 (6.1%)
Civil Servant	22 (9.6)	16 (7.0%)	8 (3.5%)	46 (20%)
Applicant	11(4.8%)	16 (7.0%)	5 (2.2%)	32 (13.9%)
Clergy	1(0.4%)	6 (2.6%)	-	7 (3.0)
Self Employed	32 (13.9%)	47 (20.4%)	13 (5.7%)	92 (40%)
Retiree	10 (4.3%)	26 (11.3%)	3 (1.3%)	39 (17%)
Total	**81 (35.2%)**	**119 (51.7%)**	**30 (13.0%)**	**230**

Age , X^2 == 6.3579 , P value = 0.784; Occupation , X2 =10.6842, P value =0.383

The result in table 3 showed that 2(0.9%) in age range 20-29 had only diabetes, 15(6.5%) had only malaria, and non had co-morbidity. In age range 30-39, 15(6.5%) had diabetes only, 26(11.3%) had malaria only, and 1(0.4%) had co-morbidity. In age range 40-49, 19(8.3%) had only diabetes, 30(13.0%) had only malaria, and 4(1.7%) had co-morbidity. In age range 50-59, 16(7.0%) had diabetes only, 19(8.3%) had only malaria, and 9(3.9%) had co-morbidity. Furthermore, in age range 60-69, 17(7.4%) had diabetes only, 16(7.0%) had only

malaria, and 9 (3.9%) had co-morbidity while in age range 70 and above, 12(5.2%) had only diabetes, 13(5.7%) had malaria only, and 7(3.0%) had co-morbidity. In terms of occupation, 5(2.2%) of the students had only diabetes, 8(3.5%) had malaria only, 1(0.4%) had co-morbidity, 22(9.6%) of the civil servants had diabetes only, 16(7.0%) had only malaria, 8(3.5%) had co-morbidity, 11(4.8%) of the applicants had diabetes, 16(7.0%) had malaria, 5(2.2%) had co-morbidity also 1(0.4%) of the clergy had diabetes, 6(2.6%) had malaria and non had co-morbidity. Furthermore, 32(13.9%) of the self employed had only diabetes, 47(20.4%) had malaria, 13(5.7%) had co-morbidity while 10(4.3%) of the retirees had diabetes, 26(11.3%) had malaria and 3(1.3%) had co-morbidity. The statistical test in this study also showed that there was no significant difference in the distribution of diabetes, malaria and co-morbidity based on age and occupation P>0.05.

Table 4: Distribution of cases of diabetes, malaria and co-morbidity of diabetes and malaria in the three selected hospitals in Imo State based on gender of the patients.

Variables	Holy Rosary hospital Emekukwu		Mercy Hospital Umulogho		Trinity Hospital Umuaka		Total
	Males	Females	Males	Females	Males	Females	
Diabetes only	14(6.1%)	15(6.5%)	11(4.8%)	15(6.5%)	12(5.2%)	14(6.1%)	81(35.2%)
Malaria only	13 (5.7%)	32(13.9%)	22(9.6%)	17(7.4%)	16(7.0%)	19(8.3%)	119(51.7%)
Co-Morbidity	6(2.6%)	8(3.5%)	4(1.7%)	6(2.6%)	2(0.9%)	4(1.7%)	30(13.0%)
Total	33(14.3%)	55(23.9%)	37(16.1%)	38(16.5%)	30(13%)	37(16.1%)	**230(100%)**

X^2 = 5.24175 P – Value = 0.0083

The result in 4 showed that in Holy Rosary hospital Emekuku 14 (6.1%) males had only diabetes, 13(5.7%) had malaria and 6(2.6%) had co-morbidity while 15 (6.5%) females had only diabetes, 32(13.9%) had malaria and 8(3.5%) had co-morbidity. In Mercy hospital Umulogho 11 (4.8%) males had only diabetes, 22(9.6%) had malaria only and 4(1.7%) had co-morbidity while 15 (6.5%) females had only diabetes, 17(7.4%) had only malaria and 6(2.6%) had co-morbidity. In Trinity hospital Umuaka 12 (5.2%) males had only diabetes, 16(7.0%) had malaria only and 2(0.9%) had co-morbidity while 14 (6.1%) females had only diabetes, 19(8.3%) had only malaria and 4(1.7%) had co-morbidity. Generally, 37 (16.1%) males had diabetes only and females 44(19.1%), 51 (22.2%) males and 68(29.6%) females had only malaria while 12 (5.2%) males and 18(7.8%) females had co-morbidity. The statistical test in this study also showed that there was a significant difference in the distribution of the prevalence of diabetes, malaria and co-morbidity based on gender P<0.05.

Table 5: The management of diabetes by patients in the three selected hospitals in Imo State.

Management Variables	Number Using the Methods	Percentages (%)
Diet alone	16	14.4

Insulin injection with diet	20	18.0
Insulin injection, tablets & diet	18	16.2
Oral hypoglycemic agents alone	9	8.1
Herbs	7	6.3
Exercise	6	5.4
Urine glucose monitoring using strips /tablets	10	9.0
Blood glucose monitoring using glucometer and oral hypoglycemic agents	25	22.5
Total	**111**	**100**

The result in table 5 indicates that 16 (14.4%) manage diabetes with only diet, 20 (18.0%) use insulin injection and diet, 18(16.2%) use insulin injection, tablets and diet, 9 (8.1%), 7(6.3%) and 6(5.4%) respectively use only oral hypoglycaemic agents, only herbs and only exercise. Ten (9.0%) used urine monitoring strips and tablets while 25(22.5%) used glucose monitor (glucometer) and oral hypoglycaemic agents.

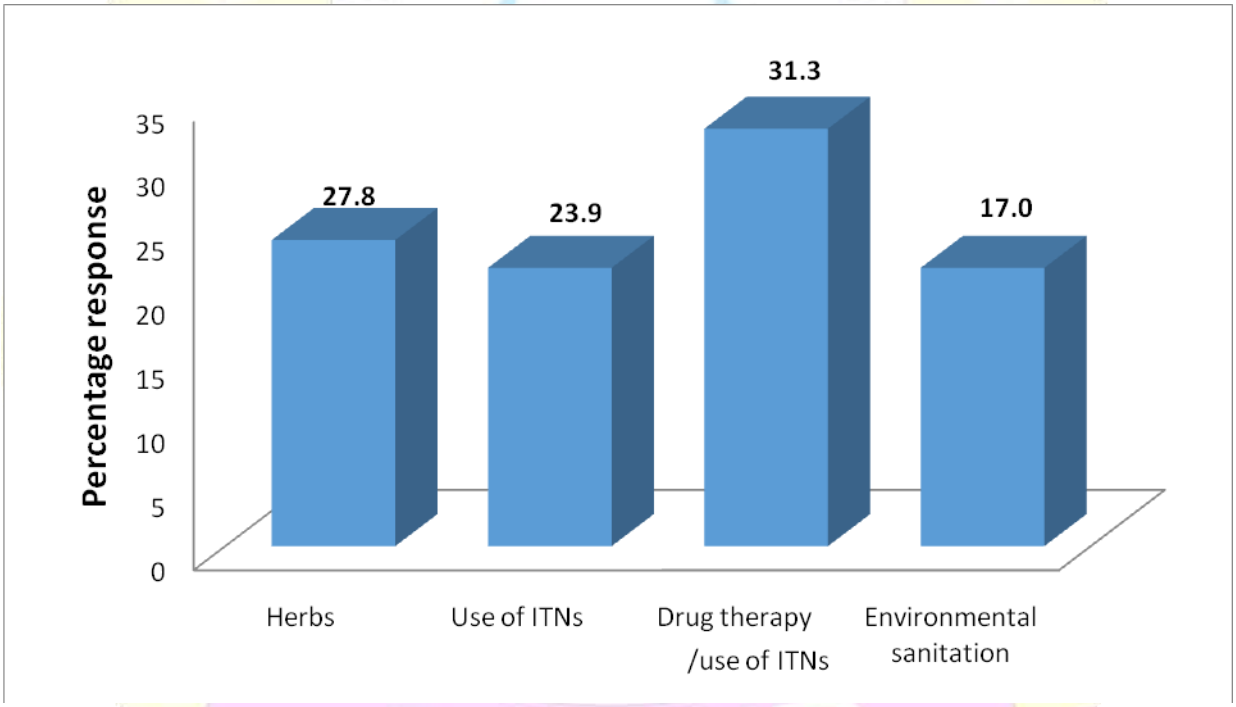

Figure 1: Showing the management of malaria by patients.

The result in figure 1 showed that 64(27.8%) of the patients used Herbs, 55(23.9%) of them used insecticide treated net (ITNs), 72(31.3%) of them used drug therapy and ITNs while 39(17.0%) of them used environmental sanitation.

Discussion

The Prevalence of diabetes mellitus, malaria and co-morbidity in the result was higher in Holy Rosary hospital Emekuku (11.1%), 15.2% and 4.7% respectively than in other hospitals. Centre for Disease Control (2010) agrees with the study were the report stated that diabetes mellitus and malaria parasite disease are common in developing countries such as Nigeria. The high prevalence of diabetes, malaria and co-morbidity in patients in Emekukwu

may be attributed to the fact that a high proportion of people in Emekukwu are farmers and are predisposed to mosquito bites in the farm While sedentary workers like traders who routinely remain inactive in their business places, eat heavily and put on weight leading to obesity are predisposed to diabetes, hereditary is also a contributory factor to diabetes. This study agrees with that of WHO (2010)[23] and Centre for Disease Control (2010). Stanley and Mathew (2009)[12] who found that the interaction of environmental factors with genetic susceptibility predispose the occurrence of diabetes also supports this result.

Findings in the distribution of diabetes mellitus, malaria and co-morbidity by age indicated that age brackets 40-49years had the highest prevalence of diabetes and malaria 8.3% and 13%, while age range 50-59 and 60-69 had the highest prevalence in co-morbidity. When put to statistical test using chi-square, there was no significant difference in the prevalence of diabetes, malaria and co-morbidity based on age P>0.05. Previous studies showed that diabetes and malaria are especially prevalent in the elderly because up to 50% of older people do suffer some degree of glucose intolerance (Centre for Disease Control, 2002; Park, 2007)[22,11]. This result is in line with Manoji, (2001)[5] and Knowler *et al.*, (2002)[6] Study which stated that diabetes starts from 40years though in south Asian, it often appears from the age of 25. It also agrees with Narayan *et al.*, (2006)[21] study which stated that majority of individuals with diabetes in developing countries are aged between 45 and 55years while in developed countries, the majority are older than 65years.

Result on occupation showed that self employed patients (e.g, traders, farmers and artisans) had the highest prevalence of diabetes 13.9%, malaria 20.4% and co-morbidity 5.7%. This result may be attributed to sedentary lifestyle. This is in line with the study of Gupta and Ghai (2007) who wrote that prevalence of type 2 diabetes is 2-4 folds higher in the least physical active individuals independent of the body mass. When put to statistical test, there was no difference in the prevalence of diabetes, malaria and co-morbidity based on occupation P > 0.05.

On the distribution of cases of diabetes mellitus, malaria and co-morbidity based on gender, findings showed that Females in the three hospitals had higher prevalence of diabetes, malaria and co-morbidity than males (Table 4). The reason might be that more females were obsessed and their lifestyle and pregnancy may also have contributed to it. This is in agreement with Coldix *et al.*, (2009) who reported that females suffer diabetes and malaria more than males. The present result however contradicted that of Kalk *et al.*, (2010)[19] who posited that in Uk, the overall male female ratio in the prevalence of diabetes mellitus and malaria is equal. The contradiction may be attributed to cultural differences. The statistical

test showed that there was a significant difference (P<0.05) between males and females in the prevalence of diabetes, malaria and co-morbidity in the 3 selected hospitals in Imo State.

On the distribution of pattern of management of diabetes by patients, findings showed most patients used blood glucose monitoring using glucometer and oral hypoglycemic agents with prevalence rate (22.5%). This is in agreement with American Diabetic Association (2003)[4] who stated that most diabetic patients are on blood glucose monitoring using glucometer and oral hypoglycemic agents. On the management of malaria, findings indicated that majority of the patients used drug therapy and ITNs in the management and control of malaria with prevalence rate (31.3%). This is supported by work done by Ezechukwu et al; (2004), Danguah et al; (2010)[20] and WHO (2012)[24].

CONCLUSION

In conclusion, diabetes mellitus and malaria are major public health problem in developing countries as well as Imo State. So awareness and Health education should be made in regards to diabetes and malaria, its management and prevention in order to reduce the disease occurrence and complications associated with them.

Ethical considerations and informed consent.

An approval was given by research ethical committee of Federal University of Technology Owerri and informed consent given by head of the hospitals and the participants.

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