THE ASSESSMENT OF THE EFFEECTIVENESS OF ENVIROMENTAL SANITATION IN THE CONTROL OF MALARIA

(A CASE STUDY OF ODOGBOLU LOCAL GOVERNMENT AREA IN OGUN STATE)

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CERTIFICATION

This is to certify that this research work was carried out **by ADEGBEMI AFOLASADE E.,** Matric Number: 17012409031of the department of Biology, School of Sciences Tai Solarin College of Education, Omu-Ijebu

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PROJECT SUPERVISOR

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ABSTRACT

Malaria hazard has become a major public health problem especially in the sub-Saharan African regions and Nigeria in particular. From a triad perspective which includes the agent, host and environment, researchers and scholars have encouraged the source reduction, elimination and eradication of mosquitoes breeding sites by concentrating on the environment. These tend to be essential because, the proliferation of mosquitoes continually perpetuate the transmission of malaria. So, it can be postulated that if the sources of mosquitoes breeding sites is eradicated or eliminated, malaria would be drastically reduced. This implies that good environmental sanitation practices could help mitigate malaria transmission, promote healthiness and improve quality of life of the populace. Findings from the study reveals that sanitation situation in Odogbolu local government is very worrying. In different living quarters of the town, human excreta are disposed of either in sanitation facilities, or in collective purification works, or in nature. However, misuse of these facilities causes the stagnation of sewage in the streets of neighborhoods, with escape of strong foul odors and proliferation of larval gites. Based on the findings of this study, the following are recommended to enhance the sanitary condition in this study area and even in the State and Nigeria at large: The government at all levels should continually review and update existing legislation with respect to urban planning, building standards, infrastructure and environmental regulations in order to make them more realistic, attainable and compatible with local conditions; Legislations should be enforced concerning indiscriminate dumping of refuse at road-sides and non-participation in the regular community sanitation exercise. Defaulters should be made to face the full wrath of the law. Health education should be done by the local authority on the need for household hygiene at various homes vis-à-vis keeping their toilets clean, disinfecting drinking water and protecting their water sources.

DEDICATION

This project is dedicated to Almighty God for his protections throughout my years of study.

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INTRODUCTION

1.1   Background to the Study

Malaria still remains a significant public health problem especially in low and middle income countries. According to the World Health Organization (WHO World malaria report 2015), malaria transmission in Nigeria is abysmally high with over 76% of the population reporting more than 1 case per 1,000 populations annually. There was a less than 50% decrease in projected incidence of malaria from 2000–2015. Nigeria and the Democratic Republic of Congo account for more than 35% of the global total of estimated malaria deaths (WHO 2016). Malaria is principally caused by protozoa (Plasmodium species) and is transmitted through the bite of an infected female Anopheles mosquito (Mwangangi et.al.., 2013). Within the tropics and sub-tropics, human malaria is seen to be the most wide spread vector-borne disease. Available statistics have documented that malaria is highly endemic in Nigeria with over 90% of the populace at risk of infection. It is the prime cause of 60% outpatient consultation for all age groups and at least half of the Nigerian populace are exposed to at least one bout of malaria attack every year (Idowu, 2012)

Malaria is principally caused by protozoa (*Plasmodium species*) and is transmitted through the bite of an infected female *Anopheles* mosquito. Therefore, the higher mosquitoes infestation in the house, the greater chance of finding the female anopheles mosquito which causes malaria (Mauji et. al, 2015). Within the tropics and sub-tropics, human malaria is seen to be the most wide spread vector-borne disease (Ahmad, 2011). Available statistics have documented that malaria is highly endemic in Nigeria with over 90% of the populace at risk of infection. It is the prime cause of 60% outpatient consultation for all age groups and at least half of the Nigerian populace are exposed to at least one bout of malaria attack every year (FED.MINISTRY ENV. 2005, FMOH 2005, Zaccheaus & Amadi 2012).

The disease is also a major contributor to anemia and it has a profound consequences and educational achievement of school; aged children (Lalloo et.al., 2006). Some studies have suggested that poor environmental sanitation and housing conditions as well as lack of appropriate control measures might be significant risk factors for malaria parasite burden (Nkuo-Akengi et.al..., 2006). Environmental factors such as the presence of bushes and stagnant waters around homes, rainfall, low altitude and high temperatures favoured the breeding of malaria vectors, as well as parasite reproduction within them (Messina et.al.., 2011), while increased urbanization tends to reduce the rate of Anopheles breeding. The key to addressing the challenge of reducing the malaria parasite prevalence is an integrated approach that combines preventative measures, such as insecticide treated bed net (ITNs), indoor residual spraying (IRS), improved access to effective anti-malaria drugs (Kokwaro, 2009), as well as proper environmental management. A combination of environmental manipulation and other control measure have also been shown to reduce the overall malaria incidence and mortality rate (Utzinger et.al.., 2001).

The quality of environment is essential for health of both adults and children. (WHO, 2013) affirmed that more than 2.4 billion people in the world currently lack access to adequate environmental sanitation and are forced to dispose their excreta in unimproved and unsanitary conditions. Majority of these people are found in Africa and other developing countries of the world. (Ekong, 2015) opined that environmental sanitation problems are responsible for about 30% of the burden of diseases in sub-Saharan Africa. Environmental sanitation problems are behavioural man-made environmental hazards which emanates from living environment. Disaster from environmental sanitation problems affects resident's health, structure, environmental resources and national and household economic assets. These problems are made more acute in these parts of the world as a result of rapid urbanization and uncontrolled population growth, without commensurate expansion in sanitary facilities.

Environmental conditions are appalling in many Nigerian cities (Mmom, 2003). The deplorable and dehumanizing conditions of physical environment calls for sober reflections from all stakeholders (Ekong, 2015). The impacts of poor environmental sanitation situations

are severe on Nigeria thus hindering and undermining its development (Bello, 2007). In Nigeria, adequate environmental sanitation has not been strictly adhered to. Its practices in the country are characterized by lack of basic amenities and poor sanitation behaviour (Akpabio, 2012, Ademiluyi, and Odugbesan, 2010, Daramola, and Olowoporoku, 2016) thus having serious consequences for health on citizens. The living environment in the country is well polluted owing to social misdemeanour of citizens. These scenarios have in turn become a recipe for disaster in urban centres (Daramola, and Olowoporoku, 2016, WHO and UNICEF, 2008).

Environmental sanitation is one of the widely known tools with significant contributions towards national development across the globe. It refers to efforts or activities aimed at developing and maintaining a clean, safe and pleasant physical environment in all human settlements (Olowoporoku 2014, WHO 2005). It includes the control of aspects of waste that may lead to the transmission of diseases. This encompasses not just excreta disposal and management, but also solid waste management, drainage and hygiene behaviour within living environments. Residents in cities with access to proper environmental sanitation have improved living conditions, enhanced health and well-being and economic productivity (Elledge, 2003, Adejumo, 2014).

An integrative approach has been recommended to mitigate the spread of malaria parasites. One of such strategy or approach is the Integrated Vector Management (IVM) through a combination of biological and chemical methods. It is aimed at improving ecological soundness and sustainability for the control of vector borne diseases, improve efficacy and cost effectiveness (Zacchaeus & Amadi, 2012). From a triad perspective which includes the agent, host and environment, researchers and scholars have encouraged the source reduction, elimination and eradication of mosquitoes breeding sites by concentrating on the environment. These tend to be essential because, the proliferation of mosquitoes continually perpetuate the transmission of malaria. So, it can be postulated that if the sources of mosquitoes breeding sites is eradicated or eliminated, malaria would be drastically reduced. This implies that good environmental sanitation practices could help mitigate malaria transmission, promote healthiness and improve quality of life of the populace (Inah et.al.., 2017).

Most large African cities are overcrowded, due to urban attraction. Little controlled urban growth leads to poor management of solid and liquid wastes produced by cities. This leads to many problems of sanitation.

The sanitation in these cities is generally dominated by self-purification works. They often repress wastewater that trickles down in living quarter streets emitting strong foul odors (Strauss, Heinss, Montangero 2000).

Moreover, water intended for consumption are very often contaminated because of drinking water connection with the sewage (Schwartzbrod, 1992). This fact can cause high health risks.

1.2   Statement of the Problem

Despite the huge investment, environmental condition in most cities is worrisome. This is because citizens' idea of environmental sanitation starts and ends with the monthly exercise. Most communities are littered with domestic wastes, solid waste, animal and human excreta etc. while sewage flows directly into open streets and nearby water bodies thus fouling the environment and attracting disease vectors (Olowoporoku, 2014, Adejumo, 2014, Ademiluyi ,2010, Olowoporoku, 2016). The ineffectiveness of these legislations/agencies to ensure a healthy environment in Nigeria could be traced to the laxity of the government and lack of political will. Others include overlapping of functions, inadequate funding and inadequacies of environmental sanitation facilities, services and personnel. This ineptitude has led to serious cases of pandemic diseases across the country. In the view of the above statement we should bear in mind that Unfavorable environmental conditions can facilitate disease transmission through various ways; the breeding of disease vectors e.g. mosquitoes can highly be influenced by high temperature and water logged areas (American Public Health Ass. 2013, Sinclair et.al…., 2014). Flood after heavy rains can result in sewage overflow and water contamination. A lot of pathogens spread from one place to another by wind and water

Poor environmental sanitation is a major cause of malaria world-wide and improving sanitation is known to have a significant beneficial impact on health both in households and across

communities. The impacts of poor environmental sanitation situations are severe on Nigeria thus hindering and undermining its development. In Nigeria, adequate environmental sanitation has not been strictly adhered to. Its practices in the country are characterized by lack of basic amenities and poor sanitation behaviour thus having serious consequences for health on citizens.

Considering the sanitation facilities in Odoogbolu Local Government of Ogun State, it is vivid that there is no proper sanitation in the area which brings about massive health issue this prompt the researcher to carry out a great deal of work to bring in lasting solutions to the problems of poor environmental sanitation and ways to curb the spread of malaria in the area of study.

Therefore, the study focuses on the assessment of the effectiveness if environmental sanitation in the control of Malaria in Odogbolu Local government Area of Ogun State.

1.3   Objectives of the Study

The general objective is to carry out an assessment of the effectiveness of environmental sanitation in the control of malaria, using Odogbolu local government area as a case study. The specific objectives are:

1.   To ascertain if inhabitants of Odogbolu know the implications of indiscriminate waste disposal in their environment.

2.   To know the rate of malaria infection among inhabitants of Odogbolu metropolis.

3.   To investigate if inhabitants of Odogbolu adopt an effective environmental sanitation.

4.   To examine the effect of environmental sanitation on the spread of malaria among inhabitants of Odogbolu local government area of Ogun state.

1.4   Purpose of the Study

The purpose of this study is to investigate the assessment of the effectiveness of environmental sanitation in the control of malaria and re-address the problem by providing possible suggestion, recommendation and solution, which would help curb the spread of malaria and creates awareness of proper sanitation and its health benefits to all residents in the area of study.

1.5   Research Questions

The relevant research questions related to this study are:

1.   Are inhabitants of Odogbolu aware of the implications of indiscriminate waste disposal in their environment?

2.   What is the rate of malaria infection among inhabitants of Odogbolu local government area?

4.   Do inhabitants of Odogbolu local government area adopt an effective environmental sanitation?

5.   What is the effect of environmental sanitation on the spread of malaria among inhabitants of Odogbolu local government area?

1.6   Significance of the Study

Considering the significant of the environment on the control and prevention of malaria, this study will be aimed at assessing environmental sanitation practices on malaria prevention and control in Odogbolu local government area. The findings in this study are also important to the government because it elucidates the need for government to provide an effective waste management and control scheme to help reduce the effect of malaria on the citizen health to a bareness minimum.

The outcome of the study is also expected to provide empirical evidence that would be useful to residents, health practitioners, curriculum developers as well as researchers. It will also help the government to realize the urgent need to provide basic infrastructural materials and equipment's in our health centres, communities, and the nation at large

The study will also be of great benefit to the researchers who intends to embark on research on similar topics as it will serve as a guide. Finally, the study will be of great importance to academia's, lecturers, parent and the general public during Symposium or Seminars.

1.7   Scope/Limitations of the study

This study will be limited in scope to cover only five towns in Odoogbolu Local Government Area of Ogun State which are:

i.   Omu
ii.   Igbile
iii.   Odo-Jobore
iv.   Ososa
v.   Irete.

This is to achieve an in-depth treatment that the research deserves since the study is strictly interested in assessing the effectiveness of environmental sanitation in the control of malaria in Odoogbolu Local Government area of Ogun State.

1.8   Operational Definition of Terms

- **Malaria:** Malaria is a disease caused by protozoa (Plasmodium species) and is transmitted through the bite of an infected female Anopheles mosquito
- **Environmental Sanitation:** It refers to efforts or activities aimed at developing and maintaining a clean, safe and pleasant physical environment in all human settlements.

- **Assessment:** This refers to an appraisal or evaluation of an event or situation.

CHAPTER TWO

LITERATURE REVIEW

CONCEPTUAL AND THEORETICAL REVIEW:

2.1   The history and origin of malaria:

Malaria is an old disease, whose name is derived from the Italian (mal-aria) or "bad air" and it has also been known as Roman fever, ague, marsh fever, periodic fever, paludisme (Martin, 2008). There were numerous, sometimes bizarre theories on how malaria was transmitted until 1898 when Dr. Ronald Ross discovered that the female Anopheles mosquito was actually responsible for transmitting malaria parasite. This discovery revolutionized malaria control, which had hitherto of-ten been haphazard or based purely on treating the patient by killing the malaria parasites (Arora & Arora, 2008, Phillip, 2006, Cheesbrough, 2006).There are lots of controversy with regards to the origin of malaria.

However, malaria probably originated in Africa and accompanied human migration to the Mediterranean shores, India and South East Asia. In the past it used to be common in the marshy areas around Rome. As malaria is a disease mostly of tropical and subtropical areas, it is particularly prevalent in sub-Saharan Africa, but also common throughout other tropical regions of China, India, Southeast Asia, South and Central America (Martin, 2008, Cheesbrough, 2006).

In Nigeria, before independence, the colonialists established Government Reservation Areas (GRA) in an attempt to build their homes far away from the natives as it was found that the travelling/flying distance of these mosquitoes from the breeding grounds was a limiting factor in spreading the parasites. Nigeria's quest for effective control of malaria began well before the WHO global malaria eradication period between 1955 and 1968 (Giles et.al.., 2007). From 1955, however, a more focused egalitarian attempt at evolving strategic plans and interventions resulted in pre-eradication pilot studies such as the Kankiya District Project and the establishment of a division in Ministry of Health to deal with the mosquito and malaria problem.

The National Malaria Control Committee (NMCC) was set up in 1975, with the set mandate to reduce the malaria burden by 25%. It produced a five year plan of action that terminated in 1980; however, it recorded only modest achievements. It took another 8 years before progress was made when a major health system reform was carried out in 1988, with the adoption of a Health Policy for the country. Within this policy, malaria was to be eradicated using the concept of primary health care. The Ministry of Health subsequently prepared guidelines for malaria control in 1989 and Government finally came out with a National Malaria Control Plan of Action in 1996. Past and present malaria control programmers as well as the most recent Malaria Control Program Plan achieved limited success in eradicating the scourge (National Malaria Control Programme, 2011). In spite of this, the malaria situation has steadily worsened and currently it is estimated that malaria accounts for 65 percent of all diseases reported in Nigerian health facilities and that 42% of pregnant women are diagnosed with malaria which affects the birth weight of infants (Akanbi, et.al.., 2009). Moreover, it is estimated that at least 1 million people die of malaria each year, mostly children under 5 years of age and more than 80% of the deaths worldwide occur in sub-Saharan African (WHO, 2005, Afolabi et.al…., 2001).

Life cycle of malaria parasite Malaria parasites exhibit a complex life cycle involving alternating cycles of asexual division (schizogony) occurring in man, an intermediate host, and sexual development (sporogony) occurringin female Anopheles mosquito which serves as the definitive host (Arora &Arora, 2008, Cheesbrough, 2006, Ross, 1999).

According to El Med (2004) Malaria is an infection of humans and other animals caused by eukaryotic organisms of the genus, Plasmodium. The protozoan first infects the liver, subsequently acts as a parasite within the system in the red blood cells, causing symptoms that typically include fever and headache, in severe cases progressing to coma and/or death. The disease is widespread in tropical and subtropical regions in a broad band around the equator, including much of sub-Sahara Africa, Asia and the United States of America with its attendant burden on drug and drug resistance. Malaria is prevalent in tropical regions because the significant amounts of rainfall, consistently high temperatures and high humidity, along with stagnant waters in which mosquito larvae readily mature, provide with the environment needed

for continuous breeding. Mosquito cycle Sexual cycle starts in the human host itself by the formation of gametocytes that are present in the peripheral blood. Both sexual and asexual forms of the parasite are ingested by the female Anopheles mosquito during its blood meal on infected patient, but only the mature sexual forms are capable of further development. In the stomach of the mosquito, microgametes are formed from microgametocyte by the process of exflagellation. It develops into a macro-gamete, its nucleus shifts to the surface where a projection is formed. Fertilization occurs when a microgamete penetrates this projection forming the zygote. The zygote matures into ookinete which penetrates the epithelial lining of mosquito's stomach and lies between the external border of the epithelial cell and peritrophic membrane (Arora &Arora, 2008, Cheesbrough, 2006). Here it develops into oocyst inside which, the sporozoite develops. The oocyst when fully mature ruptures and releases sporozoites in the body cavity of the mosquito. They accumulate in the salivary ducts and at this stage, the mosquito is capable of transmit-ting infection to man (Arora &Arora, 2008).

Malaria transmission and severity of the disease vary greatly from region to region, village to village and even from person to person (Beales and Gillie, 2002). Mortality rate from malaria is higher in children between the ages of 6months and 5 years (Afolabi, et.al…, 2001, Maitland and Marsh, 2004). Children below the ages of 6months are protected due to passive immunity acquired from the mother and the fact that fetal hemoglobin does not support parasite growth (Afolabi, et.al…, 2001). The protection ceases after 6months and the child is vulnerable till the age of 5years.Afterwards, immunity is developed as a result of repeated attacks of malaria (Sharma, et.al…, 2004).

2.2   The Concept of Malaria:

Malaria, an ancient threat to human health, remains a primary cause of morbidity and mortality globally (Wassmer, 2017, WHO, 2015). The 2016 world malaria report indicated that 212 million cases and 429,000 deaths were recorded in 2015 (WHO, 2016). Two-third of this deaths occurred among under-five (U5) children in Africa (WHO, 2016). About 25% of malaria burden in Africa (Dawaki, et.al…, 2016) occurred in Nigeria where 60% of outpatients' visits and 30% of hospital admissions are as a result of malaria (NPCN, 2017).Most often, patients

present with non-specific symptoms, such as fever, rigors, and chills. Severe malaria develops mainly among children and may manifest as extreme weakness, impaired consciousness, severe anemia, respiratory distress, convulsions, and hypoglycemia, among other symptoms.

The occurrence of long-term neurological squealed from severe malaria (Mishra, 2004), subtle developmental and cognitive impairments as a result of both severe and uncomplicated episodes (Holding, 2004) have been reported in children. Moreover, anaemia is one of the complications that accompany malaria infections and it plays a significant role in its morbidity and mortality (White, 2004). However, recent epidemiological reports have signified a reduction in the global burden of malaria (WHO, 2016, Nkumama, 2017). This has been attributed to the up-scaling up of malaria prevention and control interventions, including the use of long-lasting insecticide-treated nets (LLINs), indoor residual spraying (IRS), intermittent preventive therapy for pregnant women (IPTp), improved use of malaria rapid diagnostic tests (RDTs) and effective treatments using arte mistiming-based combination therapy (ACT) (Nkumama, 2017, Pinder, et.al…., 2016).Nevertheless, the rising problem of insecticide-resist-ant mosquitoes is hindering the usefulness of some of these interventions, with some species of mosquitoes in Western and Southern Africa being resistant to the currently available classes of insecticide in public health (Ranson, et.al.., 2011, WHO, 2005, Edi, et.al…, 2012). Researchers have pointed out the likelihood of resistant mosquitoes surviving up to a thousand times in the minimal concentration of insecticide that normally kills susceptible mosquitoes (Edi, et.al…, 2012, Ochomo, et.al…, 2013, Toe, et.al…, 2014).

Malaria is typically caused by single-celled obligate protozoan parasites of the genus Plasmodium (Ani, 2004; Okonko et al., 2009; Olasehinde et al., 2010; Unata et al., 2015; Tela et al., 2015; Kunihya et al., 2016; Udoh et al., 2016). The genus of the Plasmodium that causes malaria has four major species including Plasmodium ovale,P. vivax, P. falciparum, P.malaria and are mostly found in the sub-Saharan Africa(Ani, 2004;Alaba and Alaba, 2009; Okonko et al., 2010;Tela et al., 2015; Unata et al., 2015; Pam et al., 2015). Idowu et al. (2009) reported that majority of malaria infections in sub-Saharan Africa are caused by P. falciparum.

Of all the four species, P. falciparum has the highest frequency of occurrence followed by P. malaria. P. ovale has replaced P. vivax in West Africa and it occurs predominantly in East

Africa (Pam et al., 2015). Ani (2004) reported that mixed infections of two or more species of Plasmodiumis very common. Furthermore, Kolawole et al. (2017) reported that major death are caused by P. falciparum and P. vivax, while P. ovale and P. malaria usually cause a milder form of malaria that is hardly lethal. Of these, P. falciparum is responsible for most severe and fatal forms of malaria which is common in Africa just as P. vivax is common in America and Asia (Ani, 2004).

Morbidity and mortality rates associated with malaria in all age grades depend on several factors (Ojo and Mafiana, 2005; Egbuche et al., 2013). According to Nasir et al. (2015), Plasmodium has to undergo complex development and multiplication processes both in human and mosquito before it can be further transmitted (Nasir et al., 2015). As such their ecology is important in determining the eradication of malaria.

The ecology of mosquito could be traced to poor sanitation. As such sanitation conditions contribute to the severity of malaria. This is because poor sanitation such as dirty and non-flowing drainage systems, indiscriminate dumping of wastes without appropriate disposal mechanisms provides appropriate breeding grounds for the vectors (Pam et al., 2015).

According to Okonko et al. (2010) environmental conditions that favour the breeding of mosquitoes enhances the proliferation of the Plasmodium species. In addition, Ukpong et al. (2015) reported that the transmission dynamics of malaria is majorly influenced by a mixture of climatic and anthropogenic factors which impact on the vectors' ecology and also capable of enhancing transmission rates and patterns in certain areas.

Furthermore, the authors asserted that the attitude and activities of humans also enhance human-vector contact and as such affect the prevalence. Some of the associated attributes and attitudes include demography, environmental sanitation practices, drainage pattern among others (Ukpong et al., 2015).Environmental attributes including rainfall and its pattern, relative humidity and temperature are some of the determinants that affect the ecology of the vector of malaria (Alaba and Alaba, 2009). According to Ukpong et al. (2015), temperature plays a significant role in determining the transmission dynamics of the vector as well as the parasite growth and development.

The authors further reported that extrinsic incubation duration is significantly affected by temperature. As temperature increases and feeding rate and blood digestion frequency of the adult female Anopheles mosquitoes increase in warmer temperatures (Ukpong et al., 2015). The prevalence of malaria appears to be higher in rural areas compared to the urban centers/areas. This could be due to lifestyle. (Iloh et al. 2013, Nmadu et al. 2015), (Bassey and Nwakaku, 2017) reported that malaria is holoendemic in the rural areas and mesoendemic in the urban areas in Nigeria.

Studies have shown that rate of transmission of parasite causing malaria differ depending on local factors such as rainfall patterns, the proximity of mosquito breeding sites to people and the type of mosquito species in the area (Yaro et al.., 2010). Malaria parasites are endemic in some region, where there are fairly constant numbers of cases throughout the year, while some region have "malaria season" mostly during rainy season. World Malaria Report (WHO, 2008) shows that large and devastating epidemic can occur when the mosquito-borne parasite is introduced into areas where people had little prior contact with in-fected parasite and have little or no immunity to malaria, or when people with low immunity move into areas where malaria cases are constant.

2.3   The Concept of Environmental Sanitation:

In its modern concept, environment includes not only water, air and soil but also the social and economic conditions under which we live (Park, 2011).The key to man's health lies largely in his environment. In fact, much of man's ill-health can be traced to adverse environmental factors such as water, soil and air pollution, poor housing conditions, presence of animal reservoir and insect vectors of diseases which pose threats to man's health.

Often, man is responsible for the pollution of his environment through urbanization, industrialization and other human activities.

According to the National Sanitation Foundation of USA, the word sanitation is defined as a way of life that is expressed in the clean home, farm, business, neighborhoods and community (Park, 2011). Also, World Health Organization (WHO) defines sanitation as the

provision of facilities and services for the safe disposal of human urine and faeces (UNICEF AND WHO, 2012).

Hence, inadequate sanitation is a major cause of disease world-wide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities.

The word 'sanitation' also refers to the maintenance of hygienic conditions through services such as garbage collection and waste-water disposal. In addition, environmental sanitation according to World Health Organization is the control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical development, health and survival. It could also be seen as the principle and practice of effecting healthful and hygienic conditions in the environment to promote public health and welfare, improve quality of life and ensure a sustainable environment (Alabi, 2010).

The essential components of environmental sanitation include: solid waste management; medical waste management; excreta and sewage management; food sanitation; sanitary inspection of premises; market and abattoir sanitation; adequate potable water supply; school sanitation; pest and vector control; management of urban drainage; control of reared and stray animals; disposal of the dead animals; weed and vegetation control; hygiene education and promotion.

In most developing countries adequate environmental sanitation has not been strictly adhered to. For example in some parts of Nigeria, living with waste as part of the natural environment has become a way of life. Although there has been a remarkable improvement from what it used to be in the late eighties/early nineties, there is still much to be done as Lagos, our "Nigerian Centre of Excellence", has been depicted vast slum (Alabi, 2010).

In the United States, slum is often used to refer to marginalized neighborhoods, but in developing countries, it usually means a settlement built in or near a city by residents themselves, without official authorization or regulation. Such housing units are typically substandard, and the infrastructure and services range from non-existent to improvised. Furthermore, environmental hazards are responsible for about a quarter of the total burden of

disease worldwide and as much as 30% in regions such as sub-Saharan Africa. As many as 13 million deaths can be prevented every year by making our environments healthier. These facts and figures highlight the impact of environmental factors on public health. More than 2.4 billion people in the world currently lack access to adequate sanitation and are forced to dispose of their excreta in unimproved and unsanitary conditions. Those who suffer from this, lack most basic human needs and also tend to be victims of poverty, ill health and an overall poor quality of life (WHO, 2013).In developing countries like Nigeria, the main diseases of the environment are diarrheal disease, lower respiratory infections, unintentional injuries, and malaria. In children under the age of five, one third of all disease is caused by the environmental factors such as unsafe water and air pollution (WHO, 2010).The poor state of food sanitation in the country has been shown to play a significant role in the etiology of food borne diseases. One of the most significant diseases that arise from poor sanitation is diarrhea. Deaths resulting from diarrhea are estimated to be between 1.6 and 2.5 million every year (WHO, 2012).

Hygiene generally refers to the set of practices associated with the preservation of health and healthy living. The focus is mainly on personal hygiene that looks at cleanliness of the hair, body, hands, fingers, feet and clothing, and menstrual hygiene.

Sanitation is "the means of collecting and disposing of excreta and community liquid wastes in a hygienic way so as not to endanger the health of individual and the community as a whole". Sanitation is one of the determinants of quality of life and human development index. It is a fundamental health service without which there cannot be any improvement in the state of community health. It consists of both public and private elements, and the individual's hygiene can affect the whole community. Improving the sanitation within a community leads to an improvement in health. Thus sanitation is an integral component of environmental protection which ensures a productive life. (Park's, 2009).

Sanitation is a serious issue that is affecting most parts of the world especially the developing countries. On a global scale, the most affected are children who in most cases lose their lives due to diseases caused by poor sanitation. A pleasant environment that promotes healthful living and is hazard free is a fundamental right of all Nigerians. There is an increasing national

consciousness on the need for judicious management of the Nigerian environment in a sustainable manner. Therefore, ensuring improved Environmental Sanitation standards has become high on the political agenda of Government in the democratic dispensation.

2.4   EMPIRICAL REVIEW:

According to Water Aid (2006), approximately 1.1 billion people in the world lack access to safe water and another 2.6 billion do not have access to adequate sanitation. Water Aid also indicated that in developing countries an estimated 2.2 million people, most of who are children, die annually due to diarrhoea linked to a lack of access to safe drinking water, inadequate sanitation and poor hygiene (Water Aid 2006). The World Health Organization estimates (WHO 2004) show that 88% of the burden attributable to unsafe water supply, sanitation and hygiene severely affects children in developing countries (Lubaale and Musyok 2011). In many developing countries, sanitation is inadequate and has devastating effects on the diseases burden. WHO also estimates that 97,900 people die every year due to poor sanitation.

The rapid growth of urbanization, without an improvement of the sanitation infrastructure have reduced the capacity of most of the African nations to provide adequate sanitation services to the growing population (Adane, Mengistie et al. 2017). Most cities have poor solid waste management strategies as evidenced by overflowing garbage containers. These cities and households experience a wide range of sanitation issues including lack of adequate sanitation facilities, poor quality water supply, poor drainage, uncollected garbage, contaminated food and overcrowded housing (Owusu 2010). The burden of poor sanitation lies mainly with poor neighbourhoods. The combination of poor water supply, hygiene and sanitation has clear consequences. These include diseases such as diarrhoea, dysentery, intestinal nematode infections and schistosomiasis, as suffered by a huge number of the global population (Worley 2016) and particularly in developing countries. In spite of the evidence and the magnitude of the effects, a sizeable population around the world still lives without water and sanitation facilities; approximately 40% of the African population does not have access to improved water supply and sanitation (Clasen, Bostoen et al. 2010).

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Diarrhoeal disease is the second leading cause of death in children under five years old, and is responsible for killing around 525,000 children every year (WHO 2017). It is attributed to poor personal hygiene, sanitation and water supply (Worley 2016), including lack of clean water for proper hand-washing (Norman, Pedley et al. 2010) and exposure to human excreta (Clasen, Bostoen et al. 2010). This is exacerbated by a lack of toilets, as faeces on the ground contribute to contaminated drinking water and water resources in general. Children who are malnourished or have impaired immunity as well as people living with HIV are most at risk of life-threatening diarrhoea. 90% of these cases are attributed to poor sanitation.

CHAPTER THREE

METHODOLOGY

3.1   Research design

This study used descriptive survey design. The descriptive survey research design is used for its appropriateness in making reality known through collecting detailed factual information that describes existing phenomena at a given moment in time. This research design sought for and solicits information by asking respondents questions about their perceptions about "Assessing the Effectiveness of Environmental Sanitation in the Control of Malaria in Odogbolu Local Government area of Ogun State. The responses are given in written. The design is appropriate in this study because it enables the researcher to collect data from the respondents through the use of observation and questionnaires.

3.2   Population of the study

The population of the study consists of residents staying in Odogbolu local government Area Ogun State.

3.3   Sample and Sampling Procedure

The total population for the study is one hundred and fifty (150) residents, which were randomly selected across five towns in Odogbolu Local Government Area. The sampling technique that was used in this research study was stratified random sampling technique.

3.4   Target population

The target population for this study consist of hundred and fifty (150) male and female residents drawn from ten (10) selected towns in Odogbolu local government area of Ogun state and put together to represent the entire population of residents in the State.

3.5   Research instruments

The research instrument used for this study was questionnaire developed by the researchers. The questionnaire was designed and constructed using scale response mode based on the rating techniques. These are Agreed, Strongly Agreed, Disagreed and Strongly Disagreed.

The questionnaire will consist of two (2) sections named as section A and section B

The section A will be the personal data, and section B will be the questions based on the formulated research questions.

3.6   Validation of Research Instruments

In order to validate the research instrument, the researcher carefully prepared relevant questions about the study to make the questionnaire. The researcher later on passed this instrument to the research supervisor who subjected the research instrument to both content and face validity.

3.7   Method of Data Collection

One hundred questionnaires were distributed to the residents of the selected towns in Odogbolu (both male and female) consisting the population. The self-administrations enable the respondents to have a clear view on the issues raised in the questionnaire and also to ensure better response.

3.8   Procedure for Data Analysis

Data collected through questionnaires were coded and analyzed using percentages and Chi-square.

CHAPTER FOUR

PRESENTATION, ANALYSIS OF DATA AND DISCUSSION OF RESULT

This chapter describes the methods used in the presentation and analysis of data collected during the study. The data collected will be analyzed and the results would be presented using the Chi-square method for testing association between two or more variable.

Thus, the formula is analyzed below;

Calculate χ^2 (Chi-square)

$$\chi^2 = \sum \frac{(E_o - E_e)^2}{E_e}$$

Hence, χ^2 = Calculated Chi – Square

P = Level of Significance

E_o = Frequency Observed

E_e = Frequency Expected

Therefore; Expected frequency= <u>Number of Questionnaire</u>

Number of Response

E= <u>150</u>

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E= 37.5

From the Chi-square table, DF=1 under 0.05 is 3.84 which is constant. It will be used to determine the positive and negative.

{The rule of thumb (Decision rule): Accept research question/hypotheses, If χ^2 calculated is < (less than) χ^2 table value, reject hypotheses, if χ^2 calculated is > (greater than) χ^2 table value}.

4.1 Demographic distribution of respondents

Figure 4.1.1 Age distribution of residents in the study area
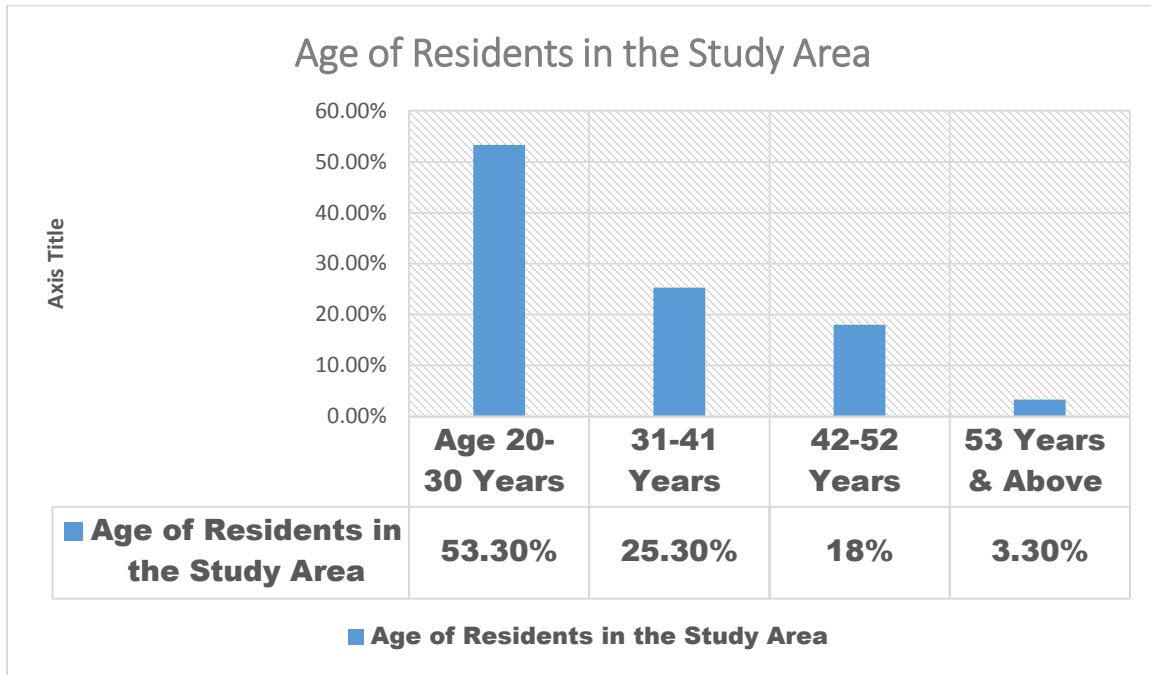
From figure 4.1.1, it has been observed that the highest age of residents who answered the questionnaire was between age 20-30 years representing 53.30% of the sampled population, followed by subsequent age of 31-41 years representing 25.30% of the sampled population, 18% of the residents in the study area also fall within the age of 42-50 years while 3.30% of the population sampled are within age 53 years and above.

Table 4.1.2: Sex distribution of Respondents

Gender	Frequency	Percent
Male	85	56.7%
Female	65	43.3%
Total	150	100.0%

The above table showed that there were more males (56.7%) than their female counterpart (43.3%).

Fig. 4.1.3: Distribution of Respondent based on their Marital Status

Marital Status of Residents in the study area

	SINGLE	MARRIAGE	DIVORCED	WIDOW
■ Percentage	54%	28%	17%	1.30%
■ Frequency	81	42	25	2
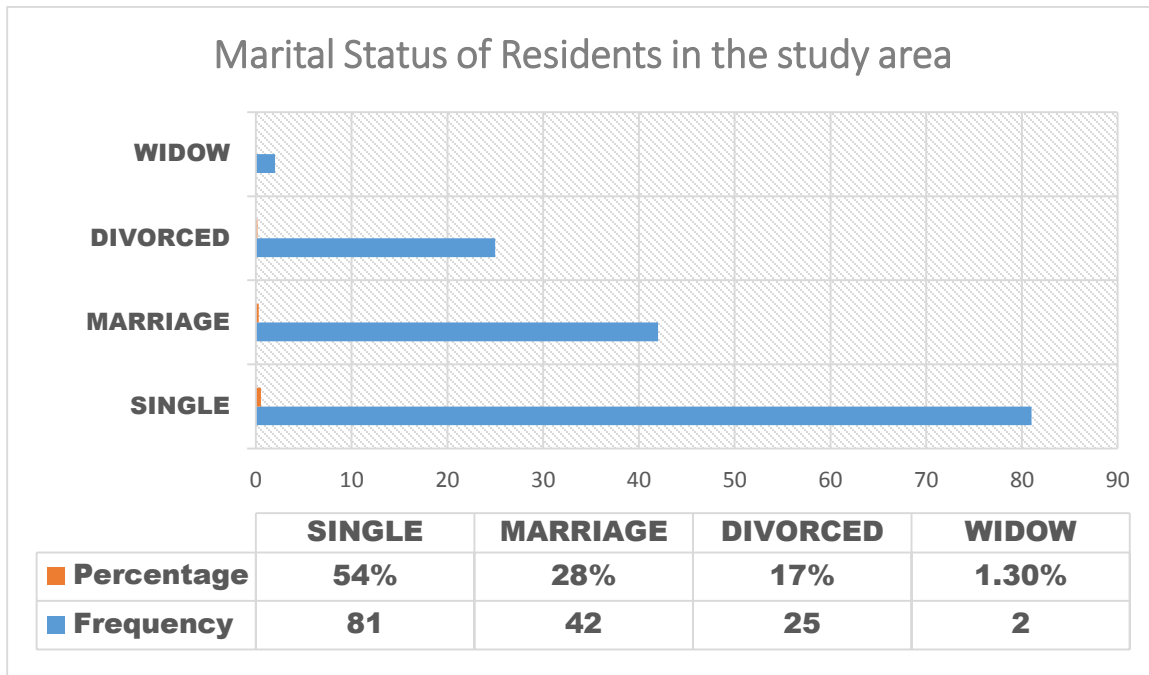
From fig. 4.1.3 it was quite observed that 54% representing 81 residents are Single, 42 residents representing 28% of the sampled population are married, and 16.70% of the residents are divorced, while 1.30% representing 2 residents of the total sampled residents are widow.

Table 4.1.4: Educational status of the residents in the study area

Educational Status	Frequency	Percentage
Pry. School	23	15.3%
WASSCE	71	47.3%
Tertiary	44	29.3
Other	12	8%
Total	150	100%

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The above table shows that 15.3% of the residents are first school leaving certificate holders, 47.3% of the residents are SSCE holder, while 29.3% are graduates from various tertiary institutions across the country and 8% of the residents have little or no education at all.

4.2 Analysis of the Questionnaire

Table 4.2.1 showing item 1-5 of the questionnaire administered

S/N	ITEMS	SA	A	D	SD	$\chi^2 cal$	$\chi^2 tab$	P	Remark
1	Poor sanitation such as dirty and non-flowing drainage systems provides appropriate breeding grounds for the vectors	115	28	1	6	2.08	5.99	0.05	Accept
2	Drainages are often taken care of in my locality	32	97	18	3	1.61	5.99	0.05	Accept
3	Indiscriminate dumping of wastes without appropriate disposal mechanisms	62	75	11	2	8.62	5.99	0.05	Reject
4	The key to man's health lies largely in his environment.	84	57	4	4	5.00	5.99	0.05	Accept
5	Improving the sanitation within a community leads to an improvement in health.	86	58	3	3	1.37	3.84	0.05	Accept

From table 4.2.1 above it has been observed that item 1, 2, 4 and 5 of the questionnaire administered shows an accepting mean ratings of 2.08, 1.61, 5.00 and 1.37 while only item 2 of the questionnaire was rejected with the mean rating of 8.62. The observations above has shown that in Ijebu-Ode local government of Ogun state that Poor sanitation such as dirty and non-flowing drainage systems provides appropriate breeding grounds for the vectors, it was also discovered that The key to man's health lies largely in his environment and that Improving the sanitation within a community leads to an improvement in health.

Table 4.2.2: showing item 6-10 of the questionnaire administered by the researcher

S/N	ITEMS	SA	A	D	SD	$\chi^2 cal$	$\chi^2 tab$	P	Remark
6	People often get sick or have frequent malaria attack due to poor waste disposal.	62	82	4	2	1.69	3.84	0.05	Accept
7	The burden of poor sanitation lies mainly with poor neighbourhoods.	73	66	10	1	6.82	3.84	0.05	Reject
8	Good drainage system within environs protects the spread and bites of the female anopheles mosquitoes.	85	61	3	1	1.30	3.84	0.05	Accept
9	Good waste/drainage system promotes healthful living.	97	50	3	0	3.77	3.84	0.05	Accept
10	Malaria is mostly contracted through mosquito bites from a dirty environment.	82	60	8	0	2.39	3.84	0.05	Accept

It was quite evident from the analysis above that People often get sick or have frequent malaria attack due to poor waste disposal as this statement shows and accepting mean ratings of 1.69, item 7 was rejected with mean ratings of 6.82 this implies that The burden of poor sanitation does not lies mainly with poor neighbourhoods. It was also observed from the table above that Good drainage system within environs protects the spread and bites of the female anopheles mosquitoes with an accepting mean rating of 1.30 and that Good waste/drainage system promotes healthful living, while item 10 shows an accepting mean rating of 2.39 indicating that Malaria is mostly contracted through mosquito bites from a dirty environment.

Table 4.2.3: showing item 11-15 of the questionnaire administered by the researcher

S/N	ITEMS	SA	A	D	SD	χ^2cal	χ^2tab	P	Remark
11	Good hygiene behavior and good excreta disposal tends to reduce the rate of Anopheles breeding.	88	58	4	0	1.40	3.84	0.05	Accept
12	There are dustbin in the locality that helps in effective waste management	62	70	15	3	2.93	3.84	0.05	Accept
13	The spread of malaria can be curbed through the use of residual mosquito nets.	84	58	5	3	9.95	3.84	0.05	Reject
14	Poor environmental sanitation is a major cause of malaria world-wide	93	52	5	0	4.84	3.84	0.05	reject
15	Good environmental sanitation practices helps mitigate malaria transmission	67	78	5	0	1.48	3.84	0.05	Accept

Item 11 in the table above shows that Good hygiene behavior and good excreta disposal tends to reduce the rate of Anopheles breeding with the highest of the respondent agreeing to this statement with a mean rating of 1.40, the residents of Ijebu-Ode local government also agree with item 12 stating that; There are dustbin in the locality that helps in effective waste management with an accepting mean rating of 2.93. Item 13 stating that; the spread of malaria can be curbed through the use of residual mosquito nets, this statement was reject with the highest mean ratings of 9.95 this is due to the fact that measures such as clearing of bushes around the environments, maintain a clean and healthy environment among others could also be used to curb the spread of mosquito. Item 14 of the questionnaire administered by the researcher was also rejected with a mean rating of 4.84. Item 15 of the questionnaire indicating that; Good environmental sanitation practices helps mitigate malaria transmission was accepted with the mean ratings of 1.48, which was below the table value 3.84.

4.3   *Discussion of findings*

In the course of this work the researcher came up with the following findings;

From the study conducted, findings shows that poor environmental sanitation is a major cause of Malaria. Specifically, malaria is prevalent in tropical and subtropical regions of the World especially in Africa. Ukaegbu et al. (2014) attributed its prevalence to rainfall, warm temperatures, and stagnant waters which provide ideal habitats for mosquito larvae. Other determinant environmental condition includes humidity, type and abundance, composition and distribution of vegetation cover. As such much of the incidence that triggers high prevalence rate is associated to environmental components. Haines et al. (2006) and Dhara et al. (2013) also reported that changes in temperature and rainfall may affect the distribution of disease vectors - e.g. those of malaria and dengue - and the incidence of diarrhoeal diseases.

From the findings of the study it was observed that the burden of poor sanitation lies mainly with poor neighbourhoods. In many developing countries, sanitation is inadequate and has devastating effects on the diseases burden. WHO also estimates that 97,900 people die every year due to poor sanitation. The burden of poor sanitation lies mainly with poor neighbourhoods. The combination of poor water supply, hygiene and sanitation has clear consequences. These include diseases such as diarrhoea, dysentery, intestinal nematode infections and schistosomiasis, as suffered by a huge number of the global population (Worley 2016) and particularly in developing countries.

It was observed from the analysis in item 5 of the questionnaire which was accepted with the mean rating of 1.37, that improving the sanitation within a community leads to an improvement in health. Thus sanitation is an integral component of environmental protection which ensures a productive life. (Park's, 2009).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1   SUMMARY

Malaria is one of the major causes of mortality and morbidity in tropical and sub-tropical nations especially in Sub-Sahara Africa. Malaria is basically transmitted from one person to another by female *Anopheles* mosquito that carries the parasite, *Plasmodium*. At present, Nigeria is one of the main countries with high prevalence rate of Malaria in the world, as such its endemic in the area. Over 95% of Nigerian population is at risk to malaria infection especially in the rural area. Several factors tend to determine the prevalence of malaria in Nigeria. Some of which include medical condition, environmental factors/seasonal influence and human status (age, gender, pregnancy, blood group and rhesus factors among others). These factors are important indicator in controlling malaria within a given locality.

From the study conducted, findings shows that poor environmental sanitation is a major cause of Malaria. Specifically, malaria is prevalent in tropical and subtropical regions of the World especially in Africa. Ukaegbu et al. (2014) attributed its prevalence to rainfall, warm temperatures, and stagnant waters which provide ideal habitats for mosquito larvae. Other determinant environmental condition includes humidity, type and abundance, composition and distribution of vegetation cover. As such much of the incidence that triggers high prevalence rate is associated to environmental components. Haines et al. (2006) and Dhara et al. (2013) also reported that changes in temperature and rainfall may affect the distribution of disease vectors - e.g. those of malaria and dengue - and the incidence of diarrhoeal diseases.

Finally, sanitation situation in Ijebu-Ode local government is very worrying. In different living quarters of the town, human excreta are disposed of either in sanitation facilities, or in collective purification works, or in nature. However, misuse of these facilities causes the stagnation of sewage in the streets of neighborhoods, with escape of strong foul odors and proliferation of larval gites. These are all problems that threaten the health and well-being.

5.2   CONCLUSION

Poor environmental sanitation practice has been strongly linked to high malaria transmission, morbidity and mortality rates especially in low and middle income countries. In Nigeria, malaria remains a major public health problem with higher endemicity in rural and semi-urban settings.

Findings in the current study showed that most respondents recorded poor environmental sanitation practices. Hence, the government at all levels in conjunction with the local communities should provide basic sanitation facilities such as good channeling of drainage systems for proper disposal of wastewater and waste collection services for proper disposal of household generated solid wastes, etc. This is critical to the prevention and control of mosquitoes and malaria transmission. Agricultural activities such as the use of bamboo in the construction of yam barns and the planting of water-bearing crops that encourage the breeding of mosquitoes should be restricted to places outside residential areas. This would also minimize mosquito breeding and exposure to malaria transmission.

From the findings of the study it was also observed that the burden of poor sanitation lies mainly with poor neighbourhoods. In many developing countries, sanitation is inadequate and has devastating effects on the diseases burden. WHO also estimates that 97,900 people die every year due to poor sanitation. The burden of poor sanitation lies mainly with poor neighbourhoods. The combination of poor water supply, hygiene and sanitation has clear consequences. These include diseases such as diarrhoea, dysentery, intestinal nematode infections and schistosomiasis, as suffered by a huge number of the global population (Worley 2016) and particularly in developing countries

However, given the importance of a clean environment on the socio-economic life and the health of community members and the nation in general, there is the need for recognizing community. Participation as an interaction, rather than a coercion, arising in a community of place and as a developmental process that must be undertaken willingly so as to reap its full potential.

5.3   RECOMMENDATIONS

Based on the findings of this study, the following are recommended to enhance the sanitary condition in this study area and even in the State and Nigeria at large:

1. The government at all levels should continually review and update existing legislation with respect to urban planning, building standards, infrastructure and environmental regulations in order to make them more realistic, attainable and compatible with local conditions.
2. Legislations should be enforced concerning indiscriminate dumping of refuse at road-sides and non-participation in the regular community sanitation exercise. Defaulters should be made to face the full wrath of the law.
3. Health education should be done by the local authority on the need for household hygiene at various homes vis-à-vis keeping their toilets clean, disinfecting drinking water and protecting their water sources.
4. Health education should be carried out on the need for the inhabitants to adopt the habit of regular hand washing after using toilets and before embarking on food preparation or taking meals.
5. The local authorities should endeavour to provide more refuse containers and place them at strategic positions.
6. The various communities should be empowered with sanitation tools like spades, cutlasses, wheelbarrow etc. for effective participation.
7. During environmental sanitation, every gutters and dirty surroundings should be properly cleanse to eradicate malaria in that locality.

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APPENDIX

Questionnaire

Dear Respondent,

I am a final year student of Tai-Solarin College of Education, Omu-Ijebu who is conducting a research on "**The assessment of the effectiveness of environmental sanitation in the control of Malaria in Odogbolu Local government Area of Ogun State".** I hereby solicit for your attention and time to help me fill the questionnaire below. The questionnaire seeks your honest responses to the question therein.

This questionnaire has got nothing to do with taxation but to elicit information for academic research work only. All information supplied shall be treated in strict and absolute confidence.

Thank you for your anticipated co-operation.

SECTION A: BIODATA

NAME: _____

AGE: 20-30 ☐   31-41 ☐   42-52 ☐   53&above ☐

MARITAL STATUS: SINGLE ☐   MARRIED ☐   DIVORCED ☐   WIDOW ☐

TOWN/VILLAGE: _____

SEX: MALE ☐   FEMALE ☐

EDUCATIONAL STATUS: Pry. Sch Certificate ☐   Wasce/O'level ☐   Tertiary ☐

Others_____

SECTION B: QUESTION SERIES FOR RESPONDENTS

Kindly tick (√) in the appropriate columns key:

SA -Strongly agree   **A**- Agree   **D** -Disagree   **SD** -Strongly Disagree

S/N	ITEMS	SA	A	D	SD
1	Poor sanitation such as dirty and non-flowing drainage systems provides appropriate breeding grounds for the vectors				
2	Drainages are often taken care of in my locality				
3	Indiscriminate dumping of wastes without appropriate disposal mechanisms				
4	The key to man's health lies largely in his environment.				
5	Improving the sanitation within a community leads to an improvement in health.				
6	People often get sick or have frequent malaria attack due to poor waste disposal.				
7	The burden of poor sanitation lies mainly with poor neighbourhoods.				
8	Good drainage system within environs protects the spread and bites of the female anopheles mosquitoes.				
9	Good waste/drainage system promotes healthful living.				
10	Malaria is mostly contracted through mosquito bites from a dirty environment.				
11	Good hygiene behavior and good excreta disposal tends to reduce the rate of Anopheles breeding.				
12	There are dustbin in the locality that helps in effective waste management				
13	The spread of malaria can be curbed through the use of residual mosquito nets.				
14	Poor environmental sanitation is a major cause of malaria world-wide				
15	Good environmental sanitation practices helps mitigate malaria transmission				