COMPARATIVE ASSESSMENT OF ENVIRONMENTAL PRACTICES AND PREVALENCE OF MALARIA PARASITE AMONG WOMEN OF REPRODUCTIVE AGE IN TWO COMMUNITIES IN IBADAN, NIGERIA

BY

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CERTIFICATION

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DEDICATION

This project is dedicated to the Almighty God to whom all Glory is due and to my wonderful son Toluwanimi Joshua Babatunde.

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ABSTRACT

Malaria remains a major public health problem with different prevalence rates across the rural-urban areas of Nigeria. It is also a major cause of morbidity and mortality among pregnant women and children. However, evidences on the disparity in environmental practices in relation to its burden are sparse. This study was designed to assess the differences in environmental practices and its influence on malaria burden among women in selected rural-urban communities in Ibadan.

A descriptive cross-sectional study was carried out in two purposively selected communities: Eniosa (a rural area) and Kube (an urban area) located in Lagelu Local Government and Ibadan North Local Government Areas respectively. Simple random sampling using balloting technique was used to select 250 women of child bearing age (15-49years) residing in the communities respectively. Data were collected using pre-tested interviewer administered questionnaire. A10-point knowledge scale was used to assess respondents' knowledge on the symptoms, prevention, treatment, and practices which promote the breeding of mosquitoes. An entomological survey following standard methods was conducted in both communities from January to March, 2009. Prevalence of malaria infection was determined using microscopy to test for presence of *Plasmodium falciparum* from participants in each community. Data were analysed using descriptive statistics, Chi-square and t-test.

Mean ages of the respondents' from Eniosa and Kube were 26.2±6.1 and 28.7±7.4 years respectively. Mean knowledge scores on malaria among respondents' in Eniosa (6.19±1.92) was significantly lower than 6.70±2.27 obtained in Kube ($p<0.05$).Open dumping of refuse was the most common method of refuse disposal in Eniosa (43.1%) compared to 13.8% in Kube. About 19.8% and 49% engaged in cassava processing within the house premises in Eniosa and Kube respectively. Respondents from Eniosa (30.6%) practiced water storage in open containers compared to 27.4% from Kube ($p<0.05$). Mosquito coil and insecticide uses at night were 44.0% and 18.3%, 6.1% and 3.2% in Eniosa and Kube communities respectively. The most common mosquito species observed in Eniosa and Kube communities were *Anopheles spp* (130 vs 47),*Culexspp* (120 vs 235), *Aedesspp* (35 vs 17) and *Mansoniaspp* (14 vs 11). *Anophelesgambiae species* were more abundant in Eniosa (73.4%) than Kube (26.5%) ($p<0.05$). Malaria parasite prevalence using microscopy was 52.9% and 38.2% ($p<0.05$) in Eniosa and Kube respectively.

Poor environmental sanitation and higher malaria parasite burden was observed in the rural community compared to those in the urban community. Health education and advocacy should therefore be targeted to improve environmental sanitation in the rural areas.

Key-words: Environmental practices, Malaria prevalence, Rural-Urban differentials, Reproductive age women

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CHAPTER ONE

INTRODUCTION

1.1 Background Information

Malaria is estimated to cause up to 500 million clinical cases and more than 1 million deaths each year (Greenwood and Mutabingwa, 2002). Every 30 seconds, a child dies of malaria and in any given year, nearly 10% of the global population will have the disease. Half of the world's population is at risk of malaria, and an estimated 243 million cases led to an estimated 863 000 deaths in 2008 (MalariaGen, 2003).

The sub-Saharan African region has the greatest number of people exposed to malaria transmission and the highest malaria morbidity and mortality rates in the world (WHO, 1993). Malaria control still remains a challenge in Africa where 45 countries, including Nigeria, are endemic for malaria, and about 588 million people are at risk (WHO, 2005).In many African countries, approximately 10% of hospital admissions are for malaria and 20% to 30% are of physician visits. Even so, 80% of malaria cases are treated at home in Africa (Medscape, 2002).

Malaria is endemic in Nigeria with seasonal transmission patterns, the peak transmission season being during the rainy season (April-October) followed by the dry season (November-March). Nigeria accounted for one fourth of all estimated malaria cases in the WHO African Region in 2006. Country- specific evidence shows that Nigeria has the largest population at risk of malaria in Africa and therefore most vulnerable to the risk of missing Millennium Development Goals target. The disease, malaria, is a major health problem in the country, with stable transmission throughout the country. It accounts for about 50% of out-patient consultation, 15% of hospital admission, and also prime among the top three causes of death in Nigeria (National Malaria Control Plan of Action 1996 to 2001). Malaria is the commonest cause of outpatient consultation and a major cause of morbidity and mortality in Nigeria, it also accounts for almost 1 million episodes annually with mortality rate of 0.15% (WHO, 1993). Falciparum malaria still remains a leading cause of morbidity and mortality among children in Nigeria (MalariaGen, 2003).

Malaria transmission occurs all year round in the south of Nigeria but is more seasonal in the north of Nigeria. Almost all cases are caused by Plasmodium falciparum, but only a small fraction is parasitological tested. Malaria surveillance data in Nigeria show neither the true magnitude of the malaria burden nor evidence of a systematic decrease, because of inconsistent and incomplete reporting (WHO, 2009).The predominant species of malaria parasite is *Plasmodium falciparum* accounting for about 96% of malaria infections. The two main species predominate as vectors in Nigeria are *A. gambiae* and *A. funestus* (MalariaGen, 2003).

Malaria can be caused by the following species of the *Plasmodium* parasite: *Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, and Plasmodium ovale.* Malaria is transmitted in humans by the *Anopheles* mosquito. The infected *Anopheles* mosquito, which acts as a vector, harbours the *Plasmodium.* There are species of *Anopheles* mosquito that have been found to be vectors of the disease in Nigeria: *Anopheles gambiae, Anopheles arabiens, A. funnestus*. Most *Anopheles* species feed on human blood at dusk and the early evening hours. The mosquito bite injects the parasites into subcutaneous tissue or the bloodstream. In parts of the world with high transmission intensity, such as coastal Africa, persons may receive hundreds of infectious mosquito bites a year. Socio-cultural and economic factors such as education, housing patterns, social groups, water storage pattern, income and treatment seeking behaviour play an important role in malaria transmission (WHO, 2008).

1.2 Problem statement

The result of the most comprehensive study of the malaria situation in Nigeria conducted across the six geographical zones in Nigeria had revealed much about the public health importance of malaria (FMOH, 2000). The study confirmed the fact that malaria is a major cause of morbidity and mortality especially among vulnerable groups including women and children less than 5 years (FMOH 2001). The incidence of malaria among the under-fives across the six geographical zones during the study were as follows: South-South - 32.7%, Southwest - 36.6%, Southeast - 30.7%, North-Central - 58.8%, Northeast - 55.3% and Northwest - 33.6%. It was also found that malaria co-exists with some other prevailing health problems. Furthermore, it was found that malaria accounted for 11% of maternal deaths in the study areas. Malaria also accounted for 63% of the diseases reported in healthcare facilities. The prevalence of malaria among pregnant women was 48% (FMOH 2000).

Malaria control strategies need to consider how changing environmental conditions – some of which may be linked to development initiatives affect malaria transmission. Poorly maintained water supply, sanitation and drainage systems contribute to the transmission of malaria by providing potential breeding areas for mosquitoes. Even in Africa, where important vectors are broadly less selective with regard to breeding sites; this can play a role in both urban and rural settings. Lack of operation and maintenance of water supply systems can result to standing pools of water from -broken water pipes, leaking taps, spillage of water around stand-pipes and wells as well as broken manhole covers – and so are implicated in providing larval habitat for malaria vectors.

Restoring, cleaning and maintaining the drainage network and introducing an effective system for solid waste management (to stop solid waste collecting in draining channels) may be important for vector control (Amoatey et al, 2008). Pools of stagnant water can be eliminated by repairs or improvements to the water supply system; soak pits can be built to remove water accumulating around stand pipes; and cisterns (water tanks) can be covered with mosquito nets or lids. With respect to wastewater treatment systems, again, simple low-cost interventions like clearing away vegetation and other matter from the sides of structures, repairing cracks in the structures and reducing the amount of floating matter in the ponds can act as vector control. And whilst sanitation structures, such as pit latrines, imperfectly sealed septic tanks, etc., do not tend to act as habitats for Anopheles mosquitoes. (Fillinger U et al, 2008; Chavasse DC et al, 1995) in the context of Environmental Management programmes, they should nevertheless be targeted for control in order to reduce biting nuisance by other culicine mosquitoes (Curtis CF, 1993; Curtis C, 2002).

Such environmental management strategies may be effective measures to reduce malaria transmission if well delivered in the context of integrated vector control management strategies. These measures however have potential benefits beyond the agenda of reducing malaria, with wider impacts of improved health, such as reducing diarrhoeal disease, malnutrition, and particularly child mortality, and evidence for this is stronger for that on malaria (World Bank, 2008).

1.3 Rationale for the study

In Africa, 30 million women living in malaria-endemic areas become pregnant each year. For these women, malaria is a threat both to themselves and to their babies, with up to 200 000 newborn deaths each year as a result of malaria in pregnancy. Malaria infection during pregnancy is a significant public health problem with substantial risks for the pregnant woman, her fetus, and the newborn child. Malaria-associated maternal illness and low birth weight is mostly the result of *Plasmodium falciparum* infection and occurs predominantly in Africa.

To achieve a reduction in malaria morbidity, the design and implementation of control strategies must be based on a sound understanding of the risk factors that contribute to transmission at a variety of spatial scales (Takken and Lindsay, 2002). These include topography (Bødker et al,2003; Thomas and Lindsay,2000), proximity to mosquito breeding sites, (Lindsay et al,2002), house design (Samani et al,1987), density of human populations (Port and Boreham,1982), use of vector control methods (Lindsay et al,1989 ;Keating et al,2005; Subramanian et al,1991), presence of domesticated animals (Lindsay et al,1993), as well as the variation in attractiveness between individual human subjects (Knols et al, 1995; Mackinnon et al,2005) and their socio-economic status (Subramanian et al, 1991). Of all these variables, malaria risk is perhaps most strongly influenced by household factors, which can account for about 28% of the total variability in incidence. Identifying and tackling the household effects must, therefore, be an efficient route to reducing the burden of disease in malaria-endemic areas.

Vector control is an important part of the global malaria control strategy. The idea behind vector control is to reduce levels of mortality and morbidity by reducing transmission of the disease. Climate and environmental conditions greatly affect the transmission and incidence of malaria, by influencing primarily the abundance and survival of vectors and parasites, and also exposure of humans and other hosts. The most important environmental factors for malaria transmission have to do with conditions for *Anopheles* mosquito breeding and survival – water in which they can breed, and minimum temperatures and humidity to allow them to survive long enough for the vector stage of the parasite's life cycle to be completed – usually about ten days. These factors are influenced by climate, as well as by topography and soil conditions, drainage, vegetation cover, land use and water – all of which vary greatly depending on local conditions.

Entomological surveys are of great importance in decision-making processes regarding malaria control strategies because they help to identify associations between vector abundance both species-specific ecology and disease intervention factors associated with malaria transmission (Romoser and Stofollano, 1998).

Prompt and accurate diagnosis and effective treatment are the cornerstones of effective malaria disease management. The clinical diagnosis is not always very easy, as the primary symptoms may resemble those of other diseases (like the flu). Therefore, laboratory diagnosis is very important and this has up to now relied almost exclusively on microscopy. Accurate malaria diagnosis is mandatory for the treatment and management of severe cases. Moreover, individuals with asymptomatic malaria are not usually screened by health care facilities, which further complicate disease control efforts (Bruno et al, 2010).

In areas where resources for malaria diagnosis are unavailable, malaria diagnosis are often made only on the basis of clinical symptoms, although this is alarmingly inaccurate. Some infected individuals carry gametocytes throughout the dry season, potentially allowing malaria transmission if vectors have the capacity during this period, and being the source of the transmission that occurs after the beginning of the rainy season (von Seidlein et al, 2003).

It is estimated that over 300,000 people, mainly pregnant women and children die of the disease each year (Salako et al, 2001). In many populations, the wellbeing of the family devolves on the mother. It is thus essential that mothers be correctly trained in the initial recognition and management of malaria related symptoms. (Nchinda, 1998; Kidane and Morrow, 2000).

1.4 Objectives

1.4.1 Broad objective

The broad objective of this study is to assess the environmental risk factors, practices and prevalence of malaria infection during the dry season among women of reproductive age in selected urban and rural areas in Ibadan, Oyo state, Nigeria.

1.4.2 The specific objectives were to:

1. Assess the knowledge, prevention and control practices of the women towards malaria control.
2. Assess the environmental conditions and practices in the selected communities that can predispose people to malaria.
3. Determine the density of malaria vector in both communities during dry season.
4. Determine the prevalence of malaria
5. Identify if there is any existing relationship between identified risk factors and malaria prevalence within and between the selected communities.

CHAPTER TWO

LITERATURE REVIEW

2.1 What is Malaria?

Malaria is a life-threatening parasitic disease transmitted by mosquitoes. It was once thought that the disease came from fetid marshes, hence the name malaria, ((bad air). In 1880, scientists discovered the real cause of malaria a one-cell parasite called plasmodium. Later they discovered that the parasite is transmitted from person to person through the bite of a female Anopheles mosquito, which requires blood to nurture her eggs. Five species of the plasmodium parasite can infect humans; the most serious forms of the disease are caused by Plasmodium falciparum. Malaria can also be caused by Plasmodium vivax, Plasmodium ovale and Plasmodium.

Malaria is naturally transmitted by the bite of a female Anopheles mosquito. When a mosquito bites an infected person, a small amount of blood is taken, which contains malaria parasites. These develop within the mosquito, and about one week later, when the mosquito takes its next blood meal, the parasites are injected with the mosquito's saliva into the person being bitten. After a period of between two weeks and several months (occasionally years) spent in the liver, the malaria parasites start to multiply within red blood cells causing symptoms that include fever and headache. In severe cases, the disease worsens, leading to coma and death.

A mosquito infects a person by taking a blood meal. First, sporozoites enter the bloodstream, and migrate to the liver. They infect liver cells (hepatocytes), where they multiply into merozoites, rupture the liver cells, and escape back into the bloodstream. Then, the merozoites infect red blood cells, where they develop into ring forms, then trophozoites (a feeding stage), then schizonts (a reproduction stage), then back into merozoites. Sexual forms called gametocytes are also produced which, if taken up by a mosquito, will infect the insect and continue the life cycle.

Currently approximately 40% of the world's population mostly those living in the world's poorest countries are at risk of malaria. The disease was once more widespread but it was successfully eliminated from many countries with temperate climates during the mid-20th century. Currently, malaria is found throughout the tropical and sub-tropical regions of the world and causes more than 300 million acute illnesses and at least one million deaths annually.

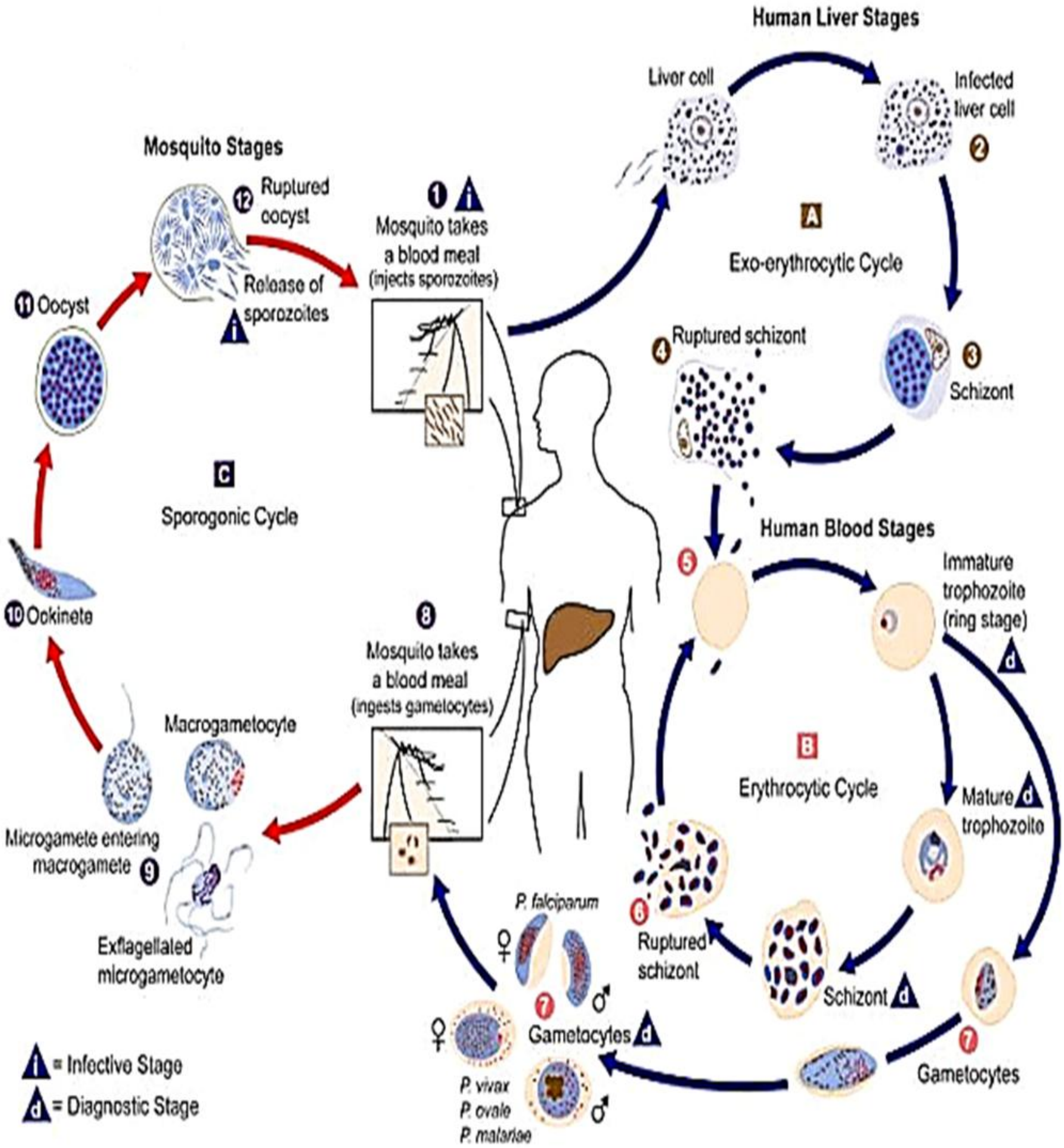


Figure 2.1: The life cycle of malaria parasites in the human body (CDC, 2006)

Malaria is the most important parasitic disease in the tropics and remains of highest public health importance. The vast majority of malaria deaths occur in Africa, south of the Sahara, where malaria also presents major obstacles to social and economic development. Malaria has been estimated to cost Africa more than US$ 12 billion every year in lost GDP, even though it could be controlled for a fraction of that sum(Malaria in Africa, 2010). There are several reasons why Africa bears an overwhelming proportion of the malaria burden. Most malaria infections in Africa south of the Sahara are caused by *Plasmodium falciparum*, the most severe and life-threatening form of the disease. This region is also home to the most efficient, and therefore deadly, species of the mosquitoes which transmit the disease. Moreover, many countries in Africa lacked the infrastructures and resources necessary to mount sustainable campaigns against malaria and as a result few benefited from historical efforts to eradicate malaria (Malaria in Africa, 2010).

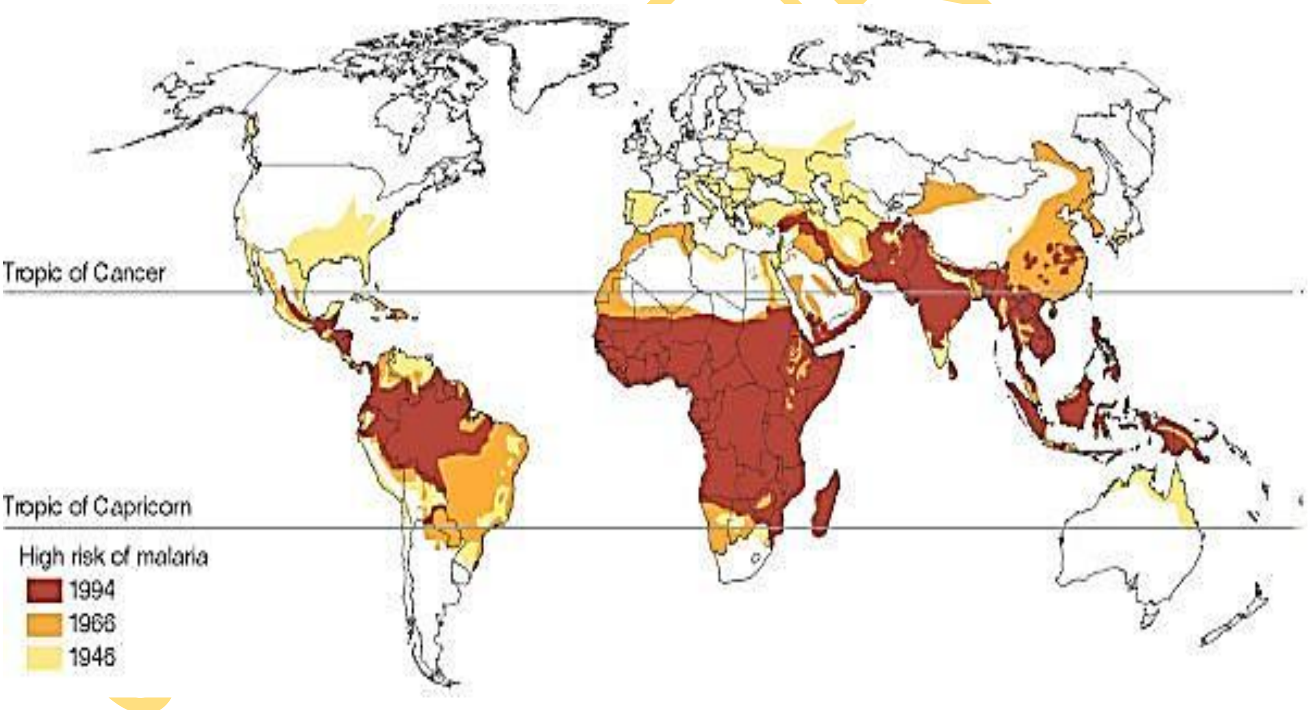


Fig 2.2: The changing global distribution of malaria risk from 1946 to1994 shows a disease burden that is increasingly being confined to tropical regions (Sachs and Malaney, 2002)

2.2 Clinical manifestation of malaria

The symptoms of malaria include fever, shivering, pain in the joints, headache, repeated vomiting, and, if untreated, generalized convulsions and coma. Malaria symptoms can mirror those of the flu, with daily fevers and headaches. For most people, symptoms begin 10 days to 4 weeks after infection, although a person may feel ill as soon as 8 days or as long as 1 year after infection. Two kinds of malaria, P vivax and P ovale, can relapse. Some parasites can rest in the liver for several months up to 4 years after an infected mosquito bites a person. When these parasites come out of hibernation and begin invading red blood cells (RBCs), the person becomes sick. The malaria parasite essentially destroys RBCs, thus causing symptoms of anaemia and other RBC depletion symptoms.

Backaches can also be a symptom of malaria caused by P falciparum. Severe anaemia exacerbated by malaria is often the cause of death in areas with intense malaria transmission. If not treated, the disease, particularly when caused by P falciparum, progresses to severe malaria or cerebral malaria. Severe malaria manifests as delirium and incessant fevers and can end in death (Medscape, 2002). The clinical response to infection depends both on the species of the parasite and on the immunological status of the patient. Non-immune travellers to malarious areas risk severe attacks. Acute malaria also occurs where exposure is limited or seasonal and where the collective immunity is relatively low. In these circumstances it can occur in epidemic proportions and affect all age groups in the community.

Acute falciparum malaria is a potentially fatal disease causing prolonged, irregular high fever, intense headache and vomiting. Complications include cerebral malaria (characterized by confusion, convulsions and rapidly progressive coma), hypoglycaemia, septicaemia, pneumonia, pulmonary oedema, acute renal failure and massive haemolysis. Chronic or repeated infection often leads to splenomegaly and progressive anaemia. Splenic rupture is a dangerous complication of vivax malaria, and P.malariae infection occasionally gives rise to a fatal nephrotic syndrome. Pregnant women, if untreated, are at particularly high risk death from falciparum malaria, especially where transmission is intermittent. In holoendemic areas they are partially protected by a measure of immunity. This reduces the risk of congenital infection, but it does not protect the placenta particularly in primigravidae, can harbour large numbers of malaria parasites. The foetus is thus inevitably exposed to the effects of placental insufficiency.

Largely as a result of passive transfer of maternal antibodies across the placenta, infants born to immune mothers living in holoendemic areas are unlikely to acquire malaria for several months after birth. Thereafter, they are at risk of death from severe and recurrent acute attacks during infancy and early childhood. From the age of five until adulthood the severity and frequency of these attacks decrease as immunity develops.

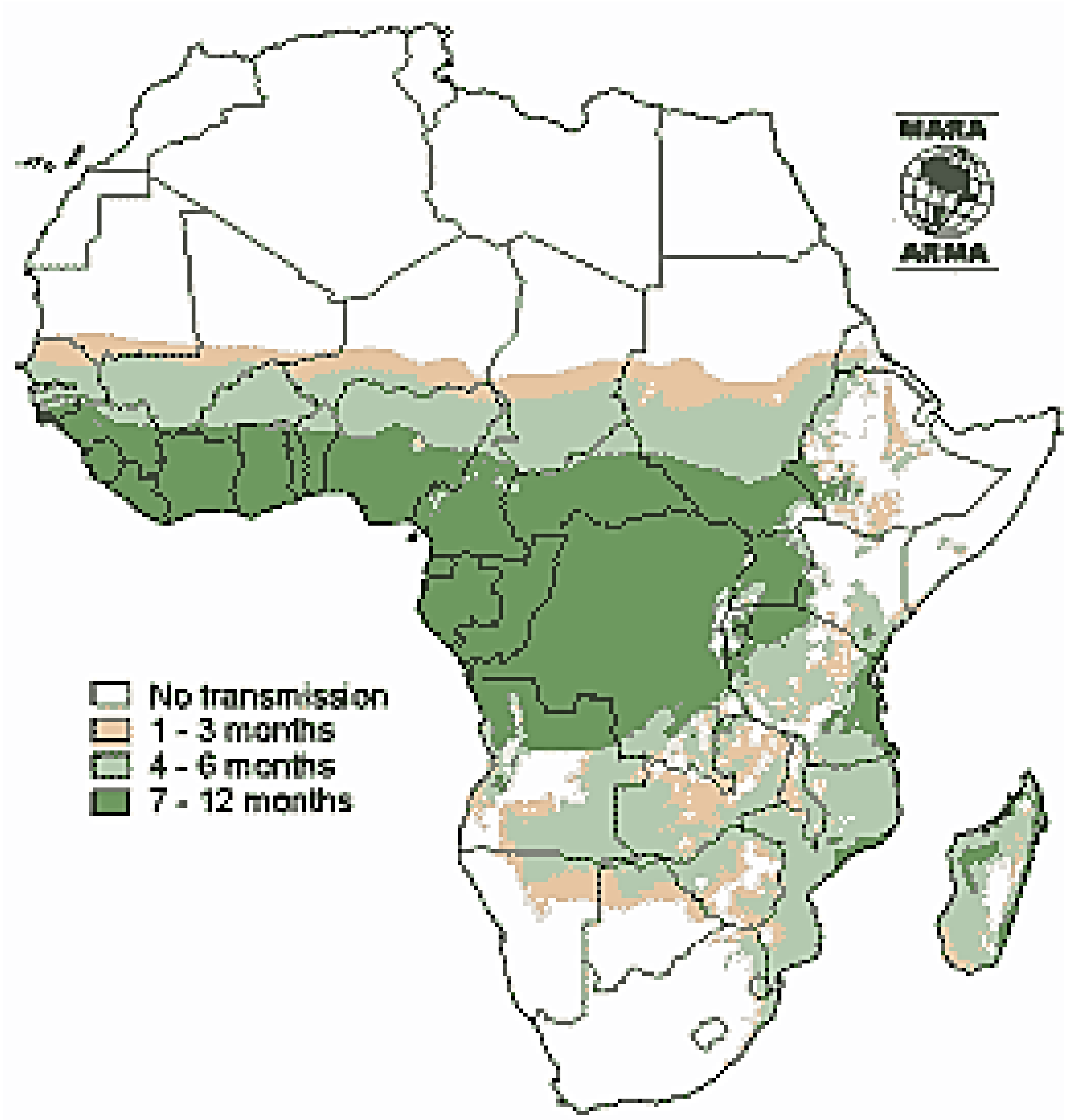
2.3 Economic impact of malaria

Malaria causes significant economic losses, and can decrease gross domestic product (GDP) by as much as 1.3% in countries with high levels of transmission. Over the long term, these aggregated annual losses have resulted in substantial differences in GDP between countries with and without malaria, particularly in Africa.

The health costs of malaria include both personal and public expenditures on prevention and treatment. In some heavy-burden countries, the disease accounts for:

- up to 40% of public health expenditures;
- 30% to 50% of inpatient hospital admissions;
- Up to 60% of outpatient health clinic visits.

Malaria disproportionately affects poor people who cannot afford treatment or have limited access to health care, trapping families and communities in a downward spiral of poverty (WHO, 2010).



Computer-generated model showing duration of malaria transmission seasons across Africa.

Fig 2.3: MARA/ARMA (Mapping Malaria Risk in Africa), 1998.

2.4 Epidemiology of malaria in Nigeria

Nigeria can be divided to three major malaria epidemiological zones, namely, forest, savannah and grass-land zones. The forest zone consists of coastal areas stretching from Lagos in the South-Western Nigeria to the forest areas in the Eastern Nigeria up to the Northern portion of the forest zone of Oyo state. The Savannah zone consists of areas north of Oyo state to the central areas of Kogi and Benue states and the Grass-land zones consists of the most northern parts of Nigeria – Katsina state and areas to its north.

Incidence of malaria varies by weather, which affects the ability of the main carrier of malaria parasites, anopheles mosquitoes, to survive or otherwise. Tropical areas including Nigeria have the best combination of adequate rainfall, temperature and humidity allowing for breeding and survival of anopheles mosquitoes. The burden of malaria varies across different regions of the world and even within a country. This is driven by the variation in parasite– vector–human transmission dynamics that favour or limit the transmission of malaria infection and the associated risk of disease and death. Of the four species of *Plasmodium* that infect humans—*P. falciparum, P. vivax, P. malariae* and *P. Oval*. Plasmodium falciparum causes most of the severity and deaths attributable to the disease, which is most prevalent in Africa south of the Sahara, where Nigeria has the largest population. It accounts for about 50 per cent of out-patient consultation, 15 per cent of hospital admission, and also prime among the top three causes of death in the country (National Malaria Control Plan of Action 1996 to2001) (WHO, 2005).

Therefore, it imposes great burden on the country in terms of pains and trauma suffered by its victims as well as loss in outputs and cost of treatments (Onwujekwe et al, 2004).

Studies have revealed that human knowledge, attitude and adoption of the various recommended applicable methods of personal and household protection against mosquito vary remarkably in different endemic regions of tropical countries. Similar recent studies from some parts of Nigeria exist in literature (Luz et al, 2007, Monath et al, 2001).

`The disease is often treated in Nigeria by self-medication, the use local herbs, use of the services of spiritualists/traditional priests or/and the use of clinic/hospital services. Similarly, common prevention measures include use of medicine (prophylaxis), insecticides (coils and sprays), ordinary mosquito nets, insecticide-treated nets (ITNs) and window and door nets.

2.5 Malaria and the economy

Malaria affects the health and wealth of nations and individuals alike. In Africa today, malaria is understood to be both a disease of poverty and a cause of poverty. Malaria has significant measurable direct and indirect costs, and has recently been shown to be a major constraint to economic development. In addition to its burden in terms of morbidity and mortality, the economic effects of malaria infection can be tremendous. These include direct costs for treatment and prevention, as well as indirect costs such as lost productivity from morbidity and mortality; time spent seeking treatment, and diversion of household resources. The annual economic burden of malaria infection in 1995 was estimated at US$ .8 billion, for Africa alone (Igbinosa, 1989). This heavy toll can hinder economic and community development activities throughout the region.

For developing economies this has meant that the gap in prosperity between countries with malaria and countries without malaria has become wider every single year. Sachs and Malaney (2002), survey a number of the impacts of malaria. The direct individual economic impacts of the disease include the value of lives lost, the value of time lost to sickness, and the expenditures on medical care, treatment, and prevention. Direct social costs include government expenditures on malaria control and prevention. The indirect costs may be greater still. These include changes in human settlement and labour patterns induced by the disease (e.g., changes in the locations where people live or farm). Indirect costs also include the consequences of the disease on fertility, demography, and human capital investments; on trade patterns and investment; and potentially on managerial quality and technology adoption. (For example, skilled managers may prefer not to work in malarial regions, resulting in reduced productivity levels).

Annual economic growth in countries with high malaria transmission has historically been lower than in countries without malaria. Economists believe that malaria is responsible for a ‘growth penalty' of up to 1.3% per year in some African countries. When compounded over the years, this penalty leads to substantial differences in GDP between countries with and without malaria and severely restrains the economic growth of the entire region (MalariaGen, 2008). Malaria causes significant economic losses, and can decrease gross domestic product (GDP) by as much as 1.3% in countries with high levels of transmission. Over the long term, these aggregated annual losses have resulted in substantial differences in GDP between countries with and without malaria, particularly in Africa. The health costs of malaria include both personal and public expenditures on prevention and treatment. In some heavy-burden countries, the disease accounts for: up to 40% of public health expenditures; 30% to 50% of inpatient hospital admissions; up to 60% of outpatient health clinic visits. Malaria disproportionately affects poor people who cannot afford treatment or have limited access to health care, trapping families and communities in a downward spiral of poverty.

Malaria also has a direct impact on Africa's human resources. Not only does malaria result in lost life and lost productivity due to illness and premature death, but malaria also hampers children's schooling and social development through both absenteeism and permanent neurological and other damage associated with severe episodes of the disease (Malaria in Africa, 2010). In Nigeria, malaria impacts on development of the country as it causes death, reduces human work capacity or productivity in all sectors including the agricultural sector (SIMA, 2002). Malaria reduces Nigeria's GNP by 1.0% annually ($348 Million), and 25.0% of household income is expended on malaria control and treatment.

2.6 Malaria and urbanisation

Malaria can no longer be considered as just a rural issue in Africa. A significant and increasing proportion of the African population lives in urban areas. There are already 40 cities in Africa with over one million inhabitants and the United Nations Environmental Programme estimates that by 2025 there will be 800 million people living in urban areas of the continent. Urban malaria prevalence rates are highly variable, even within a single city. Prevalence are highest among the poorest sections of society, since they cannot afford protection from malaria through improved housing, and are particularly vulnerable to the impact of ineffective diagnosis and treatment.

Rapid urbanization alters the frequency and transmission dynamics of malaria, with significant effects on disease-associated morbidity and mortality, which in turn has important implications for control (Harpham and Tanner, 1995; Robert et al, 2003).At present, the least developed countries, experience the highest urbanization rates, often in the range of 2–6%per year. Until recently, urban development was generally believed to reduce the risk of vector breeding, and thus malaria transmission. However, many African countries have declining economies, and most cities are struggling to cope with the pace and the extent of urbanization.

Poor housing and lack of sanitation and drainage of surface water can increase vector breeding and human vector contact, and thus pose unique challenges for control (Knudsen and Slooff, 1992; Martens and Hall, 2000). Furthermore, the adaptation of malaria vectors to urban areas has been well documented for at least two decades (Chinery, 1984) and local transmission has been conclusively demonstrated in many African cities. (Harpham and Tanner, 1995).An additional problem on the human side is that a high proportion of the urban population may be at risk of severe disease due to delayed acquisition or lack of protective immunity.

Transmission and severity of malaria are influenced by the geographic characteristics of a town and by the socio-economic environment. The heterogeneity and seasonal variation of the entomological inoculation rate, depending on both vector densities and sporozoite rates, have been documented (Akogbeto et al., 1992; Sabatinelli et al, 1986). Lindsay *et al.* 1990 showed a difference in the composition of vector species and the vector's adaptation in different subdivisions Banjul.

The percentage of urban population in Nigeria is about 44.1% with an urban population annual growth rate of 5.5. The percentage of urban children was put at 32.3% (Knudsen and Slooff,1992) and the main health problems of these children in the urban populations are malaria, measles, tetanus, helminthic infestations, acute respiratory infections, diarrhoea diseases and nutritional problems (Fotso,2006).Although these health problems are common to both urban and rural environments, recognizing and meeting the public health challenges in these growing cities of Nigeria is becoming increasingly urgent as there are evidence that the urban poor are at far higher risk from malaria than previously acknowledged (Keiser, 2004;Tabibzadeh et al, 1989). There are several features that distinguish urban and rural malaria. Urban malaria occurs in a diverse and rapidly changing environment with high levels of human migration and high-density populations. Malaria transmission intensities in urban areas are different to those of rural areas. In urban areas, risk factors that may be different to those in rural areas lead to different disease burdens (Dnelli, 2005).It has also been noted that rural and urban populations differ in several ways including their cultural practices, socioeconomic and demographic characteristics, availability and accessibility to formal and informal treatment sources, provision of basic infrastructure and childhood nutritional status (Knudsen and Slooff, 1992; Ruel, 2001; Ruel et al,1998; Tanner and Harpham, 1995).

To improve interventions, the determinants of the diversity of transmission levels within subdivisions of a city should be understood. Concerns were raised about the association between urban agricultural activities or local irrigation systems and the creation of breeding sites for *Anopheles* sp. (Afrane, 2004; Brock, 1999; Gerstl, 2001). Peri-urban areas often lack infrastructure, including poor water supply and sanitation, which provides an ideal environment for vector breeding (Knudsen and Slooff, 1992).

Misdiagnosis of malaria is a serious problem everywhere, but in areas of low malaria endemicity presumptive treatment of all fevers as malaria can result in over 75% of cases being misdiagnosed as malaria (Amexo,2004). The effect of malaria misdiagnosis on the vulnerable will result in more ill health due to delayed diagnosis and repeat visits, overburdened health services, more severe malaria, loss of faith in health services, increase in real and perceived malaria resistance, chronic disease secondary to untreated infection, increased cost to patient and to health facilities and consistent misdiagnosis that will encourage detrimental health-seeking behaviour (Amexo, 2004).

Effective provision of appropriate treatment also remains a serious challenge in urban settings. The Abuja Declaration stated that by 2005 "At least 60% of those suffering from malaria have prompt access to and are able to use correct, affordable and appropriate treatment within 24 hours of onset of symptoms." Despite the fact that access to quality health care is better on average in urban compared to rural zones, the formal public health facilities are often the last source of treatment used along the pathway to cure. Often malaria care initially involves leftover medicines from the home (from previously incomplete malaria or other treatment regimens), the purchase of cheaper herbal medicines or un-prescribed conventional medicines. The problems of obtaining treatment from a health facility may be exacerbated by the need to obtain permission from an authority figure, absence from work and loss of income, the need to raise money to fund both the treatment and associated costs such as travel (Bates et al, 2004). As a result, in Africa over 70% of malaria episodes in rural and over 50% in urban areas are self-diagnosed and self-treated (McCombie, 1996). With Home Management of Malaria proposed as an integral part of the Roll Back Malaria strategy, the consequences of presumptive treatment policies for malaria in the context of the introduction of newer and more expensive anti-malarial drug combinations urgently require further investigation.

Malaria is said to be more prevalent in rural areas due to favourable environmental conditions for parasite transmission, (Lam, 1996), however, there is significant risk of infection in urban areas. Uncontrolled urbanization leads to an increased number of slums simulating a rural environment and results in increased malaria transmission in some third world urban areas. The presence of swamps, gutters and thick vegetation in the cities enhances the breeding of vectors. Agricultural practices around dwellings also increase the risk of mosquito bites. Available evidence indicates that urbanization is having a significant impact on malaria epidemiology. Formal urban development can typically reduce anopheles mosquito vector densities, but the informal, peri-urban settlements found at the edge of many major urban centres in sub-Saharan African create conditions favourable to anopheles vector breeding. During the initial stages of their development, these sub-urban slum areas are frequently nothing more than expanded rural areas with mosquito breeding sites essentially unchanged.

2.7 Treatment seeking behaviours of mothers for malaria

In Nigeria, malaria is one of the leading causes of mortality and morbidity in children aged less than 5 years (FMOH, 1992). It is now widely recognised that symptoms, signs, classification of illness, and beliefs in a community about illness transmission and treatment differ from biomedical models, and that communication between specialists and local people is often confused. A review of recent literature shows growing interest into understanding health seeking behaviour in general (Perdiguero, 2001; Lam, 2001) and the understanding of certain clinical signs (such as fever) from a cultural perspective in particular.

Childhood mortality due to malaria has been attributed to poor health service delivery and ignorance associated with cultural beliefs. It has been suggested that social and cultural determinants of behaviour may account for the gap between awareness of modern health measures and health-seeking behaviour (Feyisetan et al 1998). Prompt access to early diagnosis and effective antimalarial treatment at health facilities is one of the major strategies for reducing the burden of malaria, therefore effective information strategies which address understandings and beliefs about the disease are necessary. Early treatment of childhood malaria in children depends upon mothers' perception about malaria and prompt recognition of signs and symptoms of malaria in the child in addition to accessibility and utilization of the appropriate health services. Household responses to illness are influenced by socio-economic and cultural factors and ease of access to treatment sources. In sub-Saharan Africa, rural and urban populations differ demographically, in socio-economic and cultural composition, and in proximity to formal and informal treatment sources.

2.8 Climate change and malaria

The spread of infectious diseases such as malaria is multi-causal but could be influenced by global climate change or climatic variability directly or indirectly (Patz,2000).Weather and climate can influence host defences, vectors, pathogens and habitat, nevertheless, disease such as malaria could be spread even without excessive rainfall and temperature increases the likelihood of its high morbidity (Bate, 2004).

2.8.1 Dry Season and malaria infection

Parasitological surveys have demonstrated that a large proportion of inhabitants who contract malaria during the wet season retain asymptomatic infections throughout the dry season. During the dry season of areas with seasonal malaria transmission, up to 40% of the population harbour parasitaemia. Of these, 10%–12% are gametocyte carriers. A proportion of individuals retain asymptomatic infections during the dry season, and the small numbers of clinical cases of malaria seen during the middle and end of the dry season are considered to be mostly due to parasitological recrudescence (Musa et al, 2008).

2.9 Malaria control

The World Health Organization (WHO) defines environmental management (EM) for vector control as "*The planning, organization, carrying out and monitoring of activities for the modification and/or manipulation of environmental factors or their interaction with man with a view to preventing or minimizing vector propagation and reducing man-vector-pathogen contact*" (WHO,1982). Environmental Management is not a replacement of other interventions, but one of several optional components that will make up an integrated vector management (IVM) approach in a vector control programme (WHO, 2004; Beier, 2008; Utzinger et al, 2002). Indeed, mathematical models of malaria transmission indicated that integrated control programs that combine multiple interventions are more likely to succeed than programs that promote only one intervention (McKenzie and Samba,2004; Killeen,2000). Utzinger et al, 2001; Watts, 1999). It made possible the construction of the Panama canal, the rubber production in Malaysia, and copper mining in Zambia, to name a few. EM focuses on breeding source reduction and therefore impacts mosquito density, and the number of mosquitoes per person (Alilio et al, 2004).

There have been some global responses to the devastating effects of malaria. These include the establishment of the Roll Back Malaria partnership by the World Health Organization (WHO) and the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM). Domestically, the government of Nigeria has subscribed to some known malaria control and prevention measures, including the free distribution of ITNs to the vulnerable groups. A major policy issue is how to put in place a programme of malaria treatment, control and prevention that is fiscally sustainable (Onwujekwe et al, 2004).

2.9.1 Evolving interventions and strategies in the fight against malaria

Malaria's influence across population groups varies according to epidemiology, decision making authority, care-seeking and other types of behaviour. However, pregnant women due to specific features of placental blood flow and immune function changes in the interface between the placenta and the foetus, have increased risk for malaria complications such as anaemia and low-birth-weight and premature infants.

The key approaches to preventing and controlling Malaria include

(1) Planning and implementing sustainable preventive measures including vector control and malaria prevention in vulnerable groups;

(2) Providing prompt diagnosis and treatment of malaria;

(3) Detecting early, containing or preventing epidemics and

(4) Strengthening local capacity in monitoring, evaluation and applied research to permit the regular assessment of a country's malaria situation.

Mosquitoes are widely distributed throughout the world and they utilize different water bodies for their breeding (WHO, 1982). Many species breed in both natural and artificial containers such as pools, gutters, coconut shells, tree holes, bamboo stumps, leaf axils, septic tank and so on (Mafiana,1989; Aigbodion and Anyiwe, 2005). The distribution of mosquitoes is influenced both directly and indirectly by climatic and environmental factors.(Mafiana et al,1998) Mosquitoes prefer an environment with certain resources (food, shelter, breeding sites, favourable temperature and suitable humidity) in sufficient amount and at appropriate time for survival and development (Romoser and Stofollano, 1998). The recent increase in ecological and environmental modification due to agricultural activities and urbanization has been observed to contribute to the breeding of various mosquito species (Amusan et al,2007).

Various factors affect mosquito abundance and their species distribution. They include climatic influences, vegetation cover and the right type of environmental breeding sites (Gimnig et al, 2001). Some aspects of human ecology also greatly influence mosquito distribution (Igbinosa, 1989). The geoclimatic effects of a tropical environment on mosquito distribution in Midwestern Nigeria include: optimal breeding temperatures, two distinct seasons: a dry, harsh, growth limiting period with higher temperatures, relative humidity and rainfall (November-February), followed by a wet season with abundant rainfall and flooding (April-October), supporting the growth and development of the aquatic (larva and pupa) stages and abundant recruitment of young adults. The wet seasons are associated with higher prevalence levels of mosquito vector-borne diseases.

A. gambiae larvae mainly occur in small temporary, sunlit pools such as borrow pits, cow hoof prints, tire tracks, drainage, ditches, and small puddles (Gimnig et al, 2001).
*A. aegypti*is the principal urban vector worldwide of the flaviviruses that cause dengue and yellow fevers (Luz et al, 2007). Infestations levels of these mosquitos are increasing due to climate changes, uncontrolled urbanization, and the expansion of international travel and trade (Monath, 2001; Lounibos, 2002). *C. quinquefasciatus*is a cosmopolitan mosquito species occurring in a wide range of larval habitats, including vegetated lakes and river margins, natural ponds, ricefields, agricultural ponds, waste water treatments and septic tanks (Muturi et al, 2007). Its ability to use a myriad of aquatic habitats for larval development has favoured its adaptability in both rural and urban environments (Muturi et al, 2006). In Africa *C. quinquefasciatus* is a major vector of Bancroftian filariasis, a potential vector of arboviruses and an important pest species.

2.9.2 Prevention of malaria

The most challenging aspect of disease control is often the human element which relates to the behavioural factors such as cultural practices that promote mosquito breeding and access to the people as well as the failure of at risk populations to use proven and effective methods of malaria control promptly and appropriately. Others include the non-behavioural factors such as geographical, ecological peculiarities, the availability of mosquito and the presence of Plasmodia (WHO, 2010).
Vector control is the primary public health intervention for reducing malaria transmission at the community level. It is the only intervention that can reduce malaria transmission from very high levels to close to zero. In high transmission areas, it can reduce child mortality rates

and the prevalence of severe anaemia. For individuals personal protection against mosquito bites represents the first line of defence for malaria prevention. Vector control remains the most generally effective measure to prevent malaria transmission and therefore is one of the four basic technical elements of the Global Malaria Control Strategy. The principal objective of vector control is the reduction of malaria morbidity and mortality by reducing the levels of transmission.

2.9.2.1 Indoor spraying with residual insecticides: Indoor residual spraying (IRS) with insecticides is the most powerful way to rapidly reduce malaria transmission. Its full potential is realized when at least 80% of houses in targeted areas are sprayed. Indoor spraying is effective for 3–6 months, depending on the insecticide used and the type of surface on which it is sprayed. DDT can be effective for 9–12 months in some cases. Longer-lasting forms of IRS insecticides are under development. Indoor residual spraying with DDT was the major reason for the success of malaria control in the 1950s and 1960s.Malaria was eradicated, or almost eradicated, from many parts of the world during this time.

2.9.2.2 Insecticide-treated mosquito nets (ITNs): Long lasting insecticide impregnated nets (LLINs) are the preferred form of insecticide treated nets for public health distribution programmes. WHO recommends universal vector control coverage, and in most places, the most cost effective way to achieve this is through provision of LLINs, so that everyone in high transmission areas sleeps under a LLIN every night. Mosquito nets, if properly used and maintained, can provide a physical barrier to hungry mosquitoes. If treated with insecticide, the effectiveness of nets is greatly improved, generating a chemical halo that extends beyond the mosquito net itself. This tends to repel or deter mosquitoes from biting or shorten the mosquito s life span so that she cannot transmit malaria infection. In some areas where mosquito nets are already widely used, it has been estimated that less than 5% are re-treated to achieve their expected impact. WHO has worked with mosquito net and insecticide manufacturers to make re-treatment as simple as possible (WHO, 2004).

However, the best hope lies with newly developed, long-lasting treated nets which may retain their insecticidal properties for four to five years the life span of the net thus making retreatment unnecessary. ITNs have been shown to reduce all-cause mortality among children< 5 years by approximately 20% (WHO, 2010). This translates to the prevention of almost 0.5 million deaths each year in Africa south of the Sahara. ITNs also protect against the development of anaemia in both pregnant women and young children, the groups at highest risk from malaria and malarial anaemia. Nets can cost as little as US$ 1.7, while a year's supply of insecticide to re-treat a net costs from US$ 0.3 to US$ 0.6. The recent development of long-lasting, wash-resistant ITNs, which will remain effective for up to four years, will avoid the current need to re-treat nets with insecticide every 6 to 12 months, which has proved extremely difficult to sustain.

2.9.2.3 Source reduction

Since many mosquitoes breed in standing water, source reduction can be as simple as emptying water from containers around the home. This is something that homeowners can accomplish. For example, homeowners can eliminate mosquito breeding grounds by removing unused plastic pools, old tires, or buckets; by clearing clogged gutters and repairing leaks around faucets; by regularly changing water in bird baths; and by filling or draining puddles, swampy areas, and tree stumps. Eliminating such mosquito breeding areas can be an extremely effective and permanent way to reduce mosquito populations without resorting to insecticides. However, this may not be possible in parts of the developing world where water cannot be readily replaced due to irregular water supply (WHO, 2010).

Open water marsh management involves the use of shallow ditches, about 4 feet (1.2 m) wide and 2 feet (0.61 m) deep, to create a network of water flow within marshes and to connect the marsh to a pond or canal. The network of ditches drains the mosquito habitat and lets in fish which will feed on mosquito larvae. This reduces the need for other control methods such as pesticides. Simply giving the predators' access to the mosquito larvae can result in long-term mosquito control. Open-water marsh management is used on both the eastern and western coasts of the United States.

2.9.2.4 Bio control

Biological control or "bio control" is the use of natural enemies to manage mosquito populations. There are several types of biological control including the direct introduction of parasites, pathogens and predators to target mosquitoes. Effective bio control agents include predatory fish that feed on mosquito larvae such as mosquito fish (*Gambusia affinis*) and some cyprinids (carps and minnows) and killifish. Tilapia will also consume mosquito larvae.

Other predators include dragonfly naiads, which consume mosquito larvae in the breeding waters, and adult dragonflies, which eat adult mosquitoes (WHO, 2004). Some other biocontrol agents that have had lesser degrees of success include the predator mosquito Toxorhynhites and predator crustaceans mesoclopes, Copepod, Nematodes and fungi. Some public agencies also employ other predators such as birds, bats, lizards and frogs, but evidence of effectiveness of these agents is only anecdotal.

Like all animals, mosquitoes have their own set of diseases. Invertebrate pathologists study these diseases with the hope that some of them can be utilized for mosquito management. Microbial pathogens of mosquitoes include viruses, bacteria, fungi, protozoa, nematodes, and microsproidia (WHO, 2004).

2.9.2.5 Drug resistance in malaria

The present strategy for malaria control, adopted by the Ministerial Conference on Malaria in Amsterdam in 1992, is to prevent death, reduce illness, and decrease social and economic loss due to the disease (WHO, 1999). Its practical implementation requires two main tools: first, drugs for early treatment of the disease, management of severe and complicated cases, and prophylactic use on the most vulnerable population (particularly pregnant women); second, insecticide-treated nets for protection against mosquito bites. Each tool has its own problems in regard to field implementation. Chloroquine remains the first-line therapy for malaria. However, the alarming increase in resistance in eastern and southern Africa requires that sulfadoxine-pyrimethamine replace chloroquine as the first-line drug. (WHO, 1998).

Antimalarial drug resistance has emerged as one of the greatest challenges facing malaria control today. Drug resistance has been implicated in the spread of malaria to new areas and re-emergence of malaria in areas where the disease had been eradicated. Drug resistance has also played a significant role in the occurrence and severity of epidemics in some parts of the world. Population movement has introduced resistant parasites to areas previously free of drug resistance. The economics of developing new pharmaceuticals for tropical diseases, including malaria, are such that there is a great disparity between the public health importance of the disease and the amount of resources invested in developing new cures (Foster, 1991; Ridley, 1997). This disparity comes at a time when malaria parasites have demonstrated some level of resistance to almost every antimalarial drug currently available, significantly increasing the cost and complexity of achieving parasitological cure. The development and spread of drug-resistant strains of malaria parasites has been identified as a key factor in this resurgence and is one of the greatest challenges to malaria control today. Although there is currently an increase in attention and resources aimed at malaria, including such initiatives as Roll Back Malaria (Nabarro et al, 1998), the Multilateral Initiative on Malaria (Nchinda, 1998) and the Medicines for Malaria Venture (WHO, 1999) a history of unpredictable support for malaria-related research and control activities in endemic countries have left many of these countries with little technical capacity for malaria control activities.

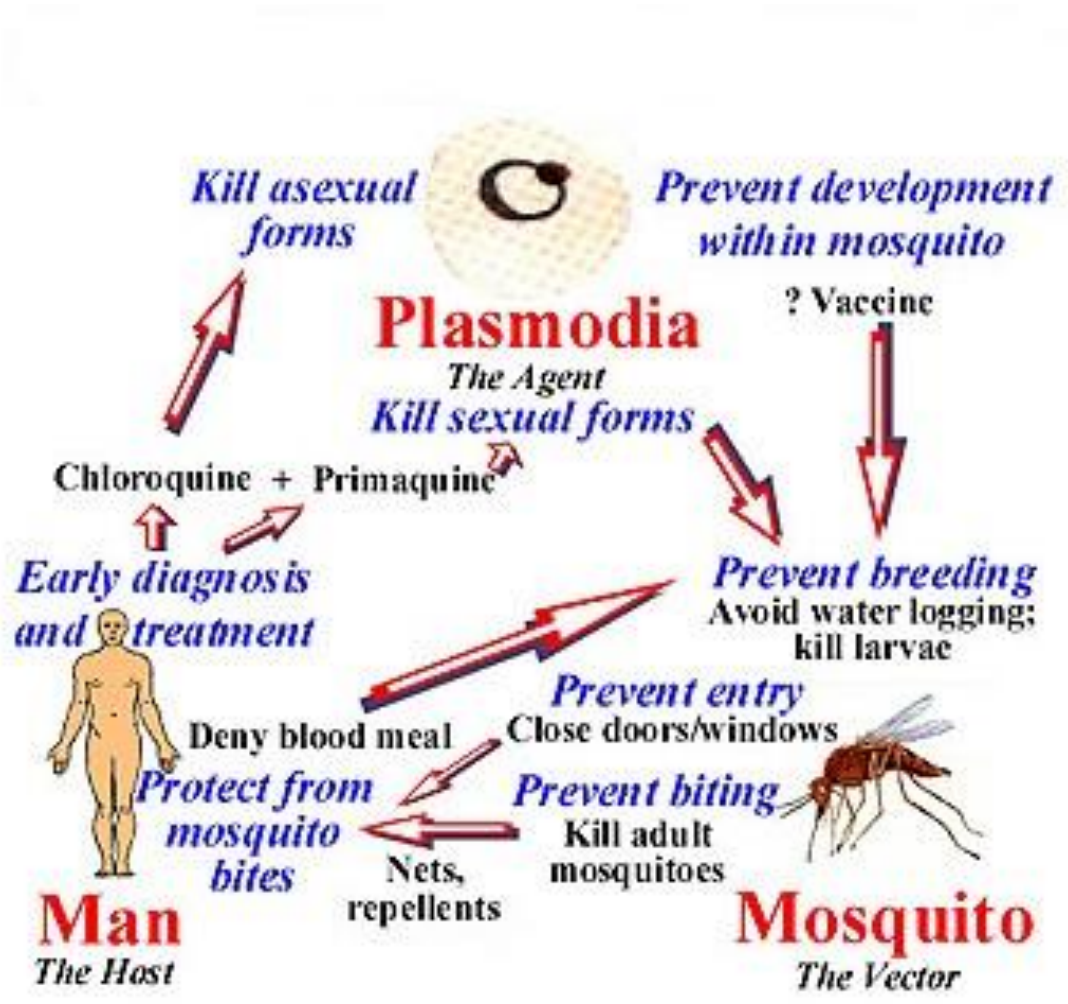


Figure 2.4: Control strategy for malaria (WHO, 2004).

2.9.2.5 Malaria Case Management

Malaria is a major cause of morbidity and mortality in sub-Saharan Africa, and prompt treatment with an effective anti-malarial is the bedrock of malaria control. For decades, as most health facilities in Africa did not perform diagnostic testing, uncomplicated malaria was typically managed with a syndromic approach in which all patients with febrile illness were treated with chloroquine. Since 2000, in the face of increasing resistance to chloroquine and other commonly-used anti-malarials, 45 African countries changed their case-management policies to recommend artemisinin-based combination therapy (ACT) as the first-line treatment for uncomplicated malaria (Barnes et al, 2005). The adoption of artemisinin-based combination therapy (ACT) for malaria in most endemic countries, and the availability of new diagnostic tools, such as rapid diagnostic tests (RDTs), have led the World Health Organization (WHO) to recommend a modified approach to malaria management. To reduce unnecessary ACT use, malaria diagnostic testing with microscopy or rapid diagnostic tests (RDTs) is often recommended.

Traditional microscopy provides a quantitative estimate of the parasite density, while RDTs do not, barely indicating the presence or absence of malaria parasites. Despite substantial investments by donors, African governments, and other partners to support these new diagnostic and treatment policies, remarkably little is known about how well the policies have been implemented. Published studies of health worker adherence to ACT policies have only been done in three low-income countries (Kenya, Uganda, and Zambia); and use of testing was evaluated in only two (Kenya and Zambia) (Hamer et.al., 2007; Skarbinskiet. al., 2009; Zurovac et. al.,2008). Results from these studies are concerning.

In sub-Saharan Africa over 70% of patients with suspected malaria diagnose and manage their illness at home with traditional remedies or drugs bought from local shops (Amexo et al, 2004). Attendance at a health clinic usually occurs only after home treatment has failed. Primary level health facilities lack tools for detection of malaria parasitaemia so a diagnosis of malaria is usually based on clinical symptoms such as fever. Despite the development of algorithms to improve the specificity of clinical malaria diagnosis, many infectious diseases mimic malaria illness so this approach leads to over diagnosis rates of 30–70% depending on malaria transmission patterns (Amexo et al, 2004; Reyburn et al,2004). Over diagnosis of malaria leads to unnecessary anti-malarial drug use, increased drug resistance, and delays in achieving the correct diagnosis: all of which prompt return visits to health facilities. Malaria misdiagnosis can either result in over estimating or under estimating the burden of disease and in both instances the burden of malaria misdiagnosis is likely to fall most heavily on the poor and vulnerable because they have less resilience to cope with the effects of prolonged ill health (Amexo et al, 2004).

Malaria is characterized by gross over-diagnosis and over-treatment, ranging from 32% to 96% of febrile patients having an antimalarial prescribed without any evidence of peripheral *Plasmodium falciparum* infection depending on the background level of malaria transmission. (Amexo et al, 2004; Barat et al, 1999; Reyburn et al, 2004; Zurovac et al, 2006).The most widely used approach to confirmatory diagnosis is malaria microscopy. However, this requires an organized health system infrastructure with functioning microscopes used by trained technicians with regular provision of reagents, supervision, and quality control. Because parasite detection is usually performed by someone other than the prescriber, there is a tendency to distrust or ignore the results of microscopy provided by the laboratory as evidenced in Tanzania (Reyburn et al,2004), Zambia (Barat,1999), and Kenya (Zurovac et al,2006). To put testing and clinical decisions in the hands of the prescriber or provide diagnostic services in settings where microscopy is not available or cannot be effectively supported, the use of rapid antigen-detection diagnostic tests (RDTs) has been encouraged as a potentially cost-effective approach to accompany the widespread implementation of expensive ACT (Barnish et al, 2004; Bell et al, 2006; WHO, 2004). Despite numerous studies on the sensitivity and specificity of RDT for malaria diagnosis (Bell et al, 2006; Moody, 2006; Murray et al, 2003) there have been no formal evaluations of their use under routine, operational conditions.To maximize the detection of parasites before any treatment is given, RDTs are recommended, despite their remaining positive, due to persistent antigenaemia, for more than 14 days following parasite elimination..

2.9.3 Malaria and vulnerable groups

2.9.3.1 Children under five

Over 40% of the world's children live in malaria-endemic countries. Each year, approximately 300 to 500 million malaria infections lead to over one million deaths, of which over 75% occur in African children < 5 years infected with *Plasmodium* falciparum (Snow et al). The rapid spread of resistance to antimalarial drugs, coupled with widespread poverty, weak health infrastructure, and, in some countries, civil unrest, means that mortality from malaria in Africa continues to rise. The tragedy is that the vast majority of these deaths are preventable.

In areas of intense malaria transmission, (Barnish et al, 2004) such as large parts of tropical Africa, where the burden of malaria is greatest and where severe disease and mortality are largely confined to children under 5 years of age, malaria treatment is often dispensed on the basis of "fever" rather than on the basis of a parasitologically confirmed diagnosis. In these settings, malaria is by far the commonest cause of childhood fevers and most young children have malaria parasitaemia. However, with high malaria transmission and high levels of immunity, a significant proportion of the infections are asymptomatic and detecting parasites in the blood does not always help to distinguish malaria from other causes of fever. Moreover, in most of these areas microscopy and rapid diagnostic tests (RDTs) are not generally available at the periphery of the health services or at community level, where most cases of malaria are managed.

In areas with intense transmission, infants and young children suffer the highest rates of acute malarial illness and mortality. Immunity is acquired with increasing age: older children and adults thus suffer fewer clinical attacks and severe malaria and mortality become rare. (Barnish et al, 2004).Approximately 7% of children who survive cerebral malaria (a severe form of the disease, characterized by coma and convulsions) are left with permanent neurological problems. These include weakness, spasticity, blindness, speech problems and epilepsy. The limited availability of specialized educational provision and equipment for such children means that opportunities for subsequent learning, and for attainment of independence, are compromised even further. Epilepsy may be inadequately treated, or untreated, due to lack of appropriate drugs and expertise, and further injury or death may result from uncontrolled convulsions. Recent evidence suggests that some children who appear to have made a complete neurological recovery from cerebral malaria may develop significant cognitive problems (attention deficits, difficulty with planning and initiating tasks, speech and language problems), which can adversely affect school performance (Holding et al, 1999).

2.9.3.2 Pregnant women

Malarial infection during pregnancy is a major public health problem in tropical and subtropical regions throughout the world. In most endemic areas of the world, pregnant women are the main adult risk group for malaria. Malaria during pregnancy has been most widely evaluated in Africa south of the Sahara where 90% of the global malaria burden occurs. The burden of malaria infection during pregnancy is caused chiefly by Plasmodium falciparum, the most common malaria species in Africa.

In areas of high or moderate (stable) malaria transmission, the deleterious impact of malaria is particularly apparent in the first and second pregnancies. Although parasite prevalence and density are higher among pregnant women compared with non-pregnant women, infections with P. Falciparum are usually a symptomatic. Clinical malaria is thus not a prominent feature of infection during pregnancy, and the major detrimental effects of infection are low birth weight and maternal anaemia. During pregnancy, P. falciparum parasites are sequestered in the placenta, often without being detectable in the peripheral blood. The evidence is still unclear on the benefits of using RDTs to detect placental malaria. In one study in Cameroon, 20.1% of pregnant women who had placental malaria at the time of giving birth were peripheral blood smear-negative (Romoser and Stofollano, 1998), and in most of these (88%) histidine-rich protein-2 (HRP2) were detected. In the same study, a combination of microscopy and rapid diagnostic test (RDTs) yielded accurate diagnoses in 94% of women with malaria.

Malaria accounts for one in five of all childhood deaths in Africa. Anaemia, low birth-weight, epilepsy, and neurological problems, all frequent consequences of malaria, compromise the health and development of millions of children throughout the tropical world. Yet much of the impact of malaria on the world's children could be prevented with currently available interventions.

2.9.3.3 Barriers to Malaria Control

Malaria control is made difficult by several technical and administrative problems.
Drug-resistant malaria parasites hinder case management by decreasing the efficacy of anti-malarial drugs and by requiring the use of alternate drugs that are often more costly, less safe and less easy to administer.

Insecticide resistance decreases the efficacy of interventions that rely on insecticides such as insecticide-treated bed nets and insecticide spraying. Inadequate health infrastructures in poor countries are unable to conduct the recommended interventions. The people most exposed to malaria are often poor and lack education. They often do not know how to prevent or treat malaria. Even when they do know, they often do not have the financial means to purchase the necessary products, such as drugs or bed nets. While the malaria-mosquito link is recognized in malaria-endemic regions of sub-Saharan Africa, a number of alternate causative mechanisms are also endorsed. Quantitative data from the various studies showed that up to 80% of survey respondents that cite causes of malaria that do not implicate transmission by mosquitoes (Adongo et al, 2005; Agyepong et al,1994). Similarly, only 8-27% of respondents related common complications of malaria such as convulsions and anaemia, to mosquitoes or malaria (Adongo et al, 2005; Mwenesi et al, 1995). This finding has important implications for malaria control programs, which rely heavily on vector control strategies, including the use of insecticide-treated bed nets (ITNs). Users must believe in a mosquito-based etiology of malaria to be sufficiently motivated to purchase or otherwise acquire ITNs, and adhere to their use. The success of anti-malarial interventions requires appropriate coordination of efforts, as well as acceptance at the community and individual levels.

Numerous barriers to adequate malaria control programs now exist, including the increasing prevalence of drug and insecticide resistance, the high rate of HIV co-infection, climate change, and civil unrest (Greenwood et al, 2005). Added to these are the potential barriers posed by the local cultural contexts in which those at risk of malaria live. Previous experience from the field of HIV/AIDS has shown that local perceptions of this disease and its causative agent are strongly influenced by cultural beliefs, and that these perceptions must be considered in the development of prevention and treatment programs (Nicollet al, 1993; Boer et al, 2004). Cultural beliefs are likely to similarly influence the treatment and prevention of malaria in Africa. Accounting for these should enhance the efficacy and scope of malaria control programs.

CHAPTER THREE

METHODOLOGY

3.1 Description of study area

This study was carried out in one urban (kube) and one rural (Eniosa) community in Ibadan north local government area and Akinyele local government area of Ibadan respectively, Oyo state, South West Nigeria. The communities comprise different ethnic groups such as the Yorubas, Igbos and Igedes.

The climate is tropical with a well-marked dry season during November to March. During this period, the prevailing temperature ranges from 20-35; rainfall from 10- 43%. The rainy season extends from April to October with a short break in August. The temperature ranges from 23-30 degree Celsius and mean annual rainfall varying between 1000 and1300mm (Adeniyan, 2007).

3.2 Ibadan North Local Government Area

Ibadan North LGA covers a landmass of 28.07km^2. It consists of administrative wards and 41 localities. It has about 306.795 inhabitants (NPC, 2006). Kube study community was purposively selected because of accessibility to the community. It is located along Queen Elizabeth road, close to Total Garden. The principal inhabitants of the community are the Yorubas, Igbos and Hausas as the minority. There is one primary health centre in Kube. This is complemented with many patent medicine dealers.

3.2.1 Akinyele Local Government Area

Akinyele Local Government Area was created in 1976 with the Administrative Headquarters located at Moniya. The Local Government shares boundaries with Afijio Local Government to the north, Lagelu Local Government Area to the east, Ido Local Government Area to the west and Ibadan North Local Government Area to the south. It covers a landmass of about 07.63km^2 and has about 139,587 inhabitants (Ayeni, 2004). It is located after Olorunda Abaa in a remote area of Ibadan. The major occupation practiced is farming. The principal inhabitants of the community are the Yoruba. Eniosa has 14 health posts namely Atapa, Arulogun, Apetere, Ajara, Agbaji, Idi-ogun, Mogaji, Orunremi, Ogeye, Olosunde, Olorunda, Abaa Oyedeji and Sagbe. There is one primary health centre to every eleven villages in Eniosa.

Fig 3.1 The study Area showing the Akinyele Local Government Area

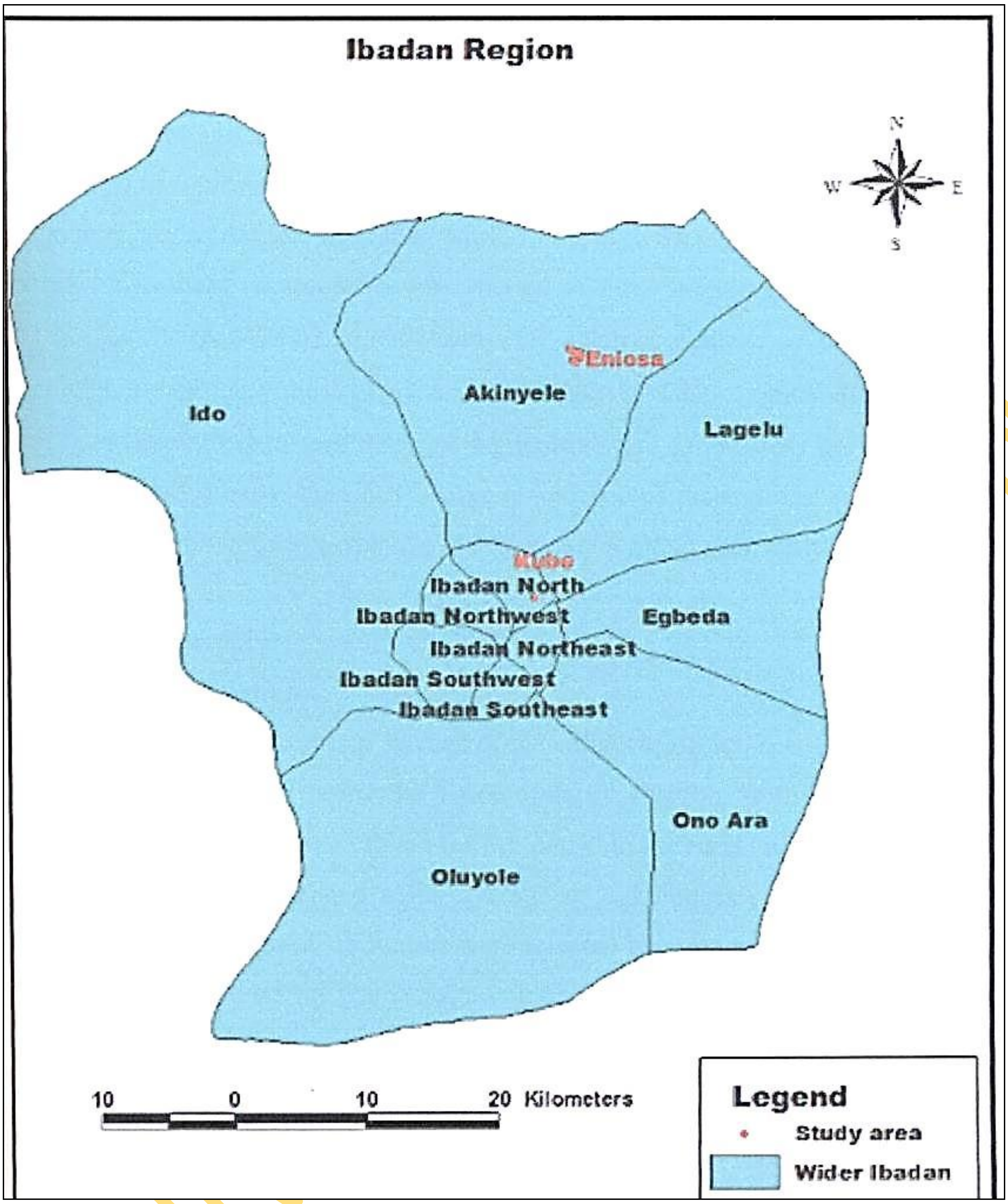


Figure 3.2 Map of Ibadan showing the study communities

3.4 Study Design

The study employed was a descriptive cross-sectional design with a comparative approach. It has three components namely; a descriptive survey, laboratory analysis and field collection. It was designed to provide baseline data on the factors influencing malaria prevalence during the dry season in reproductive aged women and to compare knowledge, attitudes and treatment practices of urban and rural mothers with respect to malaria fever. Interviewer administered questionnaires, finger prick collection of blood; entomology survey and observational checklist were employed for data collection.

A previous wet season study was conducted in these communities; this study was therefore conducted to complement and generate a comprehensive baseline data on the factors and practices that favours prevalence of malaria all year round in these communities.

3.5 Study Population

The study population included women of the reproductive age [15-49] resident in both communities. Equal number of women was used in both Kube and Eniosa communities.

3.6 Sample Size Determination

A total population (255) of women was used in Kube and equal number of women was also used in Eniosa, making a total of 510 participants.

The minimum sample size to detect a difference in prevalence of infection between the two communities is given by the formula.

$$N = \frac{(Z\alpha + Z_{1-ß})^2 \, (P1(1 - P_1) + P_2(1 - P_2)}{(P1\text{-}P2)^2}$$

Where

P_1= Proportion with prevalence of infection in urban community = 12%

P_2 = Proportion with prevalence of infection in the rural community [anticipated difference of 10%] = 22%

$Z\alpha$ = Standard normal deviate corresponding to 5% level of significance =1.96

$Z_{1-ß}$ =Standard normal deviate corresponding to power of 80% = 0.84

P_1-P_2=20%

$$N = \frac{[1.96 + 0.84)^2 \, (12[100-12] + 22[100-12]}{(12\text{-}22)^2}$$

N=217 in each group

Assuming a non-response rule of 15% the sample size becomes 255 in each group.

This gives a total of 510

3.6.1 Selection of Housing Units and Subjects

Kube and Eniosa communities were purposively chosen because they are typical urban and rural areas respectively in the local government areas. In Eniosa, 10 villages were randomly selected from a sample frame of 27 villages. Each village is made up of an average of 4-8 houses. 4 houses from each village were also randomly selected for entomological survey.

In Kube Atanda, compounds were scattered in different parts of the community. The houses were numbered. Majority of the houses consists of more than one household. One woman per household was interviewed. 40 houses were sampled for mosquitoes in each community. Consequently, simple random sampling technique was adopted to pick the participants. The respondents were interviewed individually.

3.7 Survey

3.7.1 Questionnaire Administration

The questionnaires and observation checklist were pre-tested in different communities with similar characteristics with the study communities. A total of 25 draft questionnaires were pre-tested on women of reproductive age in Oranyan community for the urban and Agbaji for the rural community.

Using the pre-tested interviewer administered questionnaires, information was collected from women aged 15-49 years who are permanently residents of the communities on socio-demographic characteristics, Awareness, Knowledge and Perceptions about malaria, Practice of malaria prevention methods, Environmental practices that pre-disposes to malaria, Health conditions and malaria practices. Only one woman per household was interviewed. The interviews were conducted in Yoruba to ensure good comprehension.

3.7.2 Onsite Observation

Observations on certain environmental indicators around the homes were made and recorded using structured checklist during the survey to examine respondents' state of environment for factors that are likely to predispose them to malaria. Each observation lasted a few minutes and factors such as source of water, overgrown bushes etc. were noted and validation of respondents' use of preventive materials in their homes.

3.8 Determination of parasite load

3.8.1 Rapid diagnostic kit method

Blood samples were collected from 20% of the respondents to determine the prevalence of infection. This was done using the finger prick method. The rapid diagnostic kit specific *plasmodium falciparum* and microscopy method was used, with the use of a blood lancet to minimize the amount of blood collected from participants because of ethical issues. The blood samples collected was immediately put unto the sample pad in the sample well.

Six drops of the clearing buffer was then dispensed into the well by holding the plastic dropper bottle vertically. Then the results were read off after 15minutes. A single pink coloured band appearing in the control window "C" signifies the result was negative, while for a positive result in addition to the control band, a second distinct pink coloured band also appears in the test window "T". The result was considered invalid where both the control and test lines did not appear in which case the test was repeated.

3.8.2 Microscopy method

For detecting malaria parasites using microscopy, the collected specimens were also used for preparation of blood smears. Thick and thin smears were prepared on the same slide and stained with 10% Giemsa solution for 30 minutes after fixing the thin smear with methanol. The blood smears were carefully examined using an oil immersion lens. Smears were deemed negative if there was no evidence of any parasites observed after examing 200 high power fields. In the event of the presence of parasites, the thick smear was used to determine the number of parasites present, while the thin smear was used to determine malaria species composition.

Plasmodium parasites were counted against 200 WBC on the thick film. Five hundred WBC were counted where less than nine parasites were counted after counting against 200 WBC. Where microscopists did the parasite counts in the thin film (against 2,000 red blood cells) as a result of heavy parasitaemia (greater or equal to 100 parasites per thick smear high power field), parasites counted were recalculated with 200 WBC. Parasite densities (parasite/µl of whole blood) were then calculated as follows:

= (Number of parasites counted/WBC counted) × WBC count/ µL of participant.

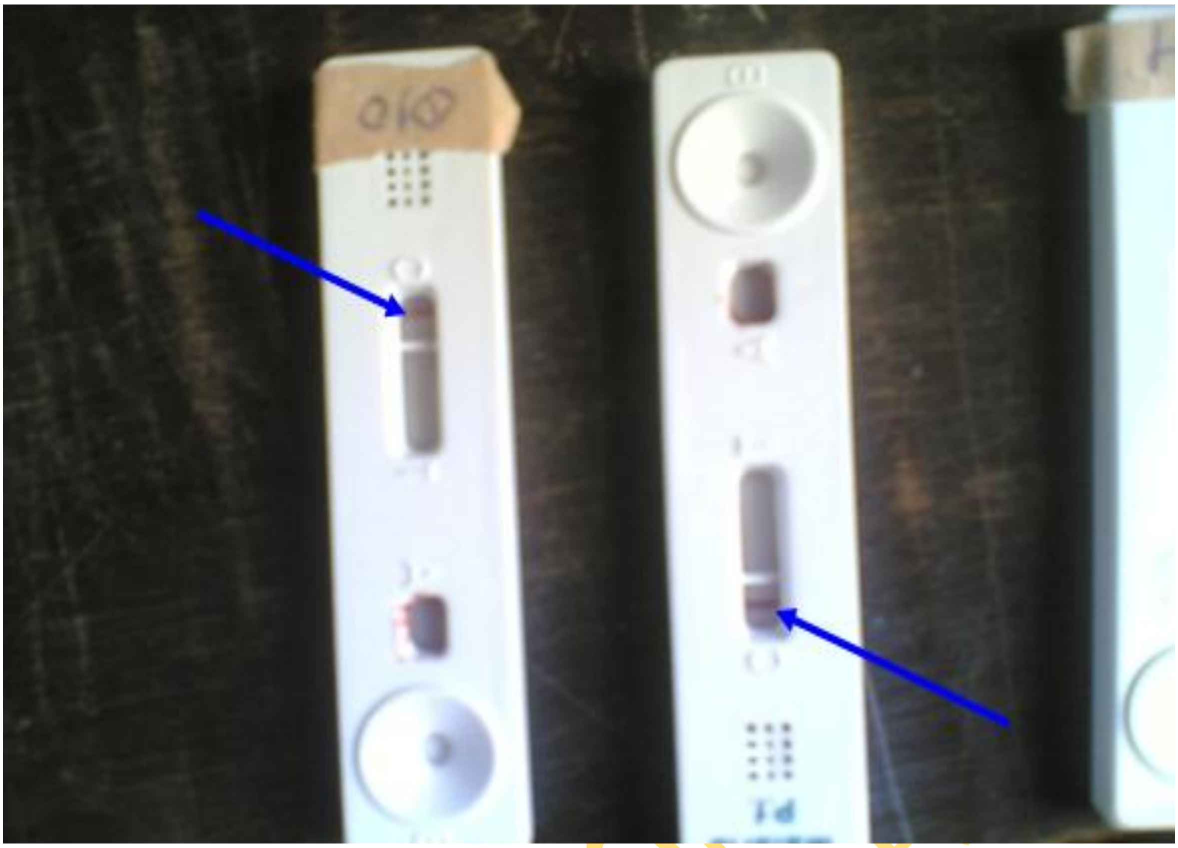


Plate 3.1 Kit test procedure showing positive result

The prevalence of infection was calculated using the formula

$$\frac{\text{Percentage infected}}{\text{Percentage examined}} \times 100$$

3.9 Entomology

A 3 month entomological survey was carried in both communities.

3.9.1 Spray Catch Method

Malaria vectors were sampled using the spray catch method to determine in-door resting density of mosquitoes using the spray sheet method. The mosquitoes were collected indoors between 6.00p.m and 10.00a.m. 40 houses in each community were randomly sampled for the entomological survey. The room was then sprayed with insecticide, every opening being shut and every food item covered. After this period mosquito found on the sheet were gathered and stored in the specimen bottles labelled according to the time of collection. Specimens were conveyed to the laboratory for further identification and classification.

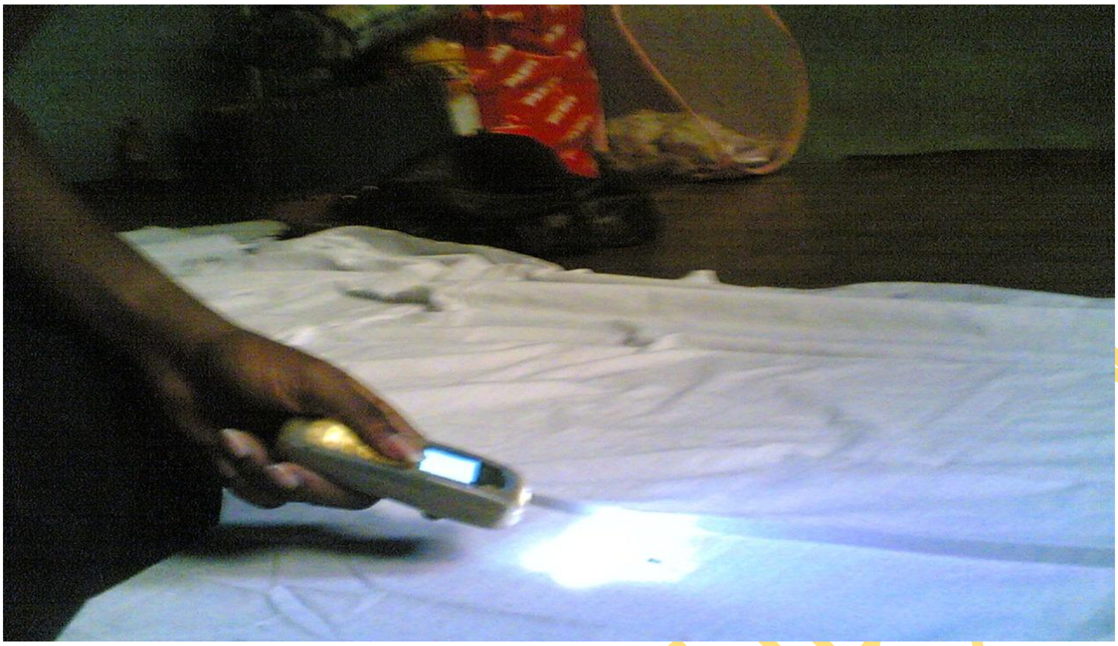


Plate 3.2 Collecting trapped mosquitoes in a sample house

Plate 3.3 Mosquito samples collected

3.9 Entry procedure and ethical consideration

An introductory letter was obtained from the Department in respect of the study and was handed to community heads and Doctor in-charge of the Primary Health Care centre. Household owners' informed consent was also sought so as to have their houses sprayed for collection of mosquito samples. The approval was based on the basis of the following:

- Absolute confidentiality will be assured
- The research will not inflict harm on the participants. Participants will be duly informed that finger prick will cause slight pain that is not harmful and will resolve almost immediately.
- The participants duly informed of all processes involved in the research before commencement.
- The participants are free to withdraw if they wish to at any point.

3.10 Incentives

All participants from whom blood sample were collected from were given ferrous, vitamin B complex and folic acid. In addition to the drugs the women were given sachets of milk. The ones that tested positive to the malaria were referred to the Primary Health Care centre.

3.11 Data Analysis

Adequate sample size was computed to be able to detect statistical significant differences in prevalence of infection between urban and rural respondents and also to ensure a high precision of data collected within a 95% confidence level. Data obtained was analysed using descriptive statistics, logistic regression and Chi-Square Tests. The household data were checked for inaccuracies and inconsistencies. .

Data were analysed using the SPSS (Version 16.0) statistical software. Descriptive statistics was presented using tables and charts; also, summary statistics were presented as means. Cross-tabulation was made between variables within each group and between each group. Chi-square and t-tests were used to determine association between categorical and non-categorical variables. A p-value of 0.05 was considered statistically significant.

CHAPTER FOUR

RESULTS

This chapter presents the analysed data obtained from the questionnaire survey, onsite observations assessment, entomological survey and prevalence of malaria parasite.

4.1 Socio-demographic characteristics

The mean ages of the rural and urban respondents were 25.8±6.7 and 28.6±7.8 years respectively with many of the respondents falling within the age range of 20-24 years: 100(41.0%) for Eniosa and 63(25.4%) for Kube respectively. The total mean age was 27.2± 7.4. Table 4.1 shows that a greater percentage of the rural respondents 68(27.6%) had no formal education. Also, good percentage of the rural respondents had completed either primary 51(20.7%) or secondary 45(18.3%) education. However, a greater percentage of the urban respondents had either secondary 82(32.9%) or tertiary education 72(29.0%) while only 38(15.3%) had no formal education.

Table 4.1 shows that majority of the rural respondents were traders 113(46.3%) while very few 7(2.9%) were civil servants. On the other hand, urban respondents were mainly traders 88(35.5%) and civil servants 34(13.7%). Most of the rural 226(91.5%) and urban 146(58.4%) respondents were married. Only nine (3.6%) rural respondents were single compared to 74(31.6%) urban respondents.

As shown in Table 4.1, the Yoruba tribe constituted a greater proportion of the rural 184(78.3%) and urban 178(72.7%) respondents. There was a larger proportion of Igbos in Kube 33(13.5%) than in Eniosa 8(3.4%). On the other hand, 36(15.3%) of the rural respondents were Igede while there were few 13(5.3%) Igedes among the urban respondents.

Christianity and Islam were the two major religions practiced. 140(57.6%) and 117(48.1%) were Christians in Eniosa and Kube respectively while 103(42.4%) and 126(51.9%) were Muslims in Eniosa and Kube respectively. As shown in Table 4.1, 138(59.2%) and 132(58.4%) of rural and urban respondents respectively had a household size of less than five while rural 95(40.8%) and 94(41.6%) respectively had a household of more than five people.

The mean household size for Eniosa (rural) was 4.6±1.8 while the mean household size for Kube (urban) was 4.5±1.6. The total mean household size was 4.5±1.7. A higher percentage of the rural respondents 137(65.9%) had an income of less than 5000 Naira compared to 44(25.1%) of urban respondents. Table 4.1 shows 14(6.7%) of the rural respondents had income of more than 10,000 naira monthly compared to 58(33.1%) of urban respondents.

Details regarding the husbands' educational status are presented on Fig 4.1. This figure shows that 19.6% of respondents' husbands in Eniosa had no formal education compared to 15.8% in Kube. More (32.2%) respondents' husbands in Kube had tertiary education compared to those in Eniosa (12.2%).

Table 4.1(a) Socio-Demographic Characteristics of respondents

Demographic Characteristics	Eniosa (*N=244) N (%)	Kube (*N=248) N (%)
Age		
15-19	25 (10.2)	21 (8.5)
20-24	100 (41.0)	63 (25.4)
25-29	51 (20.9)	63 (25.4)
30-34	39 (16.1)	40 (16.1)
35-39	23 (9.4)	32 (12.9)
40-44	5 (2.0)	25 (10.1)
45-49	1 (0.4)	4 (1.6)
Marital status		
Single	9 (3.7)	79 (31.8)
Married	217 (88.9)	143 (57.7)
Others	18 (7.4)	26 (10.5)
Religion		***N=244**
Christianity	140 (57.4)	117 (48.0)
Islam	103 (42.2)	126 (51.6)
Traditional	1 (0.4)	1 (0.4)
Ethnicity	***N=235**	***N=245**
Yoruba	184 (78.2)	178 (72.7)
Igede	36 (15.3)	13 (5.3)
Igbo	8 (3.4)	33 (13.5)
Hausa	3 (1.3)	19 (7.7)
Igbira	2 (0.9)	2 (0.8)
Edo	2 (0.9)	0 (0.0)

*No responses were excluded

Table 4.1(b) Socio-Demographic Characteristics of respondents continued

Demographic Characteristics	Eniosa N (%)	Kube N (%)
Educational Status	***N=246**	***N=249**
No formal education	68 (27.6)	38 (15.3)
Primary uncompleted	22 (8.9)	10 (4.0)
Primary completed	51 (20.7)	18 (7.2)
Secondary uncompleted	40 (16.3)	29 (11.6)
Secondary completed	45 (18.3)	82 (32.9)
NCE	9 (3.7)	22 (8.8)
Polytechnic	9 (3.7)	36 (14.6)
University	1 (0.4)	9 (3.6)
Nursing	1 (0.4)	0 (0.0)
Others	0 (0.0)	5 (2.0)
Household size	***N=233**	***N=226**
> 5	138 (59.2)	132 (58.4)
5 and above	95 (40.8)	94 (41.6)
Occupation	***N=244**	***N=248**
Trading	113 (46.2)	88 (35.5)
Artisan	28 (11.5)	30 (12.1)
Teaching	8 (3.3)	28 (11.3)
Civil servant	7 (2.9)	34 (13.7)
Others**	88 (36.1)	68 (27.4)
Income per month	***N=208**	***N=175**
<5000	137 (65.9)	44 (25.2)
5000-10,000	57 (27.4)	73 (41.7)
>10,000	14 (6.7)	58 (33.1)

*No responses were excluded

**Others: Students, House wives, Farmers and without job.

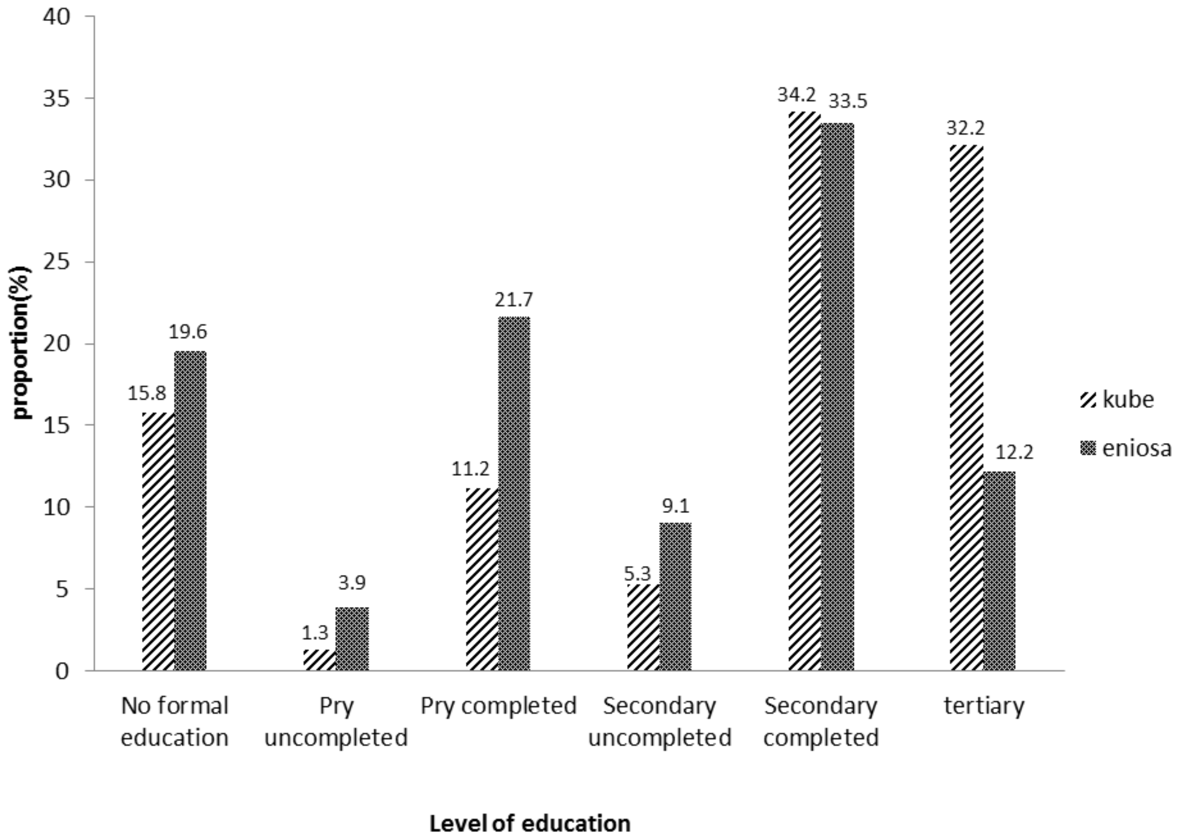


Fig 4.1 Educational status of all the respondents' husbands

4.2 Knowledge about Malaria Transmission, Prevention methods and treatment

The details relating to Knowledge about malaria transmission, prevention and treatment are presented in table 4.2. A high percentage of respondents had knowledge of the primary cause of malaria. Respondents were asked about their perception of the causes of malaria, more than half of the respondents in Eniosa 144(58.3%) and Kube 145(58.0%) correctly selected mosquito bite as cause of malaria. A total of 28(10.9%) and 6(2.4%) of respondents in Eniosa and Kube respectively reported heat, 25(10.1%) of those in Eniosa and 38(15.2%) of those in Kube indicated polluted air, 71(28.3%) of those in Eniosa and 76(30.4%) of those in Kube reported poor sanitation.

Majority of the respondents in Eniosa 198(80.2%) and Kube 199(79.6%) affirmed high body temperature as a symptom of malaria. Similarly, majority of the respondents in Eniosa 166(67.2%) and Kube 140(56.0%) affirmed headache. A few 41(16.3%) of the respondents in Eniosa and about one third 75(30.0%) in Kube also reported that shivering is a symptom of malaria (see details on table 4.2). Table 4.3 shows the distribution of respondents' knowledge of the best way to treat malaria. Sixty nine (27.5%) of respondents in Eniosa and 83(33.2%) of those in Kube said that artemisin combined therapy was the best therapy for treating malaria. A few respondents in both Eniosa 1(0.4%) and Kube 3(1.2%) said no treatment was necessary.

The factors which encouraged the spread of malaria as perceived by respondents' in the communities are shown in table 4.4. Poor drainage was reported by 48(19.4%) of respondents in Eniosa compared to 60(24.0%) from Kube. Other factors reported were improper waste disposal: Eniosa 65(26.3%) and Kube 88(35.2%), Overgrown bushes: Eniosa 104(42.1%) and Kube 56(22.4%), Stagnant water: Eniosa 78(30.8%) and Kube 95(38.0%).

Table 4.2 Respondents' knowledge on causes and symptoms of malaria

Perceived Causes*	Eniosa (N=247) N (%)	Kube (N=250) N (%)
Mosquito	144 (58.3)	145 (58.0)
Heat	27 (10.9)	6 (2.4)
Polluted air	25 (10.1)	38 (15.2)
Poor sanitation	70 (28.3)	76 (30.4)
Palm oil	16 (6.5)	4 (1.6)
Sunlight	49 (19.8)	39 (15.6)
Symptoms of malaria*		
High body temperature	198 (80.2)	199 (79.6)
Shivering	40 (16.3)	75 (30.0)
Convulsion	8 (3.2)	13 (5.2)
Headache	166 (67.2)	140 (56.0)
Anaemia	16 (6.5)	19 (7.6)
Vomitting	21 (8.5)	35 (14.0)
Diarrhea	4 (1.6)	5 (2.0)
Loss of appetite	25 (10.1)	52 (20.8)
Yellow urine	9 (3.6)	5 (2.0)
Yellow eyes	6 (2.4)	3 (1.2)

***Multiple responses were allowed**

Table 4.3 Distribution by knowledge of ways to treat malaria

Treatment*	Eniosa (N= 247) N (%)	Kube (N= 250) N (%)
No treatment necessary	1 (0.4)	3 (1.2)
Chloroquine	64 (26.0)	62 (24.8)
ACT	68 (27.5)	83 (33.2)
Injection	79 (32.0)	121 (48.4)
Changed diet	6 (2.4)	8 (3.2)
Environmental sanitation	56 (22.7)	28 (11.2)
Herbal medicine	42 (17.0)	29 (11.6)
Religious healing	0 (0.0)	1 (0.4)

*Multiple responses were allowed

Table 4.4 Distribution of respondents by knowledge of the factors that encourage the spread of malaria

Factors that encourage Spread of malaria*	Eniosa (N=247) N (%)	Kube (N=250) N (%)
Poor drainage	48 (19.4)	60 (24.0)
Improper waste disposal	65 (26.3)	88 (35.2)
Overgrown bushes	104 (42.1)	56 (22.4)
Stagnant water	76 (30.8)	95 (38.0)

*Multiple responses were allowed

Majority of the respondents in Kube (86.0%) and Eniosa (78.9%) knew that malaria can be prevented. Nineteen (7.6%) respondents from Kube and 22(8.9%) from Eniosa however reported that malaria could not be prevented. A few of the respondents reported that they did not know (2(0.8%) for Kube vs 30(12.1%) for Eniosa). Table 4.5 shows the perception of respondents on how to prevent malaria. Many of the respondents from both Eniosa 96(49.2%) and Kube 101(47.0%) indicated mosquito coil while 95(48.7%) of respondents from Eniosa and 109(50.7%) of those from Kube perceived that use of drugs was the best. Other therapies reported by Eniosa respondents were sleeping under insecticide treated nets, 64(32.8%), use of herbs 45(23.1%), use of repellent 30(15.4%) and room screening 1(0.5%) while Kube respondents reported 77(35.8%), 48(22.3%), 70(32.6%) and 2(0.9%) respectively.

Table 4.6 shows that many of the respondents in both Eniosa 104(43.2%) and Kube 118(50.2%) believed that malaria could be severe, 82(34.0%) and 60(25.5%) respectively said it is not severe. A total of 55(22.8%) of Eniosa respondents and 57(24.3%) of Kube respondents didn't have any idea. Respondents' gave different answers when asked why they considered malaria to be severe. Twelve (14.0%) of Eniosa respondents and 8(8.3%) of Kube respondents said it can cause complications. Other reasons given by Eniosa and Kube respondents respectively are that malaria could cause convulsion {13(14.0%), 19(19.8%)}, Anaemia {2(2.3%), 4(4.2%)}, death {33(38.4%), 43(44.9%)} and Tiredness {18(20.9%), 4(4.2%)}.

Many respondents from Eniosa 111(45.6%) agreed that everybody was susceptible to malaria compared to 130(52.5%) respondents from Kube. When asked who was more susceptible, 65(26.6%) of Eniosa and 43(17.3%) of Kube respondents thought it was children under the age of five while 24(9.8%) and 27(10.9%) from Eniosa and Kube respectively picked pregnant women. (See details on table 4.7). The reasons given for peoples' susceptibility to malaria are presented in Table 4.8. Some in Eniosa 48(22.0%) and in Kube 50(27.4%) attributed it to insanitary environment, 16(7.3%) and 19(10.4%) respectively said it was due to the type of food eaten while 67(30.8%) of Eniosa respondents and 25(13.7%) of Kube respondents didn't have any idea.

Some 97(39.6%) of the respondents in Eniosa and more than half 136(54.8%) in Kube indicated that malaria is mainly transmitted during the dry season while 88(35.9%) in Eniosa and 66(26.6%) in Kube believed transmission was during rainy season. However, 48(19.6%) in Eniosa and 35(14.1%) in Kube believed that malaria transmission could be anytime of the year (Table 4.8).

Table 4.5 Distribution of respondents on knowledge of therapy for malaria prevention

Knowledge of malaria Prevention**	Eniosa N (%)	Kube N (%)
Sleep under ITNs	64 (32.8)	77 (35.8)
Use of herbs	45 (23.1)	48(22.3)
Use of drugs	95 (48.7)	109 (50.7)
Use of mosquito coil	96 (49.2)	101 (47.0)
Use of repellent	30 (15.4)	70 (32.6)
Room screening	1 (0.5)	2 (0.9)
Environmental sanitation	2 (1.1)	0 (0.0)

*No responses were excluded

**Multiple responses were allowed

Table 4.6 Distribution of respondents by perceived severity of malaria and why it is severe

Severity of malaria	**Eniosa N (%)**	**Kube N (%)**
Severe	104 (43.2)	118 (50.2)
Not severe	82 (34.0)	60 (25.5)
I don't know	55 (22.8)	57 (24.3)
Reasons why malaria is severe	***N= 86**	***N= 96**
Can cause complications	12 (14.0)	8 (8.3)
Can cause convulsion	12 (14.0)	19 (19.8)
Loss of manpower	3 (3.5)	6 (6.3)
Anaemia	2 (2.3)	4 (4.2)
Lead to death	33 (38.4)	43 (44.9)
Tiredness	18 (20.9)	4 (4.2)
Lead to typhoid fever	0 (0.0)	1 (1.0)
Absenteeism in school	0 (0.0)	1 (1.0)
Low birth weight	0 (0.0)	1 (1.0)
Severe headache	1 (1.2)	1 (1.0)
Don't know	5 (5.7)	8 (8.3)

***No responses were excluded**

**Multiple responses were allowed

Table 4.7 Distribution of respondents on knowledge of those susceptible to malaria

Who is more susceptible to malaria	Eniosa (*N=244) N (%)	Kube (*N=248) N (%)
Children less than 5	65 (26.6)	43 (17.3)
Children more than 5	19 (7.8)	31 (12.5)
Pregnant women	24 (9.8)	27 (10.9)
Everybody	111 (45.6)	130 (52.5)
Old people	6 (2.5)	4 (1.6)
Sickle cell patients	5 (2.0)	7 (2.8)
Young adults	11 (4.5)	5 (2.0)
Men	3 (1.2)	1 (0.4)

*No responses were excluded

Table 4.8 Distribution of respondents by knowledge of why some people get malaria more than others and knowledge of seasonality in malaria transmission

Reasons given for selection	**Eniosa (*N=218) N (%)**	**Kube (*N=183) N (%)**
Different body systems	32 (14.7)	31 (16.9)
Immunity	22 (10.1)	44 (24.0)
Insanitary environment	48 (22.0)	50 (27.4)
Food eaten	16 (7.3)	19 (10.4)
I don't know	67 (30.8)	25 (13.7)
Blood group	17 (7.8)	10 (5.5)
Lack of care	4 (1.8)	3 (1.6)
Poor drainage	10 (4.6)	1 (0.5)
Working under the sun	2 (0.9)	0 (0.0)
When is malaria transmission high?	***N= 245**	***N= 248**
Rainy season	88 (35.9)	66 (26.6)
Dry season	97 (39.6)	136 (54.8)
Anytime of the year	48 (19.6)	35 (14.1)
I don't know	12 (4.9)	11 (4.4)

*No responses were excluded

**Multiple responses were allowed

4.3 Knowledge grade of respondents

Assessing the knowledge of the women on a 10 point knowledge scale, the overall mean knowledge score was 6.4±2.1. The mean knowledge score for Eniosa was 6.2±1.9 while the mean knowledge score for Kube was 6.7±2.3. Fig 4.2 showed that majority of the respondents in both Eniosa 185(74.9%) and Kube 163(65.2%) had poor knowledge (details on figure 4.2).

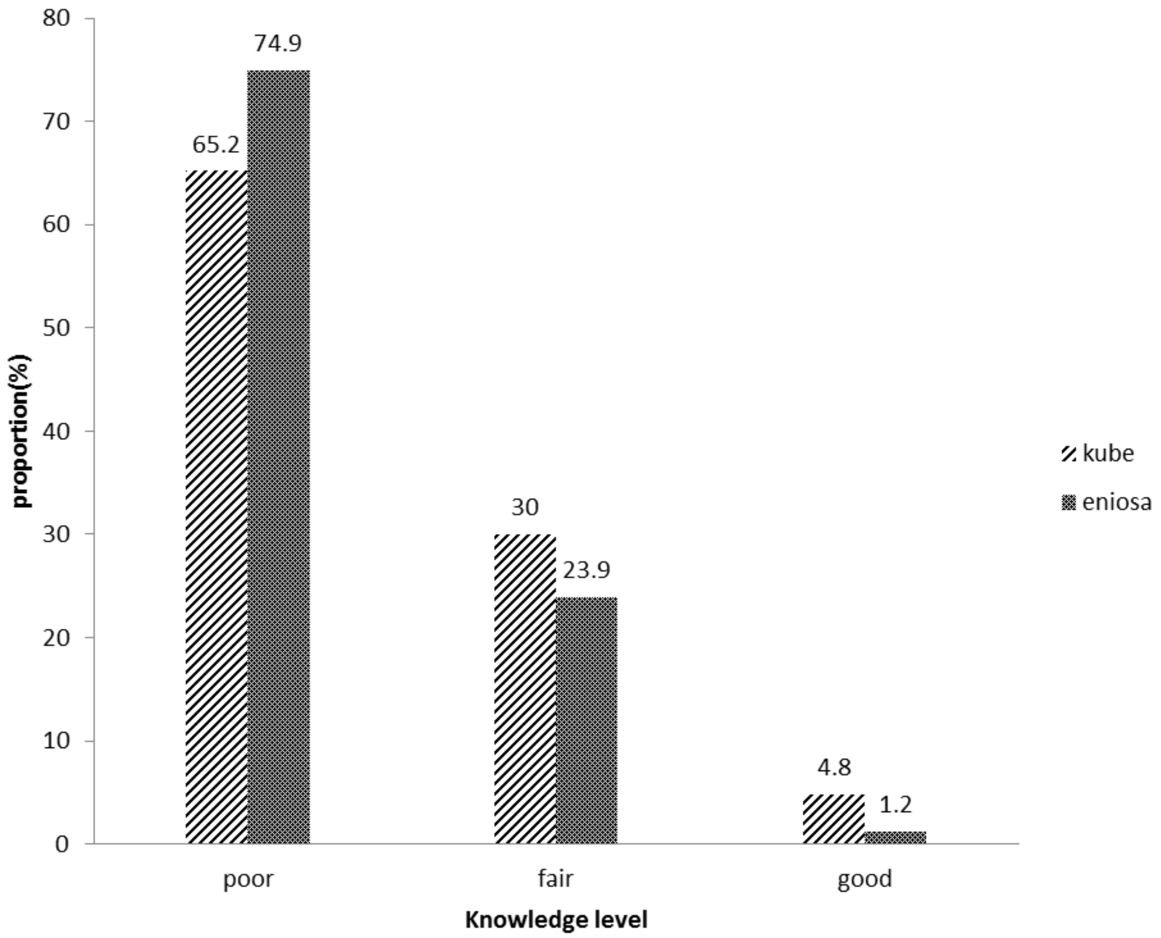


Fig 4.2 Knowledge grade of respondents

4.4 Environmental Practices that can promote spread of malaria in the communities

Table 4.9 shows that the respondents in both Eniosa and Kube collected their refuse in various ways: dustbins, baskets, buckets, heap in a place. Heaping of refuse is the most common method of refuse disposal among respondents in Eniosa community 106(43.1%) compared to 34(13.8%) respondents in Kube. Only 69(28.0%) of Eniosa respondents collected their refuse in dustbins which they leave to accumulate for days before taking to dumpsite while majority 157(63.5%) of Kube respondents used this method. Sixty two (25.3%) respondents in Eniosa community compared to 36(14.6%) in Kube made use of baskets to collect refuse (see details on table 4.9).

As shown in Fig 4.3, respondents in both Eniosa and Kube disposed off their refuse always 167(67.6%) and 190(76.3%) respectively. 43(17.6%) vs. 30(12.0%) in Eniosa and Kube respectively disposed off their refuse often, 28(11.5%) of women in Eniosa occasionally disposed their refuse against 13(5.2%) of women in kube. Figure 4.4 shows that (49.0%) and (19.8%) of respondents in Eniosa and Kube communities respectively engaged in cassava processing within the house while (30.6%) and (27.4%) of respondents in Eniosa and Kube did not engage in cassava processing.

Fig 4.5 shows that a greater proportion (67.8%) of respondents who processed cassava within the house in Eniosa community allowed it to soak in water for 3 days. This compared with (33.3%)) respondents in Kube that also soaked cassava for 3 days. The duration of soaking cassava varies depending on individuals and finished product of the cassava. Respondents in Eniosa (7.4%) and Kube (35.4%) soak for 2 days while Eniosa (13.2%) compared to Kube (12.5%) leave their cassava to soak for one week.

Sources and nature of water supply available to both communities encouraged storage of water around the house for several days. As shown in table 4.10 water were stored in different kind of containers which were local pots: Eniosa 25(10.2%) compared to Kube 10(4.0%), buckets: Eniosa 122(49.6%) compared to Kube 72(29.1%), drums: Eniosa 51(20.7%) compared to Kube 69(27.9%), kegs: Eniosa 26(10.6%) compared to Kube 26(10.5%), plastic tanks: Eniosa 13(5.5%) compared to Kube 49(19.8%). Fig 4.7 shows that 170(69.4%) and 180(72.6%) of Eniosa and Kube respondents respectively covered their drinking water container at all times while 75(30.6%) and 68(27.4%) respectively said they did not cover their containers most times.

Respondents were asked about the sources of water for different domestic purposes: drinking, cooking, washing and bathing. In the context of this study, majority of the respondents reported more than one source of water. As shown in Fig 4.6, well was the main source of water supply in both Eniosa and Kube communities 193(78.1%) vs. 113(45.2%) respectively. 18(7.3%) of Eniosa respondents mentioned they had access to pipe borne water compared to 89(35.6%) of respondents in Kube who had access to pipe borne water. Among the other sources of water supply mentioned were pond, Eniosa 17(6.9%) vs. Kube 4(1.6%), spring Eniosa 3(1.2%) vs. Kube 22(8.8%) and borehole Eniosa 16(6.5%) vs. 22(8.8%) Kube

Table 4.10 shows that many of the respondents in Eniosa 150(61.0%) and Kube 120(48.2%) got their water from public sources provided by Government and individuals for the community. Eighty eight (35.8%) and 128(51.4%) respondents from both Eniosa and Kube communities respectively had their water sources supply fitted to the house. Table 4.11 shows that both Eniosa and Kube respondents clears their surroundings. One hundred and forty one (57.3%) and 92(37.2%) of Eniosa and Kube respondents respectively would clear their surrounding bushes whenever it grows. Thirty three (13.4%) and 70(28.4%) respectively cleared bushes every week. Nine (3.7%) and 39(15.8%) in Eniosa and Kube respectively does so fortnightly. 52(21.1%) and 30(12.1%) respectively cleared their bushes occasionally while 11(4.5%) and 16(6.5%) of Eniosa and kube respectively never did at all.

Table 4.11 shows that respondents from both Eniosa and Kube kept domestic animals within the house for one reason or the other. 144(58.3%) and 125(51.0%) respondents from Eniosa and Kube respectively reared animals within and around the house. One hundred and three (41.7%) of respondents did not keep animals in Eniosa compared with 120(49.0%) of respondents from Kube that did not keep domestic animals. Seventeen (11.8%) and 34(27.2%) respondents from Eniosa and Kube respectively kept dogs and cats. Seventy seven (53.5%) and 51(40.8%) respondents of Eniosa and Kube respectively kept goats and sheep around the house while 50(34.7%) and 40(32.0%) respectively kept chickens.

Table 4.12 shows that Eniosa and Kube communities had an open drainage system near the house: Eniosa 85(34.4%) vs. Kube 145(58.9%). A total of 162(65.6%) and 101(41.1%) respondents in Eniosa and Kube respectively didn't have an open drainage close to the house. Respondents were asked how often they cleaned the open drainage system (Fig 4.8), some responded everyday Eniosa 19(24.4%) vs. Kube 33(23.9%), every week Eniosa 31(39.7%)

vs. Kube 31(22.5%), every fortnight: Eniosa11(14.1%) vs. Kube 8(5.8%), while some said every month: Eniosa 17(21.8%) vs. Kube 66(47.8%). Fig 4.10 shows that 44(17.9%) respondents in Eniosa used water closets as compared with 182(73.7%) respondents in Kube that had water closets toilets fitted to the house. A greater percentage 122(49.6%) of respondents in Eniosa made use of the bush as toilet against a negligible proportion 4(1.6%) of respondents in Kube community. Seventy (28.5%) and 46(18.6%) in Eniosa and Kube respectively used pit latrine.

Table 4.9 Pattern of refuse disposal facilities in both communities

Waste disposal	Eniosa (*N= 246) N (%)	Kube (*N= 247) N (%)
Heap in a place	106 (43.1)	34 (13.8)
Dust bin	69 (28.0)	157 (63.5)
Basket	62 (25.3)	36 (14.6)
Bucket	5 (2.0)	15 (6.1)
Calabash	4 (1.6)	5 (2.0)

*No responses were excluded

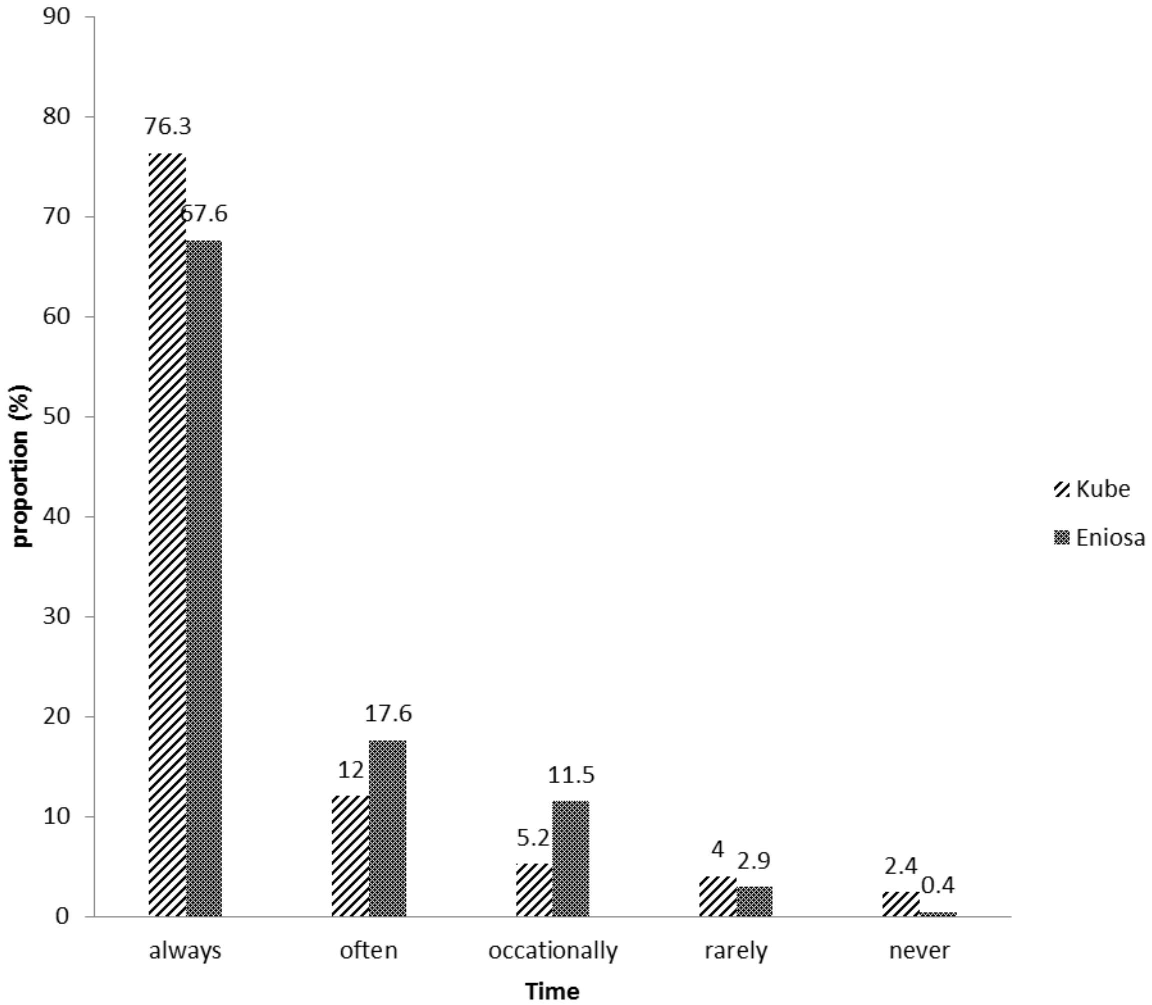


Fig 4.3 How often refuse is disposed by respondents

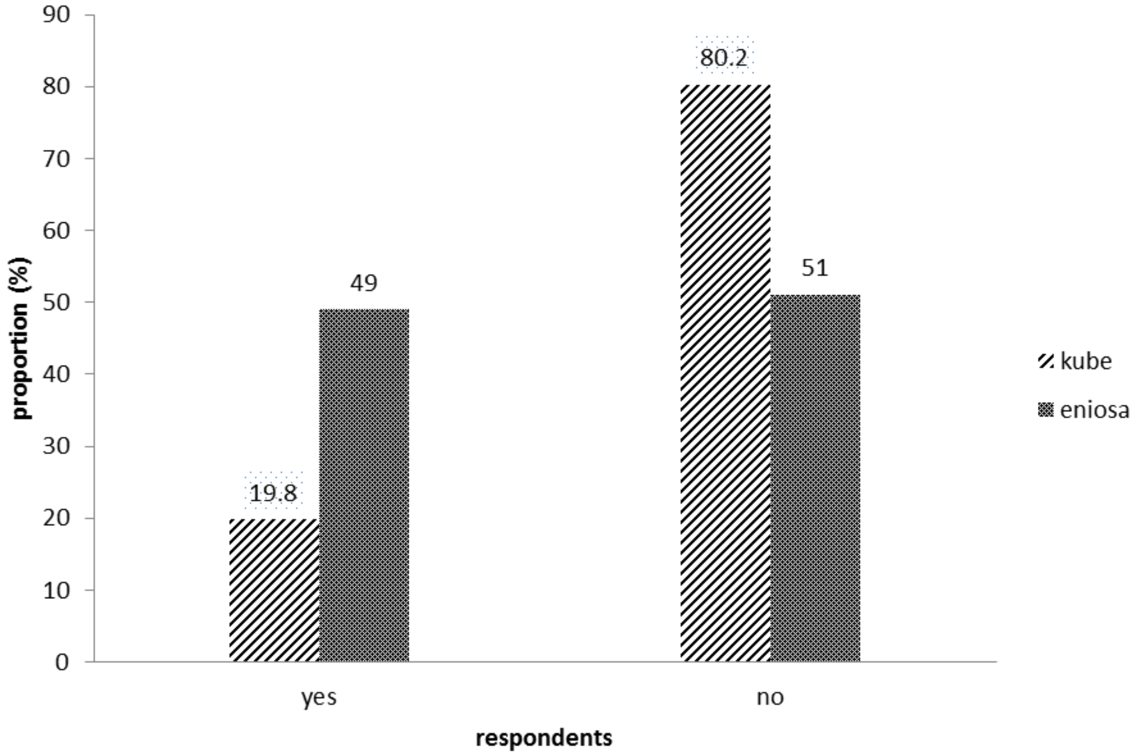


Fig 4.4 Respondents that engage in cassava processing within the house

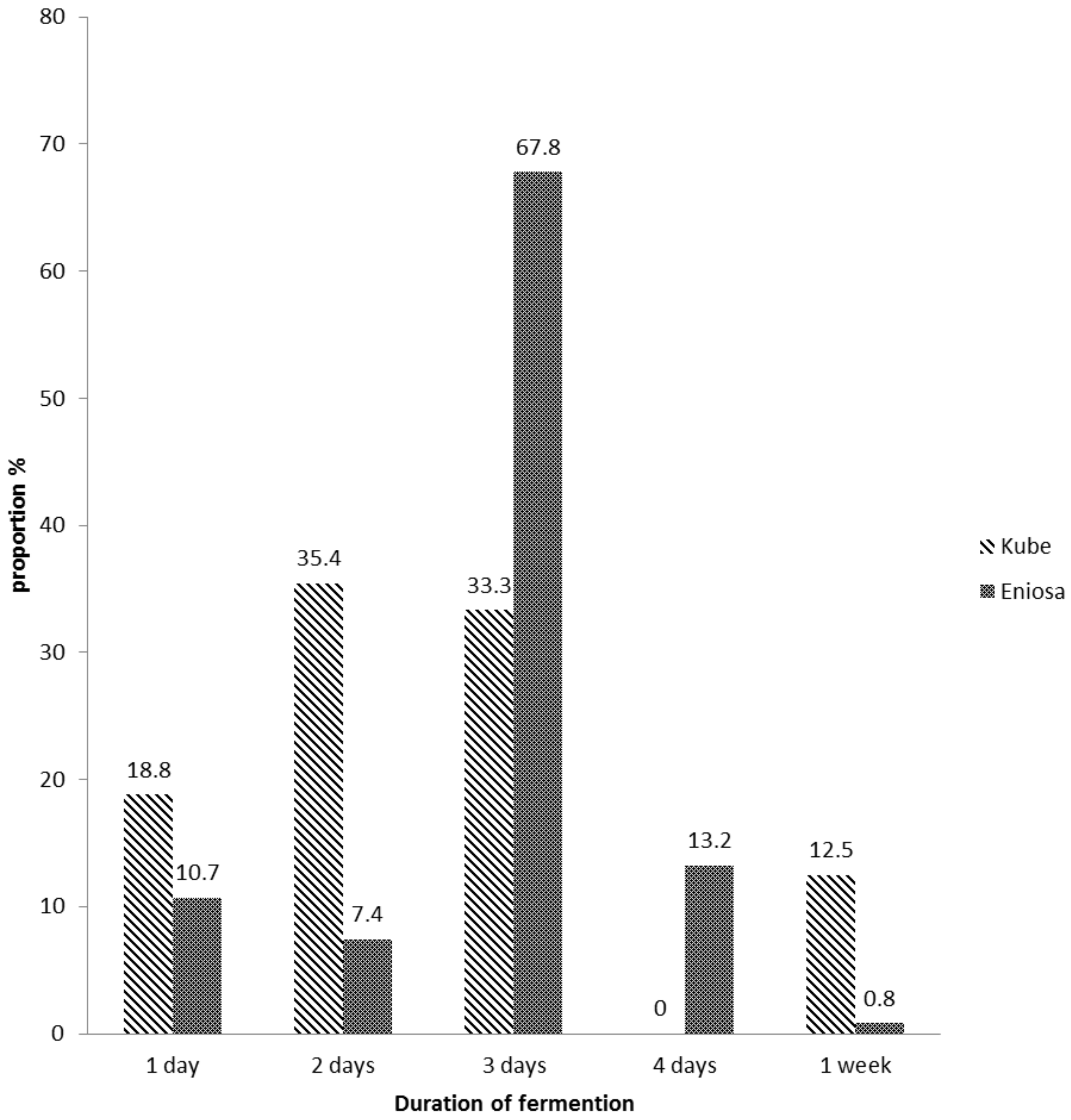


Fig 4.5 Number of Days cassava is left to ferment by respondents

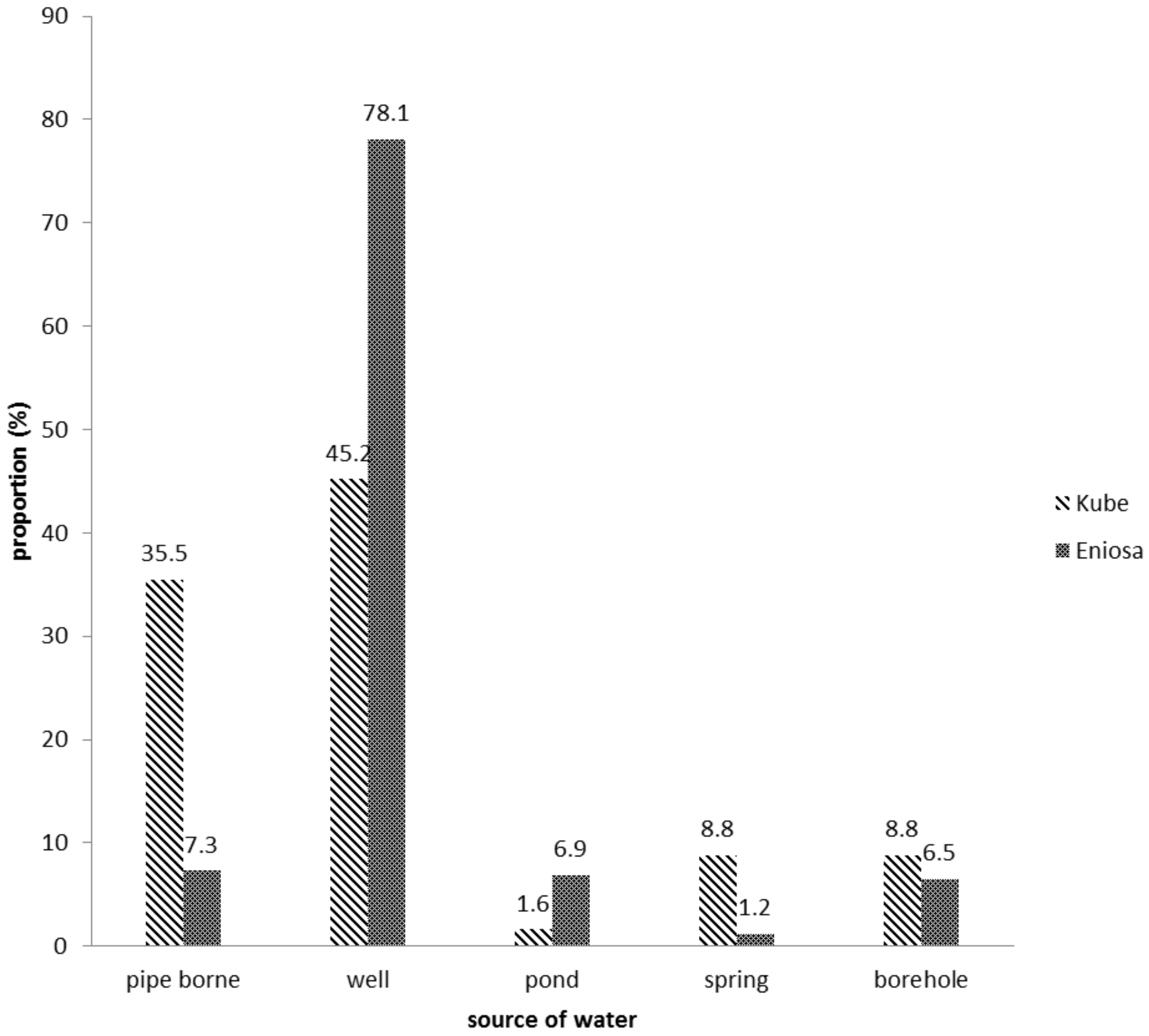


Fig 4.6 Respondents' sources of water supply

** Multiple responses allowed

Table 4.10 Pattern of water storage containers and nature of water supply used by respondents

Materials used to store water	**Eniosa (*N= 246) N (%)**	**Kube (*N= 247) N (%)**
Buckets	122 (49.6)	72 (29.1)
Local pot	25 (10.2)	10 (4.0)
Drum	51 (20.7)	69 (27.9)
Plastic tank	13 (5.3)	49 (19.8)
Keg	26 (10.6)	26 (10.5)
Open basin	4 (1.6)	13 (5.3)
Others**	5 (2.0)	8 (3.4)
Nature of water supply		***N= 249**
Fitted	88 (35.8)	128 (51.4)
Public	150 (61.0)	120 (48.2)
Neighbours	3 (1.2)	1 (0.4)
Others	5 (2.0)	0 (0.0)

*No responses were excluded

**Others: Calabash, metal tank

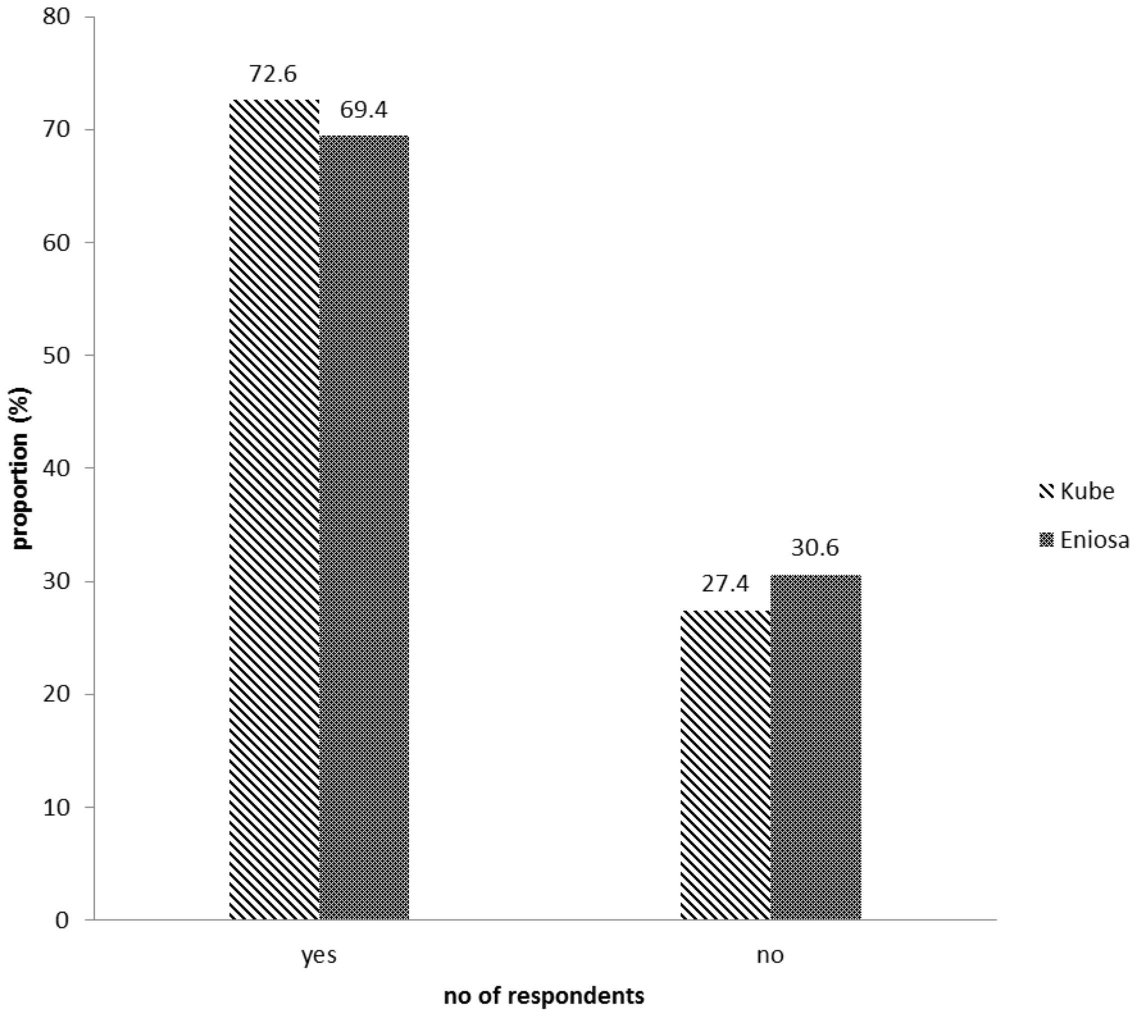


Fig 4.7: Number of respondents that kept their water containers covered

Table 4.11: Pattern of bush clearing behaviour of respondents

How often bush is cleared	Eniosa (*N= 246) N (%)	Kube (*N= 247) N (%)
Every week	33 (13.4)	70 (28.4)
Every fortnight	9 (3.7)	39 (15.8)
Occasionally	52 (21.1)	30 (12.1)
Whenever it grows	141 (57.3)	92 (37.2)
Never	11 (4.5)	16 (6.5)

*No responses were excluded

Table 4.12: Respondents who had open drainage close to the house

Open Drainage	Eniosa (*N= 247) N (%)	Kube (*N= 246) N (%)
Yes	85 (34.4)	145 (58.9)
No	162 (65.6)	101 (41.1)

*No responses were excluded

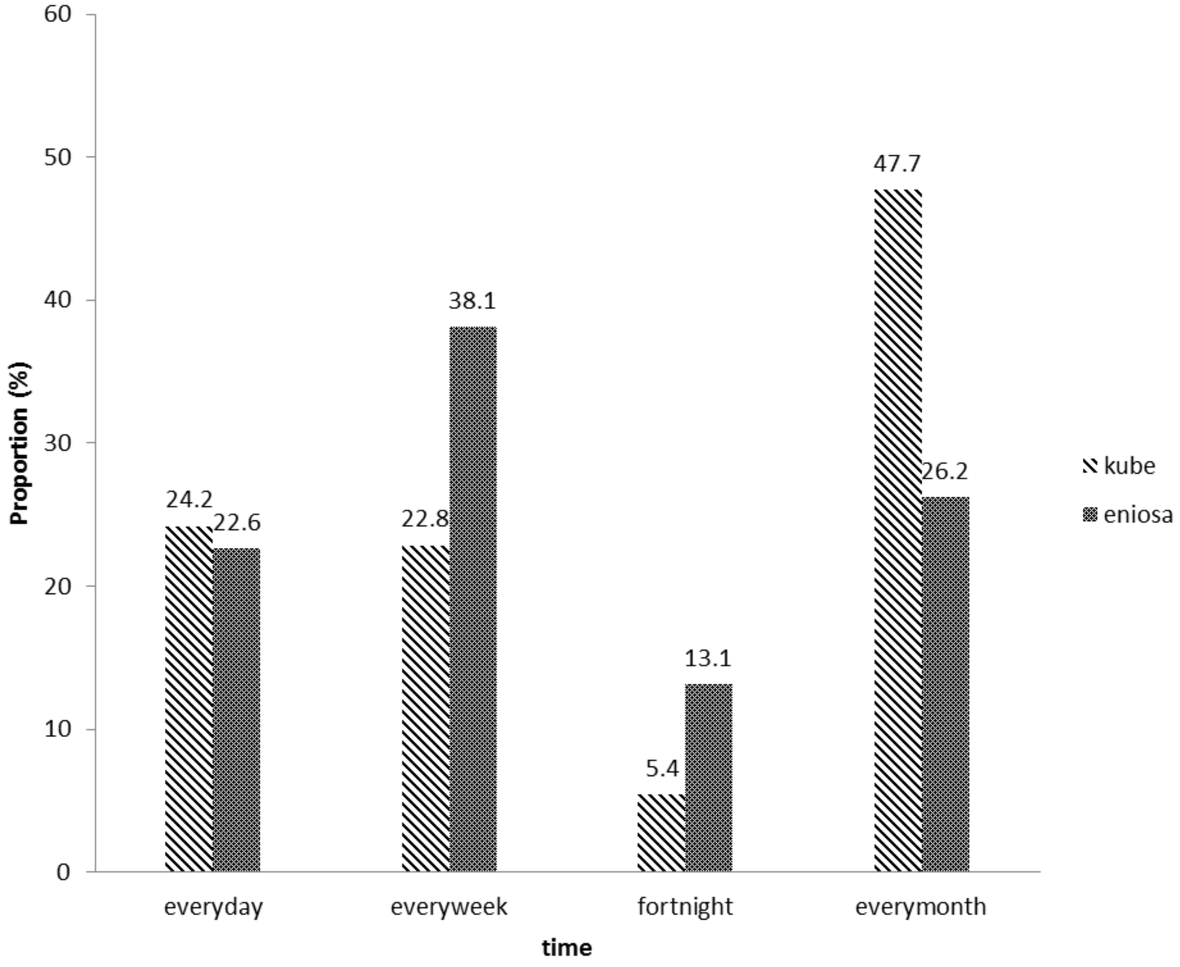


Fig 4.8 How often open drainage is cleaned

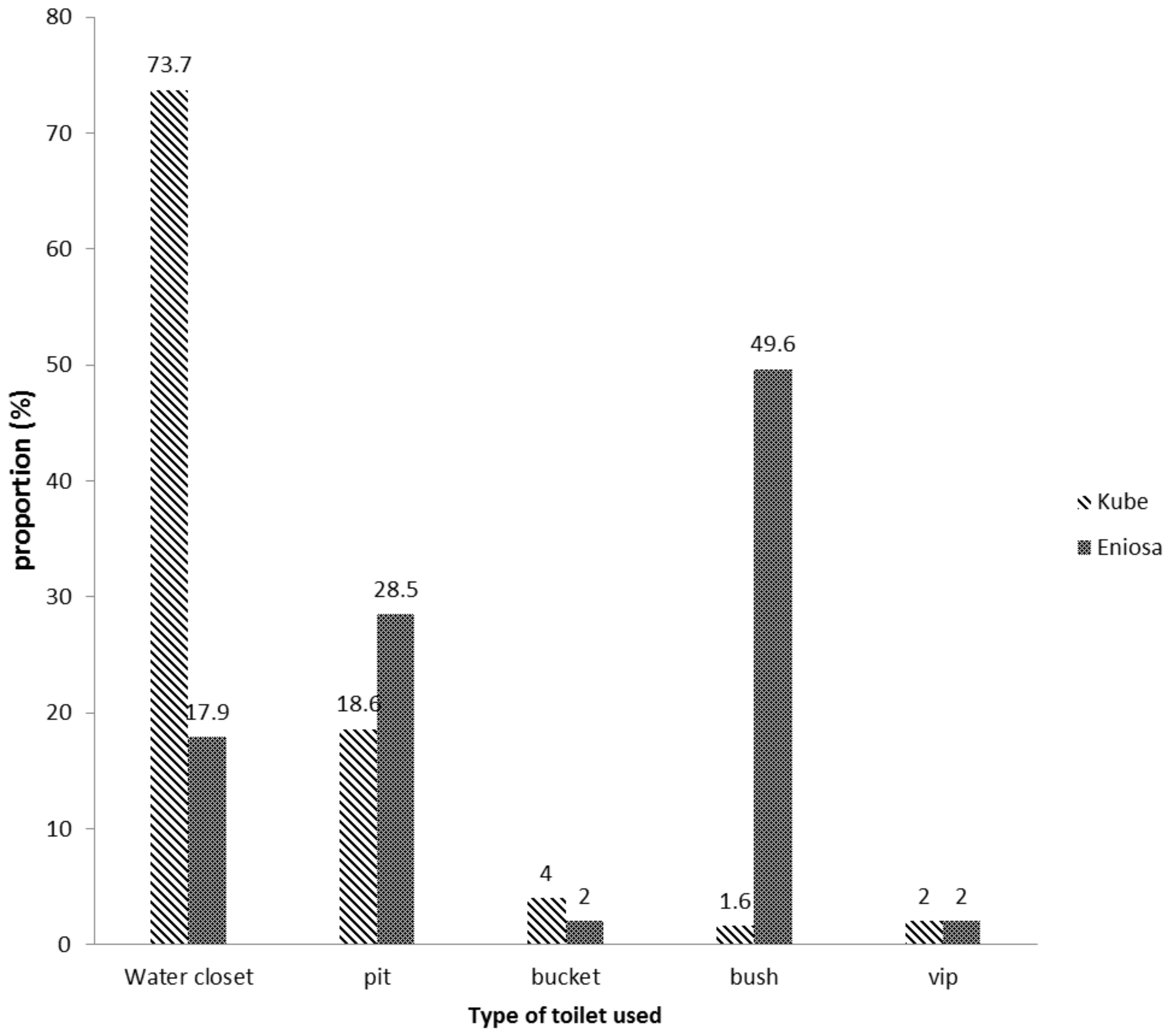


Fig 4.9 Type of toilets facilities used by respondents

4.5 Malaria Preventive measures used

Table 4.13 shows that the use of preventive measures against malaria parasite was common in both communities. The main preventive measures used were mosquito coils: Eniosa 80(34.6%) compared to Kube 40(18.3%), insecticide treated nets: Eniosa 47(20.3%) compared to Kube 69(31.7%), herbs: Eniosa 22(9.5%) compared to Kube 12(5.5%), insecticide aerosols: Eniosa 14(6.1%) compared to Kube 7(3.2%), environmental sanitation: Eniosa 13(5.6%) compared to Kube 18(8.3%), locally made insecticide (opanyan): Eniosa 9(3.9%) compared to Kube 12(5.5%) and antimalaria drugs: Eniosa 6(2.6%) compared to Kube 24(11.0%).

On the practice of malaria prevention measures, respondents were asked to categorize the measures they used to very effective, moderately effective and not effective (Table 4.14). It is worthy of note that respondents mentioned more than one preventive measures that they used. One hundred and fifty two (66.7%) respondents from Eniosa and 157(64.1%) from Kube reported that insecticide sprays are very effective, a total of 71(31.1%) Eniosa respondents compared to Kube 72(29.4%) said it was moderately effective while 5(2.2%) respondents in Eniosa and 16(6.5%) in Kube reported not effective.

On the effectiveness of use of insecticide treated nets, Eniosa 144(62.6%) vs. Kube 179(73.1%) reported very effective, Eniosa 69(30.1%) vs. Kube 53(21.6%) moderately effective and Eniosa 17(7.4%) vs. Kube 13(5.3%) said it was not effective. In response to the effectiveness of mosquito coils as a preventive measure, Eniosa 105(44.7%) vs. Kube 73(30.0%) said very effective, Eniosa 116(49.4%) vs. Kube 145(59.7%) said moderately effective and Eniosa 14(6.0%) vs. Kube 25(10.3%) said it was not effective.

Eniosa 184(80.0%) vs. Kube 142(59.2%) mentioned that the use of drugs was very effective, Eniosa 42(18.3%) vs.Kube 73(30.4%) said moderately effective and Eniosa 4(1.7%) vs. Kube 25(10.4%) said not effective. The respondents’ opinion was sought on the efficacy of burning cassava peels to prevent mosquito bites; Eniosa 27(11.6%) vs. Kube 38(15.5%) reported that it was very effective, Eniosa 63(27.0%) vs. Kube 57(23.3%) said moderately effective while Eniosa 143(61.4%) vs. Kube 150(61.2%) said it was not effective at all.

Table 4.13 Kinds of preventive measures used by respondents

Preventive Measure	Eniosa (*N= 231) N (%)	Kube (*N=218) N (%)
Mosquito coil	80 (34.6)	40 (18.3)
ITN	47 (20.3)	69 (31.7)
Opaayan	9 (3.9)	12 (5.5)
Herbs	22 (9.5)	12 (5.5)
Antimalaria drugs	6 (2.6)	24 (11.0)
Environmental sanitation	13 (5.6)	18 (8.3)
Insecticide	14 (6.1)	7 (3.2)
Nothing	32 (13.9)	13 (6.0)
Others**	8 (3.5)	23 (10.5)

*****No responses were excluded
******Others: Otapiapia, Windows and door nets, Keeping window and door locked, medical check up
***Multiple responses were allowed

Table 4.14 Perceived effectiveness of malaria prevention measures by respondents

	Eniosa (%)			Kube (%)		
Preventive measures	**Effective**	**Somewhat effective**	**Not effective**	**Effective**	**Somewhat effective**	**Not effective**
Environmental Sanitation	61.4	36.9	1.7	39.3	42.2	18.4
Door screening	9.1	65.3	25.6	11.2	55.8	33.1
Window screening	11.1	63.6	25.3	8.5	70.7	20.7
Physical killing	12.5	50.4	37.1	16.7	44.1	39.2
Burning cassava leaves	11.6	27.0	61.4	15.5	23.3	61.2
Medicinal herbs	42.0	38.8	19.2	22.3	47.1	30.6
Use of drugs	80.0	18.3	1.7	59.2	30.4	10.4
Mosquito coil	44.7	49.4	6.0	30.0	59.7	10.3
Ordinary net	26.4	56.8	16.8	14.2	55.3	30.5
ITN	62.6	30.0	7.4	73.1	21.6	5.3
Insecticide spray	66.7	31.1	2.2	64.1	29.4	6.5

4.6 Relationship between health conditions and malaria treatment practices

Respondents were asked about their past health history and management of the disease. Eniosa 242(99.2%) respondents have had malaria while 242 (98.0%) of Kube respondents have also experienced malaria sickness. Respondents were then asked how they recognised and confirm they had malaria, more than one response were given in some cases. Eniosa 42(17.4%) vs. Kube 90(37.2%)) confirmed through medical tests, Eniosa 65(26.9%) vs. Kube 37(15.3%) affirmed through a community health worker, Eniosa 2(0.8%) vs. Kube 6(2.5%) through a traditional healer, Eniosa 36(14.9%) vs. Kube 45(18.6%) recognised through a family member and some Eniosa 106(43.8%) vs. Kube 82(33.9%) said they recognized the disease themselves (Table 4.15).

As shown in Table 4.16 respondents were asked what symptoms they experienced that suggested they had malaria and the responses were aching joints, Eniosa 34(14.0%) vs. Kube 46(19.0%), high body temperature, Eniosa 175(72.3%) vs. Kube 185(76.4%), shivering, Eniosa 35(14.5% vs. Kube 63(26.0%), headache, Eniosa 160(66.1%) vs. Kube 105(43.4%), anaemia, Eniosa 11(4.5%) vs. Kube 10(4.1%), vomiting, Eniosa 13(5.4%) vs. Kube 22(9.1%), diarrhea, Eniosa (0%) vs. Kube 1(0.4%), loss of appetite, Eniosa 31(12.8%) vs. Kube 20(8.3%) and fatigue, Eniosa 38(15.7%) vs. Kube 49(20.2%).

Respondents gave different period of time that the sickness lasted. (Table 4.17) Eniosa 141(60.5%) vs. Kube 117(52.9%) said the sickness lasted for less than one week, Eniosa 60(25.8%) vs. Kube 66(29.9%) said it only lasted one week while Eniosa 32(13.7%) vs. Kube 38(17.2%) said they had the sickness for more than one week.

They were then asked whether any treatment was sought for the malaria disease and how long they noticed symptoms (Table 4.17). Eniosa 236(97.5%) vs. Kube 234(96.7%) responded that they sought for treatment while Eniosa 6(2.5%) vs. Kube 8(3.3%) did not seek for treatment. Eniosa 67(28.5%) vs. Kube 42(18.3%) sought for treatment the same day; Eniosa 88(37.4%) vs. Kube 89(38.6%) did so the next day, Eniosa 49(20.9%) vs. Kube 72(31.3%) did so two days later and Eniosa 28(11.6%) vs. Kube 20(8.4%). Eniosa 4(1.7%) vs. Kube 8(3.5%) could not remember when they actually sought for the treatment.

The respondents were further asked what type of treatment they sought, Eniosa 23(9.6%) vs. Kube 26(10.8%) said they used self-medication, Eniosa 47(19.6%) vs. Kube 73(30.3%) visited the general hospital, Eniosa 77(32.1%) vs. Kube 40 (16.6%) went to the primary health centre and Eniosa 40(16.7%) vs. Kube 93(38.6%) said they went to the chemist (Table 4.18).

As shown in Table 4.19, the respondents gave account of using different drugs and medications like artemisin combination therapy Eniosa 52(21.8%) vs. Kube 79(32.9%), chloroquine, Eniosa 90(37.9%) vs. Kube 44(18.3%), fansidar, Eniosa 10(4.2%) vs. Kube 30(12.4%), coartem, Eniosa 7(2.9%) vs. Kube 19(7.9%), herbal treatment, Eniosa 22(9.2%) vs. Kube 10(4.1%), paracetamol, Eniosa 29(12.2%) vs. Kube 22(9.1%) and antibiotics, Eniosa 5(2.1%) vs. Kube 19(7.9%). Fig 4.8 shows that 208(86.3%) of kube respondents said the drugs were effective when it was used while 33(13.7%) said it wasn't effective. On the other hand 223(92.9%) respondents at Eniosa said the drugs were effective while only 17(7.1%) responded that they were not effective.

Fig 4.11 shows that 236(97.9%) and 214(87.3%) of respondents in both Eniosa and Kube never heard nor had knowledge about integrated vector management against a negligible of 5(2.1%) and 31(12.7%) in Eniosa and Kube respectively that had heard of integrated vector management. As shown in Fig 4.12, 75(31.1%) and 71(29.0%) of Eniosa and Kube respondents respectively have had malaria fever episodes in the last 3 months before the study. One hundred (41.2%) and 112(45.3%) respondents respectively from both Eniosa and Kube communities have had a member of their household came down with malaria in the last 3 months.

Respondent's opinion was sought on who should carry out malaria control in the community. According to Table 4.20, Eniosa 56(23.1%) vs. Kube 30(12.2%) said government agencies only, Eniosa 7(2.9%) vs. Kube 13(5.3%) said private agencies, Eniosa 18(7.4%) vs. Kube 30 (12.2%) said it was the duty of the general public, Eniosa 119(49.2%) vs. Kube 127(51.6%) said it was both the government and private cooperation while Eniosa 42(17.4%) vs. Kube 46(18.7%) didn't have any idea who should carry out malaria control.

Table 4.15 Common methods of malaria diagnosis by respondents

	Eniosa (*N= 242) N (%)		Kube (*N= 242) N (%)	
Methods	Yes	No	Yes	No
Medical test	42 (17.4)	200 (82.6)	90 (37.2)	152 (62.8)
Community health worker	65 (26.9)	177 (73.1)	37 (15.3)	205 (84.7)
Traditional healer	2 (0.8)	240 (99.2)	6 (2.5)	236 (97.5)
Family member	36 (14.9)	206 (85.1)	45 (18.6)	197 (81.4)
Self-recognition	106 (43.8)	136 (56.2)	82 (33.9)	160 (66.1)

*No responses were excluded

Table 4.16 Respondents reported symptoms of malaria

Symptoms of malaria**	Eniosa (*N= 242) N (%)	Kube (*N= 242) N (%)
Aching joints	34 (14.0)	46 (19.0)
High body temperature	175 (72.3)	185 (76.4)
Shivering	35 (14.5)	63 (26.0)
Convulsions	1(0.4)	5(2.1)
Headache	160 (66.1)	105 (43.4)
Anaemia	11 (4.5)	10 (4.1)
Vomiting	13 (5.4)	22 (9.1)
Diarrhoea	0 (0.0)	1 (0.4)
Loss of appetite	31 (12.8)	20 (8.3)
Fatigue	38 (15.7)	49 (20.2)

*No responses were excluded

**Multiple responses allowed

Table 4.17 Duration of sickness and treatment seeking behaviour of respondents

Duration of sickness	**Eniosa** **N (%)**	**Kube** **N (%)**
< one week	141 (60.5)	117 (52.9)
One week	60 (25.8)	66 (29.9)
>One week	32 (13.7)	38 (17.2)
How long treatment was sought after malaria symptoms		
Same day	67 (28.5)	42 (18.3)
Next day	88 (37.4)	89 (38.6)
Two days after	49 (20.9)	72 (31.3)
Three days or more	27 (11.5)	19 (8.3)
Can't remember	4 (1.7)	8 (3.5)

*No responses were excluded

Table 4.18 Malaria management methods by respondents

Sources of treatment	Eniosa N (%)	Kube N (%)
Self-medication	23 (9.6)	26 (10.8)
General hospital	47 (19.6)	73 (30.3)
Primary health care centre	77 (32.1)	40 (16.6)
Chemist	40 (16.7)	93 (38.6)
Community health worker	45 (18.8)	3 (1.2)
Others**	8 (3.3)	6 (2.4)

*No responses were excluded

**Others: Neighbour, Kiosk/Shop, Herbalist

***Multiple responses allowed

Table 4.19 Kinds of medications received by respondents for malaria

Treatment drugs	Eniosa N (%)	Kube N (%)
Artesunate/artemisin Combination	52 (21.8)	79 (32.9)
Chloroquine	90 (37.9)	44 (18.3)
Fansidar	10 (4.2)	30 (12.4)
Quinne	10 (4.2)	13 (5.4)
Coartem	7 (2.9)	19 (7.9)
Herbal	22 (9.2)	10 (4.1)
Paracetamol	29 (12.2)	22 (9.1)
Antibiotics	5 (2.1)	19 (7.9)
Others	13 (5.5)	5 (2.0)

***No responses were excluded

Others: Injection, Promolar, Amalar

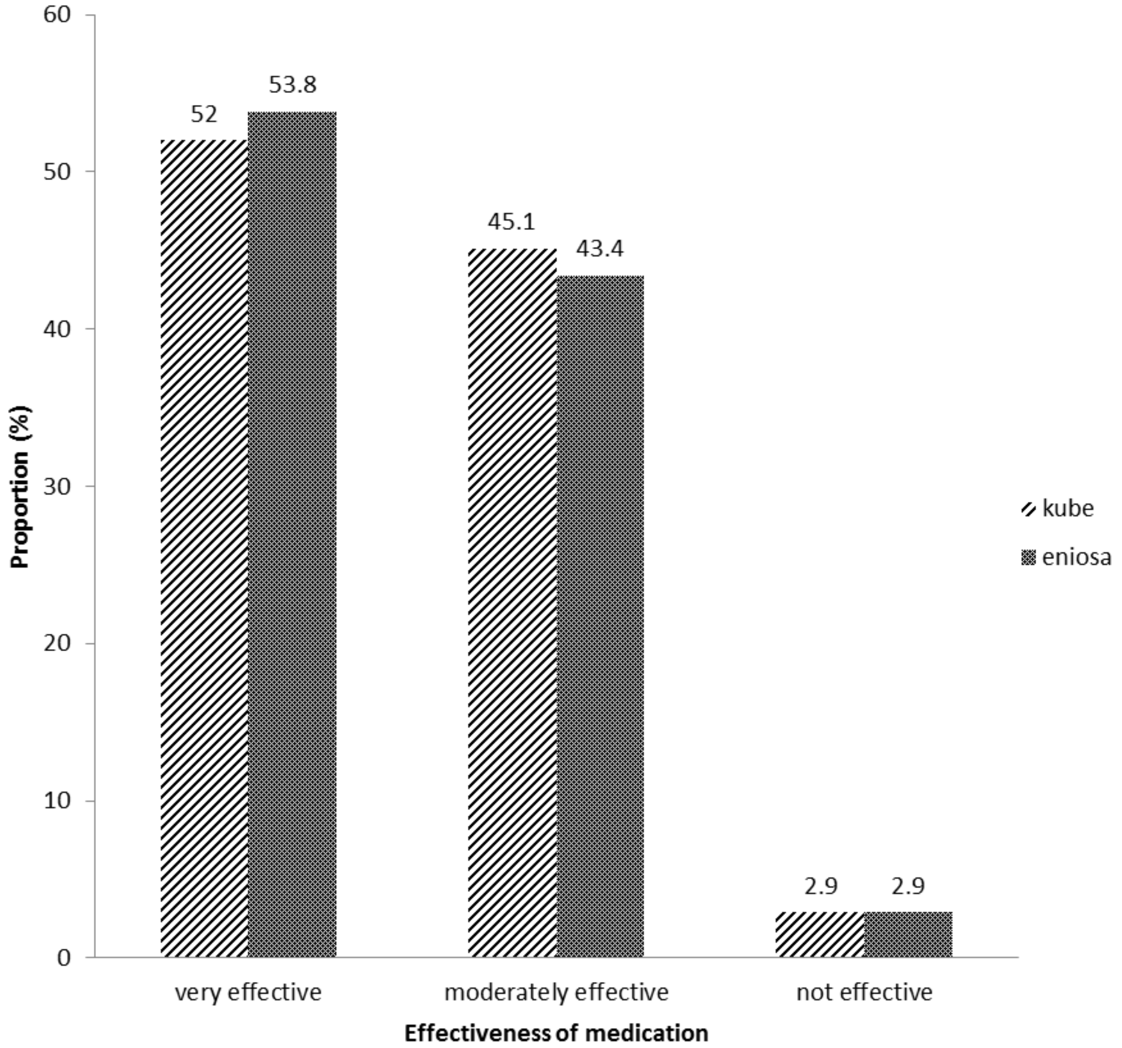


Fig 4.10 Level of effectiveness of the drugs used

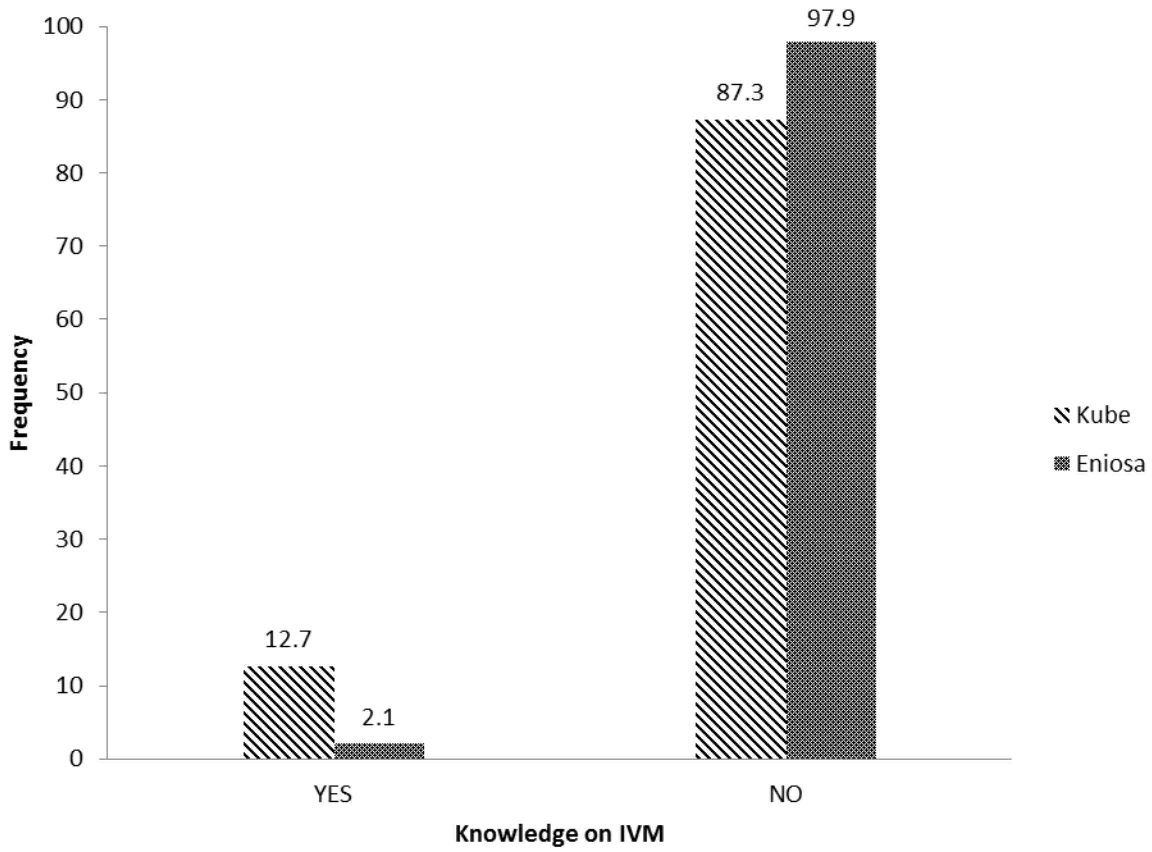


Fig 4.11 Knowledge of respondents integrated vector management

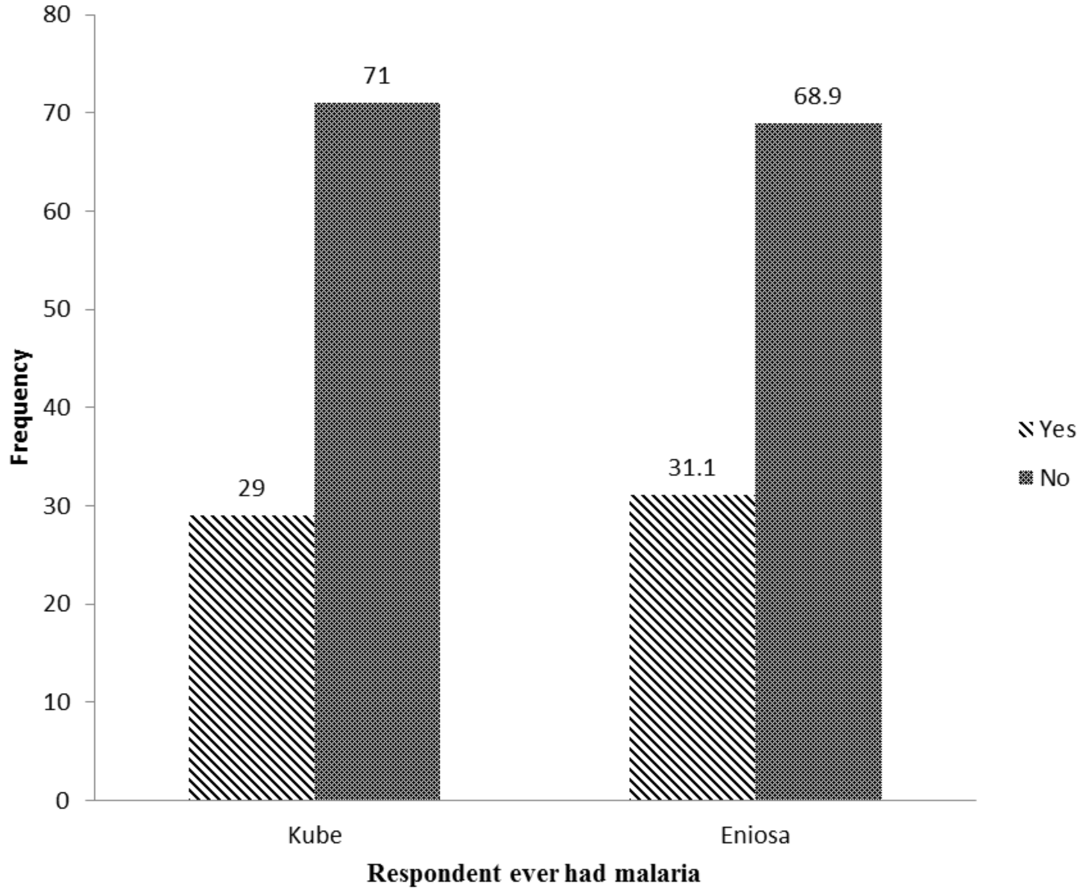


Fig 4.12 No of respondents that has ever had malaria in last 3 months

Table 4.20 Perception of respondents on who should be responsible for environmental sanitation

Responsible body	**Eniosa (*N= 242) N (%)**	**Kube (*N= 246) N (%)**
Government agencies only	56 (23.1)	30 (12.2)
Private	7 (2.9)	13 (5.3)
General Public	18 (7.4)	30 (12.2)
Government and private Corporations	11 (49.2)	127 (51.6)
No idea	42 (17.4)	46 (18.7)

***No responses were excluded**

4.7 Influence of domestic practices that encourages prevalence of malaria

The influence of malaria risk factors in Eniosa and Kube is shown in Table 4.21. The chi-square test shows that improper waste disposal, overgrown bushes and cassava processing within and around the house were established and found to be significant, (p=0.05).

Tables 4.22 and 4.23 present the association between presence of mosquito breeding sites and parasiteamia in Eniosa and Kube communities. The presence of dumpsite and overgrown bushes had significant association with malaria prevalenc ($p<0.05$). In Eniosa 71.7% of respondents who were positive for the malaria parasite had dumpsites around their houses while 64.1% of Kube respondents had dumpsites around their houses. Overgrown bushes were observed around houses of respondents who tested positive to the malaria parasite in Eniosa (71.7%) and Kube (66.7).

Logistic regression analysis showed that in Eniosa, respondents who had dumpsites around their houses were 4 times more likely to have malaria than those who did not. (CI = 1.896-10.040, P = 0.000). And in Kube, respondents who had dumpsites around their houses were 2 times more likely to have malaria than those who had no dumpsite around their houses. (CI = 0.982-5.076, P = 0.053). Those who had overgrown bushes around their houses in Eniosa were 3 times more likely to have malaria than those who did not. (CI = 1.609-8.388, p = 0.002). Respondents whose houses had overgrown bushes in Kube were 2 times more likely to have malaria than those who did not. (CI = 1.023-5.37, p = 0.042).

Table 4.21 Univariate analysis of practices that encouraged malaria

Risk factors	Eniosa	Kube	chi-square	p-value
Poor drainage				
Yes	48 (44.4)	60 (55.6)	1.52	0.22
No	199 (51.2)	190 (48.8)		
Improper disposal Of waste				
Yes	65 (42.5)	88 (57.5)	4.60	0.03
No	182 (52.9)	162 (47.1)		
Overgrown bushes				
Yes	104 (65.0)	56 (35.0)	22.10	<0.001
No	143 (42.4)	194 (57.6)		
Stagnant water				
Yes	77 (44.4)	95 (55.6)	2.87	0.09
No	171 (52.5)	155 (47.5)		
Open water storage Containers				
Yes	170 (48.6)	180 (51.4)	0.61	0.44
No	75 (52.4)	68 (47.6)		
Cassava processing				
Yes	121 (71.6)	48 (28.4)	45.94	<0.001
No	126 (39.4)	194 (60.6)		
Domestic animals				
Yes	144 (53.5)	125 (46.5)	2.63	0.11
No	103 (46.2)	120 (53.8)		

Table 4.22 Relationship between risk factors and malaria prevalence using microscopy method for Eniosa

Breeding sites	parasitaemic N (%)	Non parasitaemic N (%)	Chi-Square	p-value
Blocked drainage				
Absent	16 (30.2)	22 (44.9)	1.884	0.125
Present	37 (69.8)	27 (55.1)		
Overgrown bushes				
Absent	15 (28.3)	29 (59.2)	3.673	0.002
Present	38 (71.7)	20 (40.8)		
Ground Pool				
Absent	17 (32.1)	29 (59.2)	3.071	0.005
Present	36 (67.9)	20 (40.8)		
Discarded tyres				
Absent	13 (24.5)	36 (73.5)	8.521	0.000
Present	40 (75.5)	13 (26.5)		
Cans and containers				
Absent	22 (41.5)	16 (32.7)	0.683	0.355
Present	31 (58.5)	33 (67.3)		
Open buckets				
Absent	19 (35.8)	25 (51.0)	1.864	0.122
Present	34 (64.2)	24 (49.0)		
Dumpsite				
Absent	15 (28.3)	31 (63.3)	4.363	0.000
Present	38 (71.7)	18 (36.7)		
Pit latrine				
Absent	18 (34.0)	29 (59.2)	2.819	0.011
Present	35 (66.0)	20 (40.8)		
Bush attack				
Absent	24 (45.3)	26 (53.1)	1.366	0.432
Present	29 (54.7)	23 (46.9)		

Table 4.23 Relationship between risk factors and malaria prevalence using microscopy method for Kube

Breeding sites	parasitaemic N (%)	Non parasitaemic N (%)	Chi-Square	p-value
Blocked drainage				
Absent	5 (12.8)	29 (46.0)	5.800	0.001
Present	34 (87.2)	34 (54.0)		
Overgrown bushes				
Absent	13 (33.3)	34 (54.0)	2.345	0.042
Present	26 (66.7)	29 (46.0)		
Pool				
Absent	9 (23.1)	28 (44.4)	2.667	0.029
Present	30 (76.9)	35 (55.6)		
Discarded tyres				
Absent	8 (26.3)	32 (50.8)	2.065	0.029
Present	26 (66.7)	31 (49.2)		
Cans and containers				
Absent	14 (35.9)	36 (57.1)	2.381	0.037
Present	25 (64.1)	27 (42.9)		
Open buckets				
Absent	12 (33.3)	30 (46.0)	1.706	0.205
Present	29 (67.7)	34 (54.0)		
Dumpsite				
Absent	10 (12.7)	39 (55.6)	2.232	0.053
Present	17 (45.7)	28 (27.5)		
Pit latrine				
Absent	9 (23.1)	30 (47.6)	3.030	0.013
Present	30 (76.9)	33 (52.4)		
Bush attack				
Absent	16 (41.0)	36 (57.1)	1.917	0.114
Present	23 (59.0)	27 (26.5)		

4.8 Observations made in the communities

The level at which the environment contributed to the risk of malaria transmission in the communities, environmental quality around the households were observed. The environments in both communities were conducive for mosquito breeding. Most of the houses in Eniosa were mud houses and surrounded with bushes (Plate 4.1). Stagnant pools of water and poor drainage were observed 67.9% and 68.8 in Eniosa, and 76.9% and 87.2% in Kube.

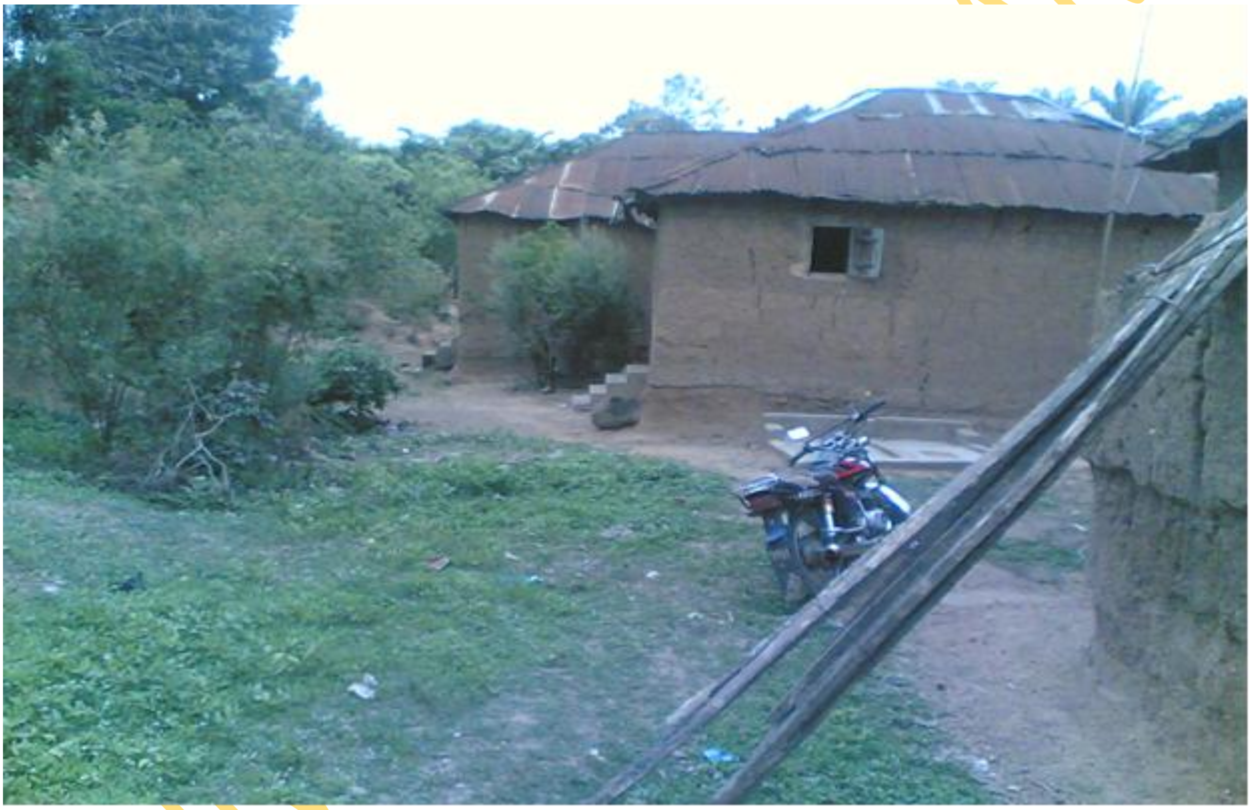


Plate 3.4 Overgrown bushes around households in Eniosa, the rural area

Table 4.24 Report of on-site observations

Environmental sanitation	Eniosa	Kube
Indicators	Present	Absent
Poor/blocked drainages	++	+++
Overgrown bushes	+++	+
Stagnant pool of water	+++	++
Housing conditions		
Mud Houses	+++	+
Open roofs	+++	+
Broken doors and windows	+++	+++
Solid waste management		
Dump site	+++	++
Incinerator	+	++
Open burning	+++	++
Refuse bins	++	++
Pit dumping	++	+
Sanitary conditions		
Pit latrine	+++	++
Septic tank	+	++
Bush attack	+++	++
Water facility		
Tap	+	++
Well	+++	+++
Spring	+	+
Bore hole	+	++
Environmental sanitation		
Cans and containers	++	+++
Discarded pots	+++	++
Discarded tyres	+++	++
Ground pools	++	++
Water storage facilities		
Open buckets	+++	+++
Drums	+	++
Open pots	++	+
Covered pots	+++	+

KEY

1-<30% Present = +

30-50% Moderately present = ++

<50% Highly present = +++

Plate 3.5: A poor bathroom facility in the rural

Plate 3.6: A feature of stagnant pool of water

Plate 3.7: Ground pool in Kube, the urban area

Plate 3.8: A feature of poor water storage within the house in Eniosa, the rural area

Plate 3.9: Poor pit toilet facility in a house

Plate 3.10: A dumpsite located within the urban community

4.9 Indoor mosquito sampling

The species observed were *Anopheles gambiae*, *Culex, aedes* and *Mansonia africana.* Culex was the most abundant species in both communities throughout the sampling period except in the latter part of the month March where *Anopheles gambiae* was the most predominant in Eniosa.

The total mosquito abundance observed in the houses sampled in Eniosa was 299 while Kube had total mosquito abundance of 310. *Anopheles gambiae* was 177, *Culex* species was 355, Aedes 48 and Mansonia 25 in both communities. In Eniosa, the total *Anopheles gambiae* observed within the sampling period was 130, *Culex* was 120, Aedes was 35 and *Mansonia africana* was 14.

In kube, the total *Anopheles gambiae* observed within the sampling period was 47, *Culex* was 234, *Aedes* was 17 and *Mansonia africana* was 11. For Eniosa, the mean mosquito count in each household was 7.3±3.3 while the mean mosquito count in each household for Kube was 7.7 ±4.2.

Table 4.25 Total mosquito abundance throughout the sampling period

Mosquito species	Eniosa	Kube	Total
Anopheles gambiae	130	47	177
Culex	120	235	355
Aedes	35	17	52
Mansonia africana	14	11	25

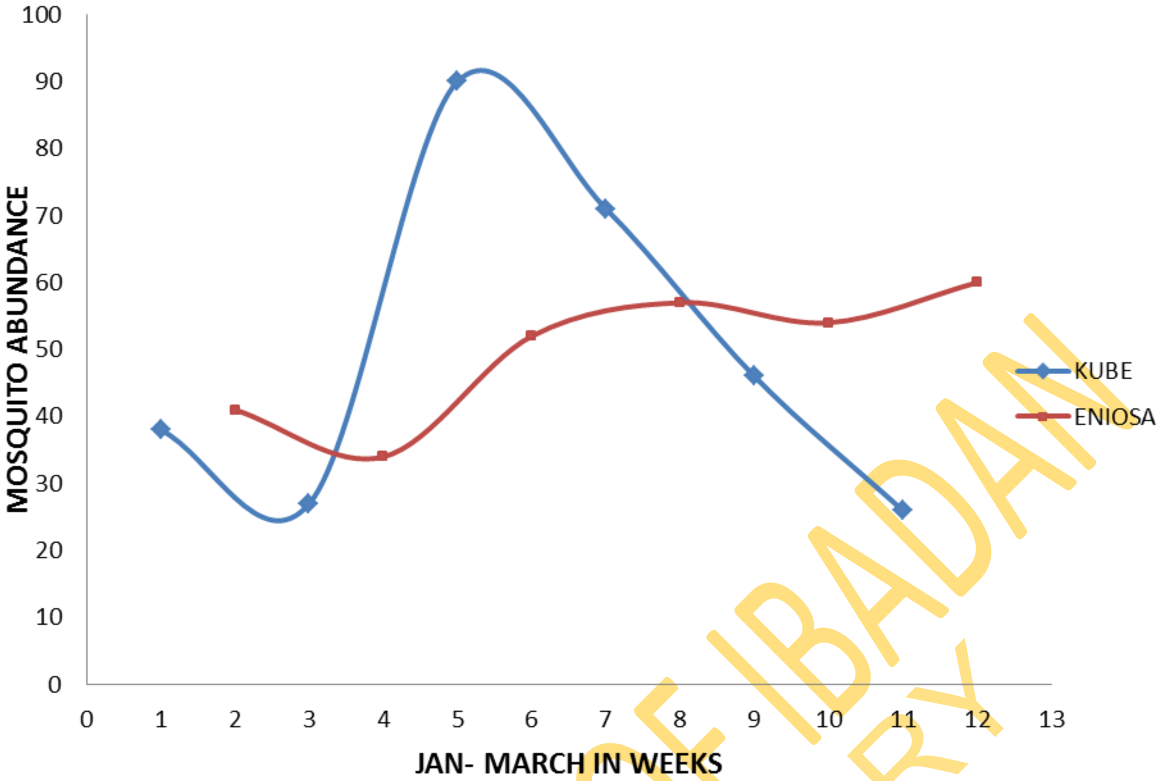


Fig 4.13: Weekly variation of mosquito abundance in the study communities

4.10 Malaria Screening

4.10.1 Microscopy test results

Eniosa participants had the highest proportion of malaria infection having 53(52.9%) with positive status during the sampling period compared to Kube which had 39(38.2%). Forty nine (47.1%) of participants in Eniosa tested negative compared to 63(61.8%) of Kube participants that tested negative to malaria falciparum using the microscopy method.

4.10.2 Rapid Diagnostic Test results

Of the 102 participants that were tested in Eniosa and Kube using the RDT, 58(56.9%) and 45(44.1%) tested positive to malaria falciparum. Forty four (43.1%) of the women tested in Eniosa were negative compared to 57(55.9%) that were negative in Kube.

Table 4.26 Respondents screened for malaria using Microscopy

Communities	No examined	Infected N (%)	Not infected N (%)	Prevalence
Eniosa	102	53 (52.0)	49 (48.0)	51.8
Kube	102	39 (38.2)	63 (61.8)	37.4

Table 4.27 Respondents screened for malaria using rapid diagnostic kits

Communities	No examined	Infected N (%)	Not infected N (%)	Prevalence
Eniosa	102	58 (56.9)	44 (43.1)	55.7
Kube	102	45 (44.1)	57 (55.9)	43.2

Table 4.28 **Monthly Meteorological data on Rainfall, Temperature and Humidity**

Data	January	February	March	Average
Rainfall (mm)	10.05	33.75	24.60	22.80
Minimum Temp (°c)	650	660.30	717.10	675.80
Maximum Temp (°c)	1007.50	948	1053.10	1002.87
Minimum Relative Humidity (%)	1044	1135	1313	1164
Maximum Relative Humidity (%)	2708	2568	2803	2693

Source: IITA, Ibadan (2009)

CHAPTER FIVE

DISCUSSION

The results of this study are organized and presented covering following sections; socio demographic characteristics of participants, knowledge of women on malaria transmission and control, practices of women to malaria prevention, domestic practices that encouraged prevalence of malaria, relationship between vector abundance and risk factors, mosquito abundance and malaria prevalence.

5.1 Socio demographic characteristics of study participants

A total of 250 women of child bearing age in both communities participated in the study. The age, marital status, religion revealed similar trend among both the urban and rural women. The total mean age of the women was 27.2±7.4 years. This shows that majority of them were at their reproductive age. Majority of the women were predominantly of Yoruba origin due to the fact that the study sites are predominantly Yoruba in the communities. Kube and Eniosa communities comprise predominantly Muslims and Christians. Considering the level of education, majority had secondary education, followed by tertiary education in the urban area and the least was primary or no formal education at all. In the rural area many of the women had no formal education followed by primary and secondary education.

Majority of the women are farmers, traders and artisans in both communities. This survey shows that only 6.7% of the rural respondents earned more than 10,000 monthly but it is sufficed to note that the respondents always felt reluctant in disclosing their actual income. 65.9% of the respondents earned less than N5, 000 per month which have implication on level of expenditure on malaria preventive measures by the individual respondents. The variation in income was as a result of the variation in their occupation and status. This implies poor health and poor sanitation in the unplanned environment due to their low purchasing power.

5.2 Knowledge of women on malaria transmission and control

The women had the knowledge that malaria locally referred to as “Iba”, meaning high fever was a dangerous disease and could cause complications if severe or not treated, however, their knowledge about causation was poor. The mean knowledge score on malaria among respondents in the urban area (6.70 ± 2.3) was significantly higher than (6.19 ±1.9) obtained by respondents in the rural area. A similar result was obtained from the wet season study conducted earlier in the two communities Adekolu A. Some of the women listed that eating too much palm oil, working in the sun and polluted air as causes of malaria. The low level of knowledge among the respondents relating to the causation or mode of transmission of malaria could increase the prevalence of malaria. Despite the 58% of people that associated malaria transmission with mosquito bites efforts were not made to tackle the environmental health conditions and practices which promote the occurrence of malaria. Misconceptions were also common in those respondents who recognized the role of mosquito in the chain of malaria transmission. Stagnant water was mentioned as the main areas for mosquito breeding by 38% of respondents in the urban community compared to 30.8% in the rural community.

In Ghana, it has been reported that malaria is presumed to be caused by excessive heat and eating oily or starchy food (Ahorlu et al, 1997; Agyepong & Manderson, 1999; Agyepong & Manderson, 1994). In Uganda, malaria is believed to be caused by poor diet and exposure to bad environmental conditions (Kengeya-Kayondo et al, 1994). People's perceptions and understandings about the perceived cause and transmission of malaria have strong implications on the preventive measures such as the current scale-up ITNs implementation (Ahorlu et al, 1997; Agyepong & Manderson, 1999).

In the two communities studied, several factors, such as the myth and misconceptions surrounding its cause contribute to its scourge. Overall, there were 42.4% incorrect responses on malaria transmission. Similar responses were also reported in rural areas of West Africa (Idowu et al, 2008; Oguonu et al, 2005; Clemence et al, 2008).

5.3 Practices of women to malaria prevention

The respondent's attitude towards malaria as a disease is important in understanding their health seeking behaviour and use of preventive methods. This study showed that the communities regarded malaria as a dangerous disease that can kill. Therefore majority of them sought for treatment when they had malaria while a small proportion did not seek for treatment (Rural 2.1% and Urban 3.6%)). It is worthy of note that the women sought for care at different periods after they noticed the symptoms of malaria fever. The results of this study indicated that over 70% of the respondents have had malaria at least once in the last three months and practiced self-medication. Rural households mostly used the services of informal healthcare providers. This trend has been reported elsewhere in Nigeria (Salako et al, 2001; Uzochukwu et al, 2004).

In the present study, a high proportion of respondents used relatively inexpensive methods such as the use of physical killing of mosquitoes and use of mosquito coils in preventing mosquito from biting them. Prevention of mosquito bites through use of specific repellent, burning of mosquito coils and use of mosquito bed nets is also common among the urban women. However, as also reported from another study done by Okrah et al. 2002, these measures are primarily targeted against the nuisance of mosquitos and not against malaria (Aikins et al. 1994; Van Bortel et al. 1996; Zimicki 1996). Among the women that control mosquitoes by physical killing in the urban area, 39.2% claimed that it was not effective and 37.1% respondents also gave the same response in the rural area. The use of mosquito coils is however characterized by some challenges. The burning of mosquito coils does not kill mosquito; rather it is only effective in dazing and keeping mosquitoes at bay for a while. Mosquito become active and resume biting once they recover from the effects of the burning coils (Oladepo et al, 2010). Only 61.1% of the women in the rural area reported that Insecticide treated nets was very effective while 72.4% of the urban women that used Insecticide Treated Nets (ITNs) reported that it was effective. Majority of households do not prevent mosquito bites and disease transmission in any way.

5.4 Domestic practices that encouraged prevalence of malaria.

5.4.1 Overgrown Bush

The practice of good hygiene in homes is crucial to malaria control (Hackenitz, 2002). A sizeable proportion of the study population sees bush clearing as effective malaria prevention method and about 13.4% and 28.3% of the rural and urban were using this method.

5.4.2 Cassava processing

In order to control malaria effectively in Kube and Eniosa some of the prevailing traditional practices among residents which favour the breeding of mosquitoes need to be addressed. The practices and environmental conditions of concern which need to be targeted for change or modification are cassava processing within the house which involves soaking for several days giving room for mosquitoes to breed, allowing pools of water to collect in containers, also, indiscriminate dumping of the peelings of cassava tubers especially in Eniosa and presence of heaps of leaves refuse. Previous investigators have reported that cassava processing activities create opportunities for mosquitoes to breed. In Cameroon, it was observed that water holes burrowed for the retting of cassava tubers constitute breeding grounds for mosquitoes (Raccurt et al, 1993).

5.4.3 Water storage practices among women

This study showed that majority of the women stored their water in buckets, followed by drums, kegs, plastic tanks and local pots. In this study the use of local pots was predominant in the rural area than the urban. This could be due to the fact that most of the rural women have low income and adequate assess to potable water. Previous reports (Okogun et al., 2003; Igbinosa, 1989) have shown earthenware material supported breeding of various mosquito species especially *Anopheles* spp in parts of Nigeria. The indiscriminate disposal of these pots, plastic materials and tins and their domestic uses are contributing factors to the abundance of these mosquitoes. Much of the problem of domestic mosquito breeding and malaria in the study areas may also be due to lack of pipe borne water. The fact that there were limited access to water encouraged the women to fetch and store water for long periods in the house which promotes the breeding of mosquitoes and 30.6% and 27.4% of the rural and urban and respondents respectively reported they do not cover their containers most times.

5.5 Relationships between vector abundance and risk factors

Most of the respondents had correct knowledge about the symptoms of malaria similar to what was found in a study conducted among urban dwellers in Benin City, Nigeria (Isah, 2007). This study found that, about 30.8% and 38% of the respondents from Eniosa and Kube respectively believed that stagnant pool could predispose to malaria. This shows that few of the population have good knowledge of how environmental conditions could aid the growth of mosquito.

In this present study, culicines (234) were most abundant in the urban area than the rural (120). The poor sanitation of the areas and presence of blocked drainage and slow flowing streams in the area appears to be responsible for this. Most of the gutters have been blocked with refuse and sewage, therefore rendering the water stagnant. This consequently enhances the breeding of different mosquito species. Predisposing factors to malaria in the communities are stagnant water found in tyres and domestic containers, Poor drainages, overgrown bushes and poor housing conditions.

5.6 Mosquito population and species

The total *Anopheles* mosquito gathered during the study was 177 with the highest number (130) of *Anopheles* caught in the rural area, compared to 47 mosquitoes of the specie caught in the urban area. Comparing the results from the two communities showed that the rural area harbours more malaria vector than the urban. This can be attributed to the poor knowledge about malaria, predominately agricultural activities going around houses and the environment which favours the breeding of the vector.

Few *Aedes* (52) were found during the three months entomological survey, even though they do not transmit malaria, *Aedes* mosquitoes are of public health importance because they can transmit avian malaria and dengue which, in turn, can lead to dengue haemorrhagic fever. Like Anopheles, they prefer clean still water for breeding but are particularly fond of artificial containers such as domestic water storage pots and vases, discarded cans, tyres, plastic bags or coconut shells. *Aedes* bites during the day and their biting peaks at dusk.

Culex was the most abundant species in both communities throughout the sampling period with a total of 355 collected. More *culex* species was collected from the urban houses (234) than the rural houses (120); this can be linked to the fact that *Culex* mosquitoes are known to be the most "successful" urban mosquitoes and the ones that residents find the most irritating. They can transmit filariasis, which can develop into elephantiasis, but are hated even where filariasis is not a problem simply because of the thousands of bites and sleepless nights they inflict. Malaria control programmes which ignore *Culex* run a very serious risk of losing popular support, as people will have no faith in Anophele*s* mosquito control that still leaves so many biting *Culex* mosquitoes about. Unlike Anopheles and *Aedes*, *Culex* breed mainly in organically polluted water; which is one of the reasons they thrive well in the urban area studied, kube being characterized with blocked gutters and polluted streams in addition to the poorly maintained of pit latrines present in some houses (Kolsky, 1999).

Majority of the respondents reported that malaria transmission is high in the dry season (54.4%) as well as in the wet season which was contrary to many previous studies that reported wet season as the peak of malaria transmission. Tukur, 2010, recorded the observations where the disease was found to be more rampant in dry seasons . Unlike their rural counterparts, 39.2% of the urban respondents reported that there is high transmission in the dry season than wet season. The seasonal variation in malaria parasite prevalence in these areas can be attributed to changes in Anopheles abundance during the year. In the dry season, the formation of water pools around some public water taps due to poor drainage, coupled with much sunlight was conducive to breeding of *A. gambiae*, this was also noted in studies of Fontenille et al, 1997 and Tadei, 1998. Thus the persistence of some pools, together with the existence of bushes or plants and refuse dumpsites that surrounded many households especially in the rural area serves as resting sites for mosquitoes during the dry season leads to high exposure to mosquito bites and risk of malaria parasite infect all year round. This discrepancy could also be due to a lot of agricultural practices going on in the rural area, poor toilets facilities, presence of bushes close to houses and poor water storage practices. All these could also be associated to socio-economic and educational status of the people. Houses built with mud had breaks and crevices on the walls and ceiling boards that provided refuges and allowed for easy passage of mosquitoes. This may also explain why more mosquitoes were caught in the rural area than urban area.

5.7 Prevalence of malaria

Asymptomatic malaria prevalence was determined using the rapid diagnostic kits and microscopy among 102 residents each from both communities. Comparing the two results showed that there was a significant difference between the number of positive cases in the rural area (52.9%) and the urban area (38.2%) using the microscopy test ($p<0.05$). Also, the rapid diagnostic kit tests showed significant difference in the malaria positive cases between the rural (56.9%) and urban (44.1%) communities.

Hence, this study found out that a high *Anopheles gambiae* population was associated with higher malaria parasite prevalence in the rural area. The high prevalence could be as a result of facilities that enhance transmission, poor malaria prevention practices and availability of breeding sites for anopheles mosquitoes.

5.8 Public health implications

Family living spaces were not adequately separated from domestic animals in both communities as many reared domestic animals around the house (Rural) 53.8% and (Urban) 40.5%. This findings, was also similar to Lindsay, 2003. Furthermore, health posts in remote areas tend to suffer from shortages in essential medicines and equipment, which often result in low-quality care and limited confidence in the health care services. In this study, sampled villages near urban centres or along accessible areas enjoy better quality health care than villages in the remote interior or on isolated stretches this was also similar to the study conducted by the Asian Development Bank, 2002. The irregular supply of anti-malarial drugs, coupled with delayed diagnoses, discouraged community members from seeking prompt care for malaria. Integrating services for prevention, treatment and care for malaria within the framework of health services, addressing migration of health professionals, harmonization of management of the major commodities (i.e. ITNs, antimalarial medicines, and diagnostics) for the disease at national and local levels is vital for reducing the burden of disease.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study attempted to assess the knowledge, prevention and practices relating to malaria and its control in the rural and urban communities, as well as, the environmental factors that can predispose women to malaria infection, this in addition to determining the density of the vector and prevalence of asymptomatic malaria in the respondents. The study found out that malaria is recognized as a major health problem by the women in the study communities.

This study showed that misconceptions about malaria still exist and that practices for the control of malaria have been unsatisfactory. Also, the cultural beliefs and practices, poverty and high illiteracy level of the people appear to have constituted a big barrier towards its effective control and intervention measures. There should be increased awareness campaigns. There is also a need for the Government to improve availability of information about malaria through rural dispensaries and primary health centre.

One major finding in this study is the very low educational status of women in the reproductive age in the rural area. Although a large number of the people are aware of the existence of malaria, its clinical impact is generally underrated. This is expected to have influenced low usage of preventive measures in these areas. According to UNICEF, "*Education saves and improves the lives of girls and women. It allows women greater control of their lives and provides them with skills to contribute to their societies. It enables them to make decisions for themselves and influence their families. It is the power that produces all the other developmental and social benefits*" (UNICEF, 2006).

The study revealed that there was poor water storage quality and inadequate water supply in the communities. Very few people have access to pipe borne water in both communities while ponds well, and spring are found to be among their sources of water. The study also showed that the sources and nature of water supply available to both communities encourages storage of water around the house for several days. Storage of water in uncovered containers for several days was observed to encourage breeding of mosquito vector.

The study revealed that the sanitary conditions in the communities were poor. There were no good waste disposal facilities. Refuse was heaped close to houses while some dump in surrounding bush after several days' accumulation which could hold water and serve as breeding sites for mosquitoes. The study also revealed poor toilet facilities especially in the rural area. Defecating in the bush was a major practice in the community while poorly managed pit latrines were predominant in the urban community. These conditions are potential risk factors for vector breeding and spread of infections.

The study revealed that the commonest drug used by both rural and urban residents in treatment of malaria was chloroquine and paracetamol. ACT was shown to be used more by the urban women than rural respondents. This could be attributed to their less frequent use of modern health facilities like private, general hospitals and hence they relied more on the drugs bought from patent medicine dealers. The cost and availability of drugs may have also contributed to this as chloroquine is known to be cheaper and readily available than other anti-malarial drugs like coartem and artemesinin-based combination therapy (ACTs).

The study also showed that almost all the women had not heard of integrated vector management. The study revealed that majority of the rural women make use of the primary health care centres, hence, construction of more PHC centres in rural areas will likely improve the physical accessibility of health facilities. It has been noted that the geographical proximity of services to peoples' homes is one of the most important factors that affect utilisation of health services, particularly in rural areas of developing countries (Buor, 2003; Hasibede & Dye, 1988; Onwujekwe & Uzochukwu, 2005).

As distance increased, the level of utilisation decreased and vice versa, and hence people who live far away from services sufficed a greater disadvantage regarding the use of services. Subsidized payment or targeted exemption system especially in the rural areas will likely improve their health seeking behaviour. However, strengthening access to health systems as a whole in rural areas is an important feature in improving health seeking behaviour amongst both urban and rural dwellers.

The study shows that use of ITNs, a technology known to be highly effective in controlling mosquitoes, was not a common practice especially in the rural community. Mosquito coil was preferably used in both communities. This is of concern because roll back malaria (RBM) has been promoting the use of ITN in the last 7 years. The lack of popularity of ITN may be due to its high cost, lack of knowledge and scarcity in many rural communities.

The study shows that seasonally, the disease was rampant in dry seasons as well as in the wet season. It is believed that, this is due to the high temperature, improper waste disposal and lack of good environmental practices.

6.2 Recommendations

1. There is a need for community intervention programmes directed towards correcting misconceptions about the cause of malaria, the recognition of danger signs which will require prompt referral to health facilities and improving health seeking practices.

2. Appropriate home management with effective drugs given in correct dosages should also be promoted since majority resort to self-treatment. Since the women are already sourcing their treatment from the patent medicine dealers, the training of both caregivers and the patent medicine vendors is advocated in order to meet the objectives of home management and early and appropriate treatment and referral of severe cases.

3. Implementation of an environmental control programme could be achieved by improving drainage of flooded areas and blocked gutters and through campaigns to clear bushes and disposal of garbage (such as building local incinerators). House improvements should take into consideration the sealing off of crevices and breaks in the walls and roof.

4. The rapid diagnostic kit test is reliable and simple to interpret. The test is a potential alternative to microscopy in places where the facilities for microscopy are poor. Therefore, it is reasonable to consider future use of RDTs as an epidemiological tool for the rapid screening of malaria.

5. Majority of households do not prevent mosquito bites and disease transmission in any way. There is therefore the need to intensify awareness and education and to make the ITNs available at affordable prices in these malaria hyper endemic areas as the use of insecticide-treated nets will decreased the number of malaria cases

6. Demonstration of the use of ITNs in the home should be anchored by the Ministry of Information and such demonstrations should take place at market places, town halls and where people mostly gather. Social structure of each community should be taken into consideration as women are not allowed to sit in the same place as men in some communities.

7. Healthcare providers with adequate training in malaria treatment and control should be adequately equipped for home visitation so as to interact informally as much as possible with the people and promote the result oriented integrated home management of malaria. As revealed because of the underlying differences between rural and urban areas malaria prevention and control measures may have to be modified in both environments.

8. Also inclusion of the key components of the Roll Back Malaria in the curricula at elementary schools, secondary as well as vocational schools would further boost information dissemination as well as initiate a gradual internalization of the programme.

9. A gender approach contributes to both understanding and combating malaria. Gender norms and values that influence the division of labour, leisure activities, and sleeping arrangements, may lead to different patterns of exposure to mosquitoes for males and females. it is recommended that understanding how gender patterns of behaviour influence exposure to mosquitoes, including use of ITN, can assist in developing more effective recommendations for prevention of malaria infection.

10. It is recommended that keeping the environment clean by maintaining proper sanitation is the best overall solution to malaria control.

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APPENDIX I

IRB Research Approval Number……………………….

This Approval will elapse on……./……./……

Title of Research:

COMPARATIVE ASSESSMENT OF ENVIRONMENTAL PRACTICES AND PREVALENCE OF MALARIA PARASITE AMONG WOMEN OF REPRODUCTIVE AGE IN TWO COMMUNITIES IN IBADAN, NIGERIA

Name and Affiliation of Researcher:
This study is being conducted by Folorunsho Abimbola Idowu, Department of Environmental Health Sciences, Faculty of Public Health, College of Medicine, University of Ibadan.

Purpose of Research:
To identify the environmental risk factors and their influence during the dry season on the density of mosquitoes and prevalence of infection among women of reproductive selected urban and rural Ibadan communities.

Procedure of the research that shall be required of each participants and approximate total number of participants that would be in the research:
The research shall begin with a pretest, which is basically questionnaire administration, of which some future participants and members of the community shall be involved in a one on one interviewer's method with the principal investigator. This is to test the validity of the questionnaire.

The research shall be taking place in two communities (a rural and an urban).

- Questionnaire administration and Biological sample collection to determine malaria prevalence (finger prick blood collection method on slides, which shall be used for the field microscopy and rapid diagnostic kit specific for *plasmodium falciparum*, paracheck-Pf™ by the principal investigator and the community laboratory scientist).

  Sample size: A total number of 250participantsfrom each community shall be recruited for the study

Collection of mosquitoes from the houses of the respondents shall follow simultaneously. Mosquito collection instruments which consists a plain white sheet, and pyrethrum spray shall be used. Mosquitoes shall be collected once in every week from the houses of the respondents, for a period of 3months.

Expected duration of research and of participant(s) involved

This research will take place during the dry season and is expected to last for a period of 3months and will involve an entomological survey and finger prick blood collection.

Risks

It is expected that this research would pose no harm to all research participants, although a specific biological sample (blood) of minute quantity shall be collected, through the finger prick method. The finger prick process will cause the participant a minute pain which will disappear after few days.

Cost of Participating

Your participating in this research will only cost you your time.

Benefits

This research would help you in determining the following

a) State of health in relation to malaria disease.
b) Vector burden of your indoor environment
c) The relation between environmental factors and malaria vector burden.
d) The most effective malaria vector control practices

Confidentiality

All information collected will be tagged and coded into various numbers and names of participants shall not be collected. This is to ensure that no links would be established after the research. UI/ UCH Ethics Review Committee may have access to these records.

Voluntariness

Your participation in this research is entirely voluntary.

Consequences of participant's decision to withdraw from research

You can also choose to withdraw from the research at anytime. Please note that some information obtained from you may be modified and used in reports and publication. However the researcher promises to make good faith efforts to comply with your wishes as much as practicable.

Any apparent or potential conflict of Interest:

This research work is strictly for academic purpose and is self funded.

Statement of Person Obtaining Informed Consent:

I have fully explained this research work to ____

and given sufficient information, including risks and benefits necessary for an informed decision.

DATE ____________________ SIGNATURE _________________________

NAME __________________________

Statement of person giving Consent:

I have read the description of the research. I understand that my participation in this research is voluntary. I know enough about the purpose, methods, risk and benefits of the research study to judge that I want to participate in it. I understand that I may freely stop being a part of the study at any time. I have received a copy of the informed consent form.

DATE_____________________SIGNATURE____________________

NAME__________________________

Detailed contact information including contact address, telephone, fax, e-mail and any other contact information of researcher(s), institutional HREC and Head of Institution:
This research has been approved by the Health Research Ethics Committee of the University of Ibadan and University College Hospital and the chairman of this committee can be contacted at BIODE building, room T10, 2nd Floor, institute for Advanced Medical Research and Training(IMRAT), College of medicine, University College Hospital. Email: uiuchirc@yahoo.com . If you have any question about your participation in this Research, you can contact the principal Investigator Folorunsho, Abimbola Idowuat the Department of Environmental Health Sciences, College of Medicine , University of Ibadan. Her phone number and email address are 08032881535 and truevirtue2k3@yahoo.comrespectively. You can also contact the Head of Department of Environmental Health Science, College of Medicine, University of Ibadan.

Thanks.

APPENXIC II

ETHICAL CONSIDERATION

A. **Non – Maleficience:** The research work will not inflict harm or any hurt on participants in any way and participants will have equal right in participating in the study.

B. **Confidentiality:** All information given by participants would be used mainly for research work and no link would be established to participants in anyway. Absolute confidentiality will be fully ensured.

C. **Disclosure of information:** All the processes in this research work would be duly explained to participants before the study commences.

D. **Benefits:** This research would help you in determining the following:

e) State of health in relation to malaria disease.

f) Vector burden of your indoor environment

g) The relation between environmental factors and malaria vector burden.

h) The most effective malaria vector control practices

E. **Right to withdraw /decline from the study:** Participation of participants in this research work is entirely voluntary. At any point in the course of the research any participants who wish to withdraw is eligible to do so.