AN ETHNOBOTANICAL SURVEY OF PLANTS USE IN THE TREATMENT OF MALARIA IN ADO EKITI LOCAL GOVERNMENT AREA OF EKITI STATE.

BY

ADEKOLA OLUWAPELUMI OLUWADAMILOLA

MATRIC NO: PSB/14/2351

A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF PLANT SCIENCE AND BIOTECHNOLOGY, FACULTY OF SCIENCE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE, FEDERAL UNIVERSITY OYE EKITI, EKITI STATE NIGERIA.

MARCH, 2019.

DEDICATION

This project work is dedicated to almighty God, maker of Heaven and Earth and all that is in it. It is of His faithfulness, love, grace and Mercy. It is not of Him that willeth nor of him that runneth but of God that showeth mercy. I also dedicate this to my irreplaceable parents Ven & Mrs O.O Adekola for their love, support and encouragement.

CERTIFICATION

This is to certify that this project titled "**AN ETHNOBOTANICAL SURVEY OF PLANTS USED IN THE TREATMENT OF MALARIA IN ADO-EKITI LOCAL GOVERNMENT, EKITI STATE"** was carried out by **ADEKOLA OLUWAPELUMI OLUWADAMILOLA (PSB/14/2351),** in partial fulfillment of the requirements for the award of the degree of Bachelor of Science. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the B.Sc.

18-03-2019

MRS DEBORAH CHUKWUMA **DATE**

SUPERVISOR

8-03-19

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to God Almighty and to everyone who had helped me throughout the period of this project. I am grateful most especially to my Supervisor Mrs Deborah Chukwuma for her non-stop support, motherly role and guidance towards the success of my project, God bless you ma, I am forever grateful.

A big thank you to my Parents for their support morally, financially and through prayers. A special thank you goes to the Head of Department, other wonderful lecturers in the department and other Staffs in the department. Thank you for your moral support and guidance.

I really appreciate my best friend Olaleye Oluwatosin who served as my source of encouragement throughout and was always sharing his ideas and thoughts about the project. To all my family and friends especially Mr Ayodeji Adedapo, who encouraged me and were always checking up on me thank you so much God bless you all.

ABSTRACT

Malaria is a Mosquito-borne disease caused by the *Plasmodium* species. Malaria has been observed to be prevalent in Nigeria and severe cases lead to death. Plants have been used since ancient times to cure ailments and serve other purposes for man and animals. In this study, an ethnobotanical survey was carried out on plants used in the treatment of malaria in Ado-Ekiti Local Government Area of Ekiti State, Nigeria and information on these plants was documented. Ethnobotanical data were collected using oral interaction and a semi-structured questionnaire, which was administered to 150 respondents in the Local Government Area. The survey revealed that 36 plant species belonging to 17 families were used for the treatment of malaria. Also, the plant part used, preparation methods and recipes used for malaria treatment. Plant materials used for treatment were gotten from the wild. The respondents prefer traditional medicine in the treatment of malaria compared to Artemisinin-based combination therapies (ACT). It was concluded that the usefulness of medicinal plant for malaria treatment and other diseases was effective. Therefore, the study recommend that people should be sensitized on the potency of usefulness of medicinal plants for the treatment of malaria and other diseases.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.0 INTRODUCTION

The word "Ethnobotany" is coined from two Greek words: "*Ethno*" which means the study of people in relation to their cultures and "*Botany*" which is the study of plants. Therefore, Ethnobotany is the scientific study of the existing relationship between plant and humans. Ethnobotany shows how communities of a particular region make use of the indigenous plants for their everyday activities which include food, clothing, shelter and medicine (Aiyeloja *et al*., 2006). The documentation of this relationship between plants and humans, which cuts across different cultures is very important for the conservation and utilization of biological resources (Muthu *et al*., 2006).

Ethnobotany was coined by John William Harshberger in 1895 and the study became a well-known science through the works of Richard Evans Schultes, Richard is often referred to as the father of Ethnobotany. Ethnobotanists investigate plants used by various Ethnic groups around the world and document the knowledge gained from this study for the benefit of people and for further scientific research works. Ethnobotany involves several other disciplines which include but not limited to Ecology, Cytology, Biochemistry, Forestry, Horticulture etc.

Man has been dependent on plants for medicine, these plants contain chemical substances that

medicine to prevent and cure diseases (Ekor, 2014), and about 25 % of the synthesized drugs are manufactured from medicinal plants (Pan *et al*., 2013). According to Kelly (2010), plants contain organic substances and these substances are believed to be responsible for the usage of these plants, in treatment of diseases and also several other uses. Plants generally are used for several purposes like beautification, shelter, food for man, and fodder for animals, fuel etc.

Malaria disease is caused by *Plasmodium* species, these parasites are transmitted to humans through the bites of female Anopheles mosquito (Rawlins *et al.*, 2008). The symptoms of malaria infection include fever, headache, chills, shivering, and loss of appetite, vomiting, general body weakness and joint pains (Emmanuel *et al.*, 2006). The constant evolution of the malaria parasite has rendered the cheapest and most widely available anti-malarial treatments ineffective and recent reports show the increasing resistance of *Plasmodium falciparum* to artemisinin-based compounds (Htut, 2009; Cui *et al*., 2012). Persistence of malaria symptoms after treatment with modern antimalarial drugs has resulted in loss of faith in such drugs (Ukaga *et al.*, 2006) and has led to increased tendency towards the use of herbs in the treatment of malaria in Nigeria.

1.1 JUSTIFICATION

This study is aimed at documenting ethnobotanical potentials, mainly anti-malarial activity of herbs in the Ado-Ekiti local government area of Ekiti State.

1.2 OBJECTIVES

The Specific Objectives are:

CHAPTER TWO

LITERATURE REVIEW

2.0 ETHNOBOTANY

Ethnobotany involves the study of how communities of a particular region make use of indigenous plants in the region for food, clothing and medicine (Aiyeloja *et al.*, 2006). Ethnobotany allows the documentation of information about plants used locally for treatment of diseases in a particular community.

Plants have been used over time by human for treatment. Prescription drugs contain compounds which are derived directly or indirectly, from plants (Oksman-Caldentey *et al.*, 2004). Modern day synthetic drugs and compounds owe their active chemical compound to a bioactive compound in a plant. (Rates, 2001). Thus, plants continue to be a very important resource for new medicines and beneficial compounds. African flora is greatly rich with a lot of medicinal plants, which indigenous people are familiar with and have used overtime (Dike *et al.*, 2012). Indigenous people worldwide have used oral traditions to compile detailed knowledge regarding the use of medicinal plants, and this information is disseminated from generation to generation (Abel *et al.*, 2005).

2.1 HERBAL MEDICINE

The use of herbs for treatment of diseases is common in the developing countries. Studies in Nigeria show that a lot of people prefer herbal medicine to synthetic drugs. This is due to the

extracts, mixtures, etc. Today a substantial number of drugs are developed from plants which are active against a number of diseases (Principe, 2005).

WHO recognized the practice since 1977 in its policy document and maintained that "a medicinal plant" is any plant, which in one or more of its organs contains substances that can be used for the therapeutic purposes or which, are precursors for the synthesis of useful drugs (WHO, 1991). Medicinal plants are plants containing inherent active ingredients used to cure disease or relieve pain (Okigbo *et al*., 2008).

In African countries, approximately 80% of the population uses traditional medicine for the treatment of various diseases and ailments like malaria, typhoid, ulcers, skin diseases, diabetes, reproductive problems, aches and pains and also for various socio- cultural and economic reasons. (WHO, 2008) Ethnobotanical surveys have shown that these traditional medicines have been found to be effective especially in the treatment of malaria which is of great concern to any African nation (WHO, 2002). Studies have documented over 1,200 plant species from 160 families used in the treatment of malarial or fever (Willcox *et al.*, 2004). Practitioners of herbal medicine include herbalists, bonesetters, village midwives or traditional birth attendants, traditional psychiatrists, herb sellers, and other specialists (Sofowora, 1996).

Traditional medicines have been used to treat malaria for thousands of years and are the source of the two main groups (artemisinin and quinine derivatives) of modern antimalarial drugs. With the problems of increasing levels of drug resistance and difficulties in poor areas of being able to afford and access effective antimalarial drugs, traditional medicines could be an

on which plants, preparations, and dosages are the most effective. Thirdly, the concentration of active ingredients in a plant species varies considerably, depending on several factors.

2.2 MALARIA

Malaria is a mosquito-borne infectious disease affecting humans and caused by parasitic protozoans (a group of single-celled microorganisms) belonging to the *Plasmodium* type (WHO, 2014). Symptoms of Malaria include fever, tiredness, vomiting, and headaches, periodic attacks of chills and fever, anemia, splenomegaly (enlargement of the spleen), and often other fatal complications (Andrej *et al.,* 2003). According to the World Health Organization (WHO) a child dies every 45 seconds as a result of the disease. This deadly disease Malaria is a common and life-threatening especially in many tropical and subtropical areas (WHO, 2012) and Africa faces the greatest impact of this disease (Parija, 2008). Reports show that this disease infects about 250 million people yearly with about 800000 cases of such infection resulting in death (WHO, 2010) According to the World Health Organization's Reports (2013), and the Global Malaria Action Plan, 3.4billion people (half the world's population) live in areas at risk of malaria transmission in 106 countries and territories. In 2012, malaria caused an estimated 207 million clinical episodes, and 627,000 deaths and statistics showed that 90% of deaths in 2012 occurred in the African Region (WHO, 2013). In 2013, 97 countries had on-going malaria transmission, and about 80% of malaria cases resulted in death in 18 most affected countries and about 40% of malaria deaths occur in just two countries: Nigeria and the Democratic Republic of the Congo (WHO, 2013). The disease is most

the disease in Africa since the turn of millennium have been partially effective, with rates of the disease dropping by an estimated 40% on the continent.

WHO reports in 2008 shows that Nigeria accounts for quarter of all Malaria cases in Africa. Records also show that malaria is prevalent in Nigeria and accounts for an annual loss of 132 billion Naira (Onwujekwe *et al*., 2000; Federal Ministry of Health, 2005; Jimoh *et al*., 2007). Areas in Ado LGA experience malaria due to the poor drainage system in some areas. The poor drainage system leads to stagnant waters in these areas. The stagnant waters serve has breeding homes for the pathogen and this in turn infect people and the *Plasmodium* is introduced into the human body leading to the malaria infection. *P. falciparum* is considered to be the most deadly species and is responsible for severe malaria anemia while *P. vivax* is associated with an increased risk of splenic rupture, which has a high mortality rate when it occurs and *P. malariae* causes a persistent infection (Hall, 2009).

2.3 PATHOLOGY OF MALARIA

Malaria is an acute fever illness with an incubation period of 7 days or longer. Thus, a Fever illness developing less than 1 week after the first possible exposure especially for travelers is not malaria (WHO, 2012). Generally, five species of *Plasmodium* can infect and be spread by humans (Caraballo, 2014). Most death cases are caused by *Plasmodium falciparum* because *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae* generally cause a milder form of malaria. (Caraballo, 2014; WHO, 2014). Three species of malaria parasites occur in

swim towards the Liver, where they traverse the endothelium, invade hepatocytes, they mature and reproduce (Caraballo, 2014). Over a period of 6–16 days, depending on the species, the parasites undergo several rounds of replication and differentiate into invasive merozoite stages (Hall, 2009). Symptoms to show infection include: fever, headache, muscular aching and weakness, cold, vomiting, cough and in rare cases diarrhea and abdominal aches. Other symptoms related to organ failure may supervene, such as acute renal failure, pulmonary edema, generalized convulsions, circulatory collapse, followed by coma and death. (WHO, 2012). From the Reports shown it is noted that *P. Falciparum* malaria can become severe and in most cases lead to death if not treated as soon as symptoms are noticed in a patient. To confirm symptoms to be malaria related, people undergo laboratory tests. Areas that do not have access to these test depend on the history of fever as noted by traditional healers to diagnose malaria. Thus the common teaching "fever equals malaria unless proven otherwise".

2.4 MALARIA AND HERBAL TREATMENT

Traditional medicines have been used to treat malaria for thousands of years and they serve as the source of the 2 main groups of modern anti-malaria drugs (artemisinin and quinine derivatives) (Baird *et al.*, 1996) Despite the efforts exerted to provide effective anti-malarial drugs, some communities still suffer from getting access to these services due to many barriers (Elmardi, 2009). Cost consideration, absence of side effects such as itches that occur in chloroquine and ineffectiveness of chloroquine (Calzada *et al.*, 2008) and some other anti-

Nigeria in Nigeria 2005 (Mokuolu *et al*., 2007). In under developed areas ACT cannot be effectively used as a lot of patient in these areas cannot afford the cost of ACT. The use of ACT is also limited by production of artemisinin derivatives to Good Manufacturing practices standards and toxicity (Haynes, 2001; Malomo *et al.*, 2001; Adebayo and Malomo, 2002; Borstnik *et al*, 2002; Afonso *et al.*, 2006; Boareto *et al.*, 2008)

CHAPTER THREE

MATERIALS AND METHODS

3.0 STUDY AREA

The survey was carried out in Ado-Ekiti (7.6124°N, 5.2371°E), Ekiti State, South west Nigeria. The State has 16 Local governments Areas. Ado-Ekiti is the state capital and has one local government, Ado Local Government covering the town. The town is a center of Business activities for the State. These areas include Oke-ila, Odo-ado, Ugbeyinadun, Ereguru, Ogbon Ado, Oja Oba, Ile-ileri, Ajilosun and other places within Ado- Ekiti. The residents of these areas belong mainly to the Yoruba ethnic group.

3.1 ETHICAL APPROVAL

The purpose of this study was explained to the respondents (Herb sellers, Mothers, Traditional medical practitioner and herbalist) in Ado Local Government Area and each respondent gave his/her consent.

3.2 ETHNOBOTANICAL SURVEY

Herb sellers, Herbalist, Farmers and old people (Men and Women) were interviewed using semi-structured questionnaire (Appendix) to obtain information about their knowledge of various species of plants used in the treatment of malaria. The information was obtained through verbal conversations with the respondents. The respondents cut across age groups except individuals below the age of 18

- Origin of knowledge about Medicinal plants
- How they diagnosis patients with Malaria
- Treatment: Local names of plant, part used, time of harvesting part used, method of preparation, mode of administration, dosage, Duration of treatment and side-effects

3.3 PLANT COLLECTION, IDENTIFICATION AND PREPARATION OF VOUCHER SPECIMEN

For proper identification of the plants and future studies, plants were collected and images captured. Proper identification of plants was done at the herbarium of the Taxonomy section of Forestry Research Institute of Nigeria (FRIN), Jericho Hills Ibadan.

3.4 DATA ANALYSIS

The data collected was analyzed using descriptive statistics such as percentage, frequencies and mean to describe the socio-demographic characteristics and the types of plant species used as traditional medicine for malaria treatment.

CHAPTER FOUR

RESULTS, DISCUSSION, CONCLUSION AND RECOMMENDATION

4.1.0 RESULTS

Table 4.1: Distribution of Respondents based on Gender

GENDER	FREQUENCY	PERCENTAGE
Male	74	49.33
Female	76	50.67
Total	**150**	**100.00**

Table 4.2: Age of the Respondents

Age (Years)	Frequency	Percentage
Less than 31	5	3.33
31 – 50	24	16.00
51 – 70	86	57.34
Above 70	35	23.33

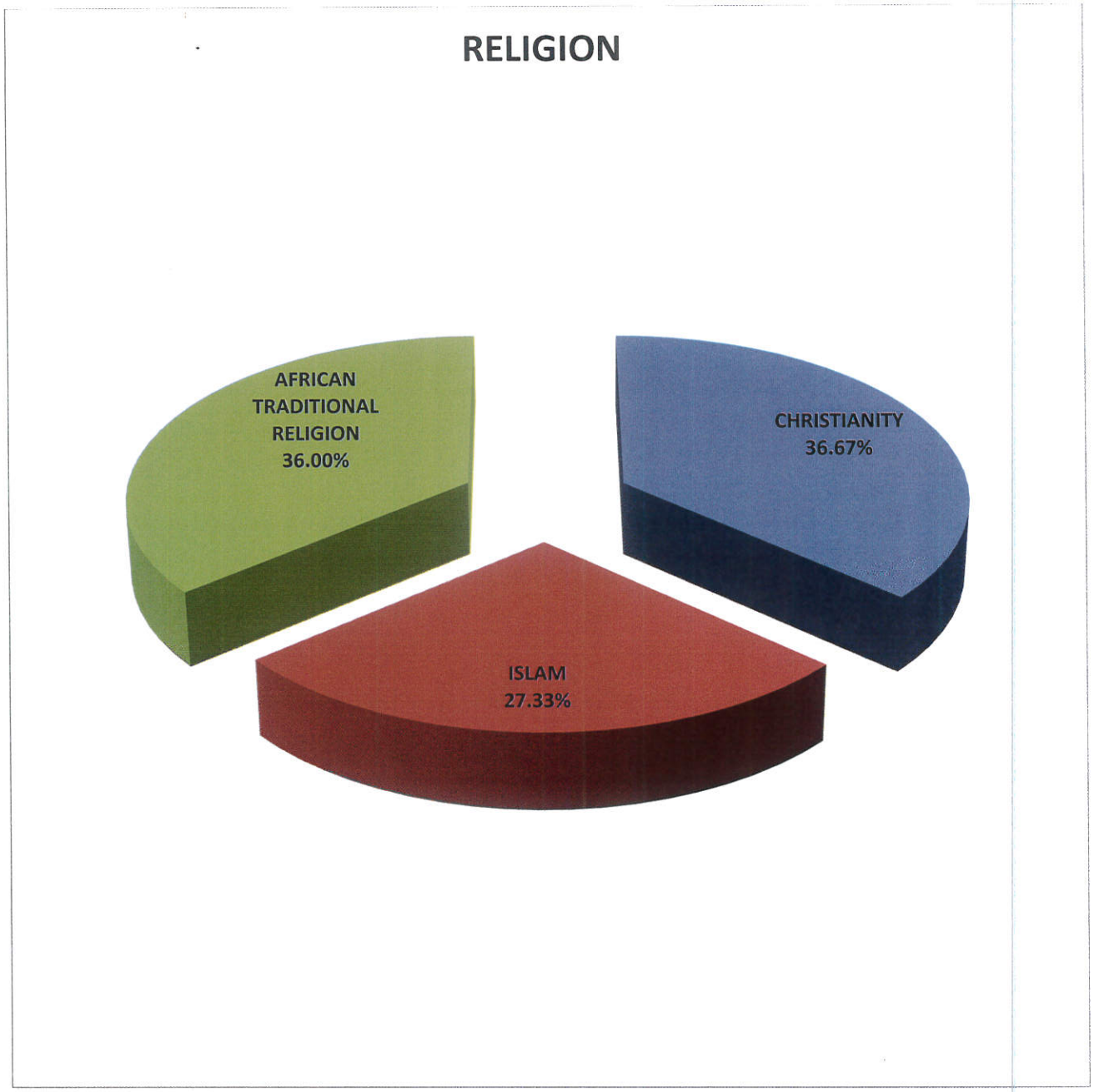
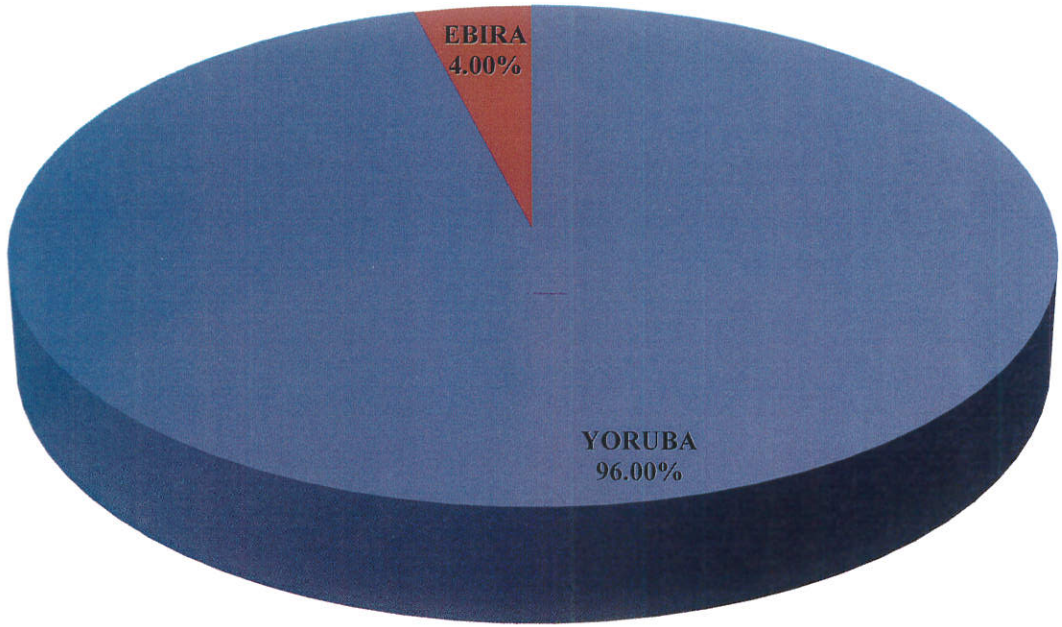


Figure 4.1. Religion practiced by the respondents

TRIBE OF THE RESPONDENTS



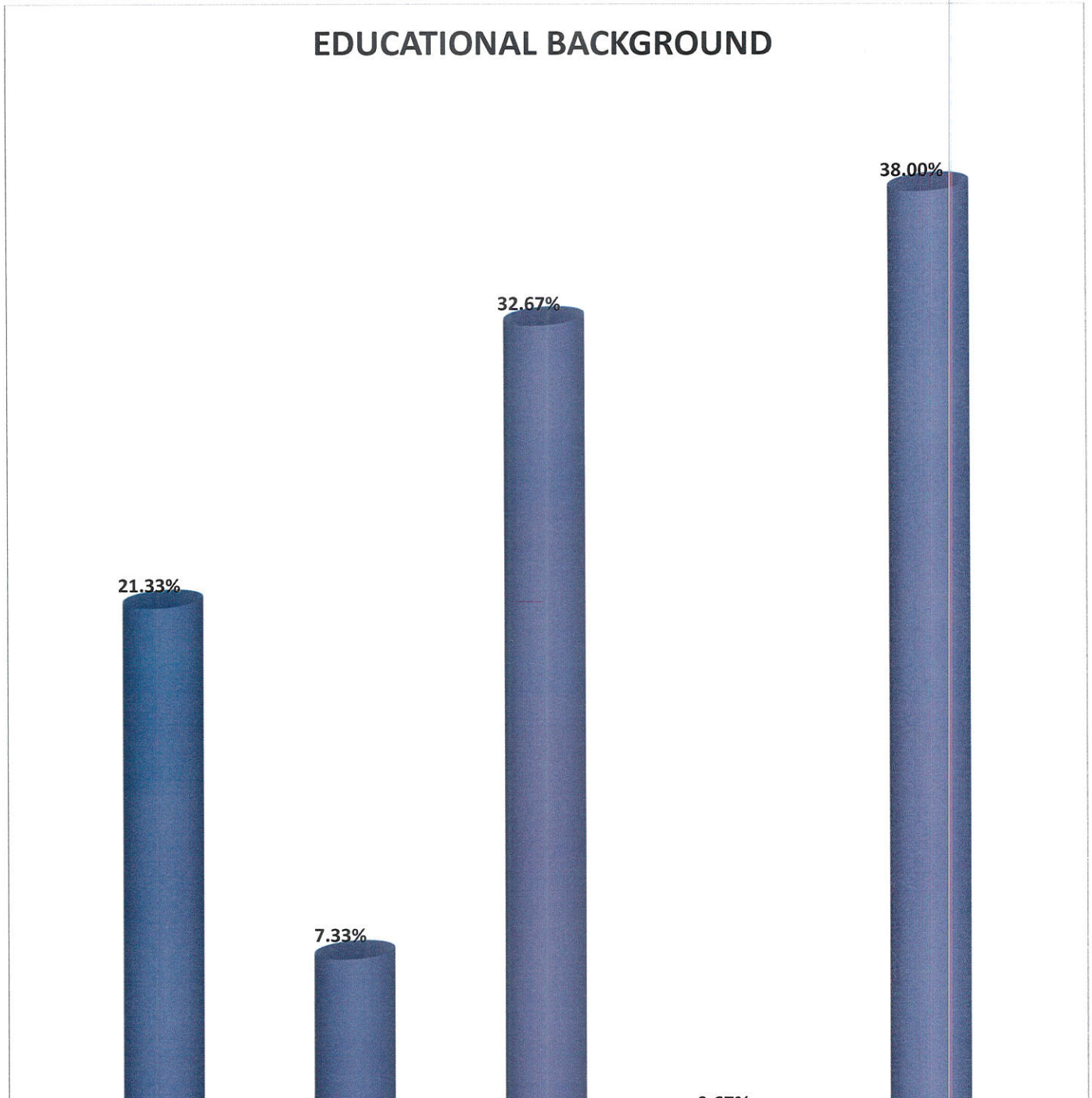

EDUCATIONAL BACKGROUND
21.33%
7.33%
32.67%
38.00%

Table 4.3 A list of plants used in the treatment of malaria in ado local government area

SN	BOTANICAL NAME	LOCAL NAME	FAMILY	PART(S) USED
1	*Aframomum melegueta* K. Schum	Ataare	Zingiberaceae	Fruit
2	*Ageratum conyzoides* L.	Imi esu	Asteraceae	Leaves, roots
3	*Allium sativum* L.	Ayuun	Liliaceae	Bulb
4	*Alstonia boonei* R. Br.	Ahun	Apocynaceae	Stem bark
5	*Anacardium occidentale* L.	Kasu	Anacardiaceae	Leaves , stem bark
6	*Ananas comosus* (L.) Merr.	Ope oyinbo	Bromeliaceae	Fruits
7	*Azadiractha indica* A.Juss	Dongoyaro	Meliaceae	Leaves, Stem bark
8	*Bridelia feruginea* Benth.	Era	Euphorbiaceae	Bark
9	*Cajanus cajan (L.)* Millsp.	Feregede	Fabaceae	Leaves
10	*Capsicum annuum* L.	Atawsewe	Solanaceae	Fruit
11	*Carica papaya* L.	Ibepe	Caricaceae	Leaves, fruit
12	*Casalpinia bonduc* (Linn) Roxb.	Ayo	Leguminosaee	Leaves
13	*Cassia fistula* L.	Kaashia	Fabaceace	Leaves

17	*Citrus paradisi* Macfad.	Giirepu	Rutaceae	Fruit, stem twigs
18	*Cocos nucifera* L.	Agbon	Arecaceae	Stem bark, fruits
19	*Cymbopogon citratus* L.	Ewe tea, kooko oba	Poaceae	Leaves
20	*Enantia chlorantha* Oliv.	Awopa	Annonaceae	Stem bark
21	*Gossypium barbadense* L.	Owu	Malvaceae	leaves
22	*Khaya grandifolia* C.DC.	Oganwo	Meliaceae	Stem bark
23	*Khaya senegalensis* (Desr.) A. Juss.	Aganwo	Meliaceae	Stem bark
24	*Lannea welwitschii* (Hiern) Engl.	Orira	Anarcadaceae	Stem bark
25	*Mangifera indica* Linn.	Mongoro	Anacardiaceae	Leaves, stem bark
26	*Morinda lucida* Benth.	Oruwo	Rubiaceae	Leaves,StemBark, Root
27	*Nauclea latifolia* L.	Egberesi	Rubiaceae	Roots, leaves
28	*Parkia biglobosa* (Jacq.) R.Br. ex G.	Iru, Igba	Fabaceae	Seed, Bark
29	*Polyalthia longifolia* Sonn.	Masquerade tree	Annonaceae	Leaves
30	*Pterocarpus osun* Craib	Osun	Leguminoaceae	Stem bark, Root
31	*Sorghum bicolor* (L.) Moench	Okababa	Poaceae	Grain head, leaves
32	*Spondias mombin* L.	Iyeye	Anacardiaceae	Leaves, stem bark

36	*Zingiber officinale* Roscoe.	Ata ile	Zingiberaceae	Rhizome

4.1.1 TAXONOMIC DESCRIPTION OF PLANTS

1. **Botanical Name:** *Aframomum melegueta*

   Description: *Aframomum melegueta* is an herbaceous perennial plant native to swampy habitats along the West African coast. Its trumpet-shaped, purple flowers develop into pods, containing numerous small, reddish-brown seeds. The stem at times can be short, and usually shows signs of scars and dropped leaves.

2. **Botanical Name:** *Ageratum conyzoides*

   Description: *Ageratum conyzoides* (billygoat-weed, chick weed, goatweed, whiteweed) is an herb with ovate leaves and white flowers.

3. **Botanical Name:** *Allium sativum*

   Description: *Allium sativum* is a bulbous plant that produces hermaphrodite flowers. It is pollinated by bees, butterflies, moths, and other insects.

4. **Botanical Name:** *Alstonia boonei*

Description: Cashew tree is large and evergreen, the leaves are spirally arranged. The flower is small, pale green at first turning red as it approaches ripening stage.

6. **Botanical Name:** *Ananas comosus*

   Description: The pineapple is an herbaceous perennial that has a short stem with tough, waxy leaves and large fruit.

7. **Botanical Name:** *Azadiractha indica*

   Description: Neem is a fast-growing tall tree. It is evergreen, but in severe drought it may shed most of its leaves or nearly all leaves. The branches are wide and spreading. Protandrous, bisexual flowers and male flowers exist on the same individual tree.

8. **Botanical Name:** *Bridelia feruginea*

   Description: A shrub tree with brown wood. It is said to be fire-resistant and termite-proof. The bark, leaves and roots are all ingredients of medicinal herbs.

9. **Botanical Name:** *Cajanus cajan*

   Description: *Cajanus cajan* is a perennial shrub, usually grown as an annually. It has thin roots, slender stem and branch. Fruit is a linear pod.

10. **Botanical Name:** *Capsicum annuum*

    Description: A perennial plant with single flowers with an off-white color. The fruit are berries

Description: *Carica papaya* is an evergreen tree that has white latex in all parts. Leaves spirally arranged. Fruits are large, cylindrical, with fleshy orange pulp, hollow berry. It has hermaphrodite flowers and fruit have numerous seeds numerous, which are small and black in color.

12. **Botanical Name:** *Caesalpinia bonduc*

Description: Caesalpinia bonduc is a large vine tree. The stems and leaves are covered with prickles and incomplete flowers. The fruit is a spiny legume, 5-8 cm in length, turning brown at maturity. There are about 2-3 grey seeds.

13. **Botanical Name:** *Cassia fistula*

Description: The tree is medium-sized, with deciduous leaves. The fruit is a legume containing several seeds.

14. **Botanical Name:** *Chromolaena odorata*

Description: *Chromolaena odorata* is a rapidly growing perennial herb with soft stems but the base of the shrub is woody. It has white to pink color leaves. The plant is hairy and the leaves give off a pungent, aromatic odour when crushed.

15. **Botanical Name:** *Citrus aurantifolia*

Description: The lime tree is irregularly branched and possesses sharp spines and sour fruit. The tree produces small, white flowers and yellowish-green fruit which is round or egg-like in shape.

16. **Botanical Name:** *Citrus aurantium*

Description: *Citrus aurantium* is an evergreen Tree with hermaphrodite species (has both male

Description: The grapefruit trees have glossy, dark green, thin leaves. The fruit is big, yellow-orange skinned with segmented flesh and acidic juice.

18. **Botanical Name:** *Cocos nucifera*

Description: Cocos nucifera is a large, palm with pinnate leaves. Coconuts are generally classified into two general types: tall and dwarf.

19. **Botanical Name:** *Cymbopogon citratus*

Description: Lemon grass is a tropical, evergreen, perennial grass that is aromatic.

20. **Botanical Name:** *Enantia chlorantha*

Description: African whitewood is an ornamental tree with a dense foliage and spreading crown.

21. **Botanical Name:** *Gossypium barbadense*

Description: *Gossypium barbadense* is an evergreen Shrub. It has yellow flowers and black seeds and it produces cotton with long and silky fibers.

22. **Botanical Name:** *Khaya grandifolia*

Description: *Khaya grandifoliola* is a medium to large-sized tree. It is usually deciduous in the dry season; the young leaves are strikingly reddish and often occur together with flowers.

23. **Botanical Name:** *Nauclea latifolia*

Description: *Parkia biglobosa* is a dicotyledonous angiosperm. The pods of the tree, commonly referred to as locust beans, are pink in the beginning and turn dark brown when fully mature.

25. **Botanical Name:** *Polyalthia longifolia*

Description: *Polyalthia longifolia* is an evergreen tree tall tree. The tree is cultivated for its timber and ornamental value.

26. **Botanical Name:** *Pterocarpus osun*

Description: Evergreen or deciduous small to medium-sized tree with bisexual flowers.

27. **Botanical Name:** *Sorghum bicolor*

Description: Sorghum is a strong tall growing grass. It has grain head with cluster of seeds.

28. **Botanical Name:** *Vernonia amygdalina*

Description: *Vernonia amygdalina* plant is a shrub. The leaves are dark green colored with a characteristic odour and have a bitter taste. The bark is grey or brown and has a rough texture that is flaked. Its flowers are white, small, tiny, and clustered with small fruits that are slightly hairy, with small nuts inside.

29. **Botanical Name:** *Xylopia aethiopaca*

Description: Xylopia aethiopica is an evergreen, aromatic tree.

4.1.2 METHOD OF PREPARATION AND ADMINISTRATION OF MEDICINAL PLANTS

PREPARATION METHODS

Plants contain active ingredients and these active ingredients bring about the medicinal properties of these plant. These active ingredients include Alkaloids, Cardiac Glycosides, Flavonoids, Phenols, Tannins, and Vitamins. There is need to extract these active ingredients from plants, the extraction is done to separate the soluble plant components leaving behind the insoluble residue (Azwanida, 2015). In the survey conducted, the following methods were used by traditional healers to prepare herbal medicine:

INFUSION

This is the method of extracting active ingredients from plant materials by steeping the material in water or alcohol for a period of time. Infusion time range differently depending on plant materials.

DECOCTION

This method involves boiling plant materials to extract the active ingredients. Boiling is usually done for a minimum of 15 minutes and increases depending on the quantity of plant materials. The herb sellers prefer this method of preparation and this supports the claims of Gronhaug *et al.*, (2008) and Simbo (2010).

CONCOCTION

Dermally: Patient rubs herbal medicine of skin or takes bath with the medicine.

Table 4.4 Recipes used in malaria treatment.

RECIPE NO.	PLANTS	PART USED	MODE OF PREPARATION	SOLVENT AND ADMINISTRATION
1	*Carica Papaya* *Citrus paradise* *Ananas comosus* *Citrus aurantium* *Cymbopogon citratus* *Polyalthia longifolia* *Sorghum bicolor*	Fruit Fruit Fruit Fruit Leaves Leaves Head grain	DECOCTION Fruits will be thoroughly washed and rinsed and cut into smaller pieces. Leaves will be rinsed once in water and placed in a pot and the fruit placed on top. Pap water is added and pot placed on fire to boil for about 15-20minutes.	Pap Water(omidun) Orally – Patients drink $^1/_2$ glass cup of herbal preparation twice daily.
2	*Vernonia amygdalina*	Leaves Fruits	CONCOCTION The ingredients will be	Water Orally-patient 3-5 table

			a smooth paste. And it is later mixed with a little quantity of water.	Orally -- patient drinks $^1/_2$ glass cup two times daily.
4	*Bridelia feruginea* *Capsicum annuum*	Stem bark Fruit	The ingredients will be ground together to form a smooth paste.	Waters Orally- Patient takes once per day
5	*Bridelia feruginea* *Capsicum annuum* *Pterocarpus osun* *Parkia biglobosa* *Zingiber officinale*	Stem bark Fruits bark, roots Seed Rhizome	CONCOCTION Ingredients will be ground together and cooked with palm oil and meat for 10-15 minutes to form a concoction.	Water Orally- Patients licks soup and can use it to take meals.
6	*Enantia chlorantha* *Alstonia boonei*	Stem bark	INFUSION Bark is extracted from the tree and dropped or placed in the palm wine for a period of time to allow the extraction of the contents of the stem	Palmwine Orally- Drink twice per day, morning and night time

			preparation is ready for use.	
7	*Chromolaena odorata*	Leaves	The leaves will be boiled for a period of 10-15 minutes and afterwards allowed to cool.	Water Orally- Patient is made to drink once per day.
8	*Citrus aurantifolia* *Zingiber officinale*	Fruit Rhizome	Extract juice from *Citrus aurantifolia* fruit by squeezing. Already ground *Zingiber Officinale* is added to the juice and thoroughly mixed. The content (Yolk and Albumen) of the local Egg is added to the mixture and thoroughly mixed.	Juice from *Citrus aurantifolia* Orally- Patient drinks early in the morning
9	*Alstonia boonei* *Zingiber officinale*	Stem bark Rhizome	*Zingiber officinale* will be ground. Pap water	White pap water Orally- Patient drinks

			mixture is allow to stand for 3hours.	
10	*Xylopia aethiopaca* *Mangifera indica*	Stembark,Leaves Stembark	Ingredients will be soaked in Solvent for 2 hours after which it is ready for use.	Alcohol (Dry Gin) Orally- Patient drinks Two times daily
11	*Cajanus cajan* *Sorghum bicolor*	Leaves Grain head	Ingredients will be placed in pot preferably earthen pots. Solvent is added and will be boiled for 20-40mins.	Water/White pap water. Orally- Patient drinks two times daily.
12	*Cymbopogon citratus* *Polyalthia longifolia* *Citrus aurantium*	Leaves Fruit	The ingredients will be placed in earthen pots and boiled for about 20-40mins. Afterwards it is left to cool.	Pap water/Water Orally- Patient drinks early in the morning and later in the Evening. Dermally- Patient will bathe with the mixture
13	*Carica papaya*	Leave drop	The leaves will be placed	Water

14	*Enantia chlorantha*	Bark and Leaves	The ingredients will be place in an earthen pot that already contains the White Pap water. It is boiled for 15-30minutes.	White Pap Orally-Patient drinks Twice daily.
15	*Enantia chlorantha*	Bark and Leaves	The ingredients will be well ground together, the grounded ingredients and Alabukun powder is mixed with the 7up drink.	7up drink Orally-Patient Drinks mixture once daily
16	*Alstonia boonei* *Aframomum melegueta*	Stembark and Leaves Fruit	Ingredients will be soaked in White Pap Water for 3 days.	White Pap water Orally Patient drinks early in the Morning

of the respondents were female while almost half (49.33%) of them were male. This depicts that female were involved in herbal treatment than their male and this could be as a result of their roles in the family and society. Table 4.2 revealed the distribution of the respondents by age. More than half (57.34%) of the respondents were between the age range of 51-70 years, 23.33 percent were more than 70 years, while 16.00 percent of them were between the age range of 31 – 50 years and the remaining 3.33 percent of them were below 31 years. Thus, the mean age of the respondents was 60.39 years. This implies that most of the respondents in the study area who uses herbal medicine for the treatment of malaria were aged people.

Figure 4.1 shows that Christianity is practiced by 36.67% of the population, Islam is practiced by 27.33% of the population and African traditional religion is practiced by 36.00% of the population which implies that Christians in this areas involve more in the practice of herbal treatment. Figure 4.2 shows the distribution of the respondents based on their tribe. A majority (96.00%) of the respondents belongs to Yoruba ethnic group while the remaining 4.00% are from Ebira ethnic group. This depicts that majority of the respondents were Yoruba and this could be as a result of the location of the study.

The result in Figure 4.3 shows the distribution of the respondents based on their educational background. Almost two-fifth (38.00%) of the respondents had tertiary education, 32.67 percent of them had secondary education, 21.33 percent of them had no formal education, while

Anacardiaceae (4) leading the list with the number of most plants. Respondents find traditional treatment cheaper and more accessible than synthetic drugs and therefore resort to the use of herbal plants in the treatment of malaria. Healers' record that patients can develop shortage of blood in severe cases of malaria and hence noted that it is safer to treat malaria as soon as symptoms of it is noticed in patients. This corroborates the works of Weatherall *et al.*, (2002) and Lamikanra *et al.*, (2007) who both noted that malaria leads to anemia. Vomiting and sweating are side effects experienced by few patients.

Recently, herbsellers are faced with difficulty in getting herbs as constant deforestation occur in the local government area and there are no appropriate measures for plant regeneration within the local government. Herbs are mainly obtained from the wild and as such, fresh plants cannot be easily accessed by the healers. The knowledge about medicinal herbs and treatment methods was learnt from parents and society, by learning from other herb sellers, traditional healers or research studies. The survey revealed that the information about the treatment of diseases with herbs has been passed on from generation to generation. The study also revealed that at times these information is been hoarded within the lineage as there is the belief that the information is to be kept as a secret for the lineage and serve as a power to be handed over to generations

4.3 CONCLUSION

4.4 RECOMMENDATION

Due to the gradual loss of the plant materials in the environment, there is need to encourage people to participate in plant regeneration programs. Agricultural centres should encourage tree planting program. There is also need for future research to investigate the effectiveness of recipes and appropriate dosage for treatment. Herb sellers need to be educated on how to collect plants without injuring the mother plant. And they should be educated on how to administer the right dosage and measurement during preparation.

REFERENCES

Abel C., Busia K., Med H.H. (2005). An exploratory ethnobotanical study of the practice of herbal medicine by the Akan peoples of Ghana. *Herbal Medicine in Ghana* 10 (2).

Adebayo J.O., Malomo S.O., (2002). The effect of co-administration of dihydroarteminism with Vitamin E on the activities of cation ATPases in some rat tissues. *Nigerian Journal of Pure and Applied Sciences* 17, 1245-1252.

Adibe, M.O. (2009). Prevalence of Concurrent Use of Herbal and Synthetic Medicines among outpatients in a mission hospital in Nigeria. *International Journal of drug development.* Dec 2009:1(1):60-66.

Afonso A., Hunt P., Cheesman S., Alves A.C., Cunha C.V., Do Rosario V., Cravo P., (2006). Malaria parasites can devlop stable resistance to artemisinin but lack mutations in candidate genes atp6 (encoding the sarcoplasmic and endoplasmic reticulum Ca^{2+} ATPase), tctp, mdr1, and cg10. *Antimicrobial Agents Chemotherapy* 50, 480-489.

Aiyeloja A.A., Bello O.A. (2006). Ethnobotanical potentials of common herbs in Nigeria: a case study of Enugu state.Educ.Res.Rev.1, 16–22.

Andrej T., Matjaz J., Igor M., and Rajesh M. (2003). *Critical care* 7(4):315-323. Doi: 10.1186/cc2183

Azwanida N.N (2015). A Review on the Extraction Methods Use in Medicinal Plants,

falciparum and vivax malaria in Palawan, The Philippines. *Transactions of the Royal society of Tropical Medicine and Hygiene* 90, 413-414.

Boareto A.C., Muller J.C., Bufalo A.C., Botelho G.G.k., de Araujo S.L., Foglio M.A., de Morais R.N., DAlsenter P.R., (2008). Toxicity of artemisinin (Artemisia annua L.) in two different periods of pregnancy in Wistar rats. *Reproductive Toxicology* 25, 239-246.

Borstnik K., Paik I.H., Shapiro T.A., Posner G.H., (2002). Antimalarial chemotherapeutic peroxides: artemisinin, yingzhaosu A and related compounds. *International Journal of Parasitology.*

.Calzada J; Samudio F; Bayard V; Obaldia N; Mosca de I; Pascale J. (2008). Transactions of the Royal Society of *Tropical Medicine and Hygiene* 2008, 102, 694–8.

Caraballo H (2014). "Emergency department management of mosquito borne illness: Malaria, dengue, and west nile virus". *Emergency Medicine Practice*. 16 Archived from the original on 2016-08-01.

Cui L., Wang Z., Miao J., Miao M., Chandra R., Jiang H., Su X.-Z. (2012). Mechanisms of in vitro resistance to dihydroartemisininin Plasmodium falciparum. Article first published online:6AUG2012.http://dx.doi.org/10.1111/j.13652958.2012.08180.x.

Dike, I.P., Obembe, O.O. (2012). Towards the conservation of Nigeria's indigenous medicinal plants. *Journal of Medicinal Plants Research* 6, 2517-2529.

Eisenberg D., Davis R., Ettner S. (1998): Trends in alternative medicine use in the United States 1990-1997; results of a follow up survey. *Journal of American Medical Association*, 280:1569-1575.

Ekor .M. (2014). Front Pharmacol. 10;4:177.doi:10.3389/fphar.2013.00177.eCollection.

Elmardi E. (2009) *Malaria Journal* 2009, 5, 8-39

Emmanuel AM; Malebo M; Mhame P; Kitua AY; Warsame M. (2006) *Malaria Journal* 2006, 5, 58

Federal Ministry of Health (2005) National Antimalarial Treatment Policy. FMOH, National malaria and vector Control Division, Abuja, Nigeria 2005.

Gronhaug T.E. Glaeserud .S. Skogsrud .M. *et al.* (2008) Ethnopharmacological survey of six medicinal plants from Mali. *West-Africa.J Ethnobol Ethnomed.* 2008;4:26

Hall Fenton B. and Fauci Anthony S. (2009) Malaria Control, Elimination, and Eradication: The Role of the Evolving Biomedical Research Agenda.

Haynes R.K. (2001). Arteminism and derivatives: the future for malaria treatment? Current Opinion in Infectious Diseases 14, 719-726.

Htut, Z.W. (2009). Artemisinin resistance in plasmodium falciparum malaria. New England journal of medicine Vol. 361, pp 1807–1808.

Idowu ET; Mafe MA; Otubanjo OA; Adeneye AK. (2006) *African journal of medicine and*

Lamikanra AA, Brown D, Potocnik A, Casals-Pascual C, Langhorne J, Roberts DJ. (2007) Malarial anemia: of mice and men. *Blood*. Jul 1;110(1):18-2

Malomo S.O., Adebayo J.O., Olorunniji F.J., (2001). Decrease in activities of cation ATPases and alkaline phosphate in Kidney and liver of artemether treated rats. NISEB Journal 1, 175-182.

Mokuolu, O.A., Okoro, E.O., Ayetoro, S.O., Adewara, A.A. (2007). Effect of artemisinin-based treatment policy on consumption pattern of antimalarials. American Journal of Tropical Medicine and Hygiene 76, 7–11

Muthu, C., Ayyanar, M., Raja, N., Ignacimuthu, S., (2006). Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India. *Journal of ethnobiology and ethnomedicine* 2, 43, http://dx.doi.org/10.1186/ 1746-4269-2-43.

Nitta T., Arai T., Takamatsu H., Inatomi Y., Murata H., Iinuma M., Tanaka T., Ito T., Asai F., Ibrahim I., Nakanishi T., Watabe K. (2002). Antibacterial activity of extracts prepared from tropical and subtropical plants on methicillin-resistant staphylococcus aureus. *Journal of Health Science* 48, 273–276.

Okigbo RN, Eme UE, Ogbogu S (2008). Biodiversity and conservation of medicinal and aromatic plants in Africa. *Biotechnology (Molecular Biology)* Rev.3(6): 127-134.

Oksman-Caldentey KM., Inze D., (2004). Plant cell factories in the post-genomic era: new ways to produce designer secondary metabolites. *Trends in Plant Science* 9,433–440.

Pan Si-Yuan, ZhouShu-Feng, GaoSi-Hua, YuZhi-Ling, Zhang Shuo-Feng, Tang Min-Ke , Jian-Ning Sun, Dik-Lung Ma, Yi-Fan Han, Wang-Fun Fong, Kam-Ming Ko (2013) New perspectives on how to discover drugs from herbal medicines: CAM's outstanding contribution to modern therapeutics. Evidence-Based Complementary and Alternative Medicine Volume 2013, Article ID 627375, 25 pages http://dx.doi.org/10.1155/2013/627375.

Panda, Sujogya Kumar; Luyten, Walter (2018). "Antiparasitic activity in Asteraceae .with special attention to ethnobotanical use by the tribes of Odisha, India". *Parasite. 25: 10.* doi:10.1051/parasite/2018008. ISSN 1776-1042. PMC 5847338. PMID 29528842.

Principe, P. (2005) Monetising the Pharmacological Benefits of Plants. *US Environmental Protection Agency, Washington DC.*

Rates, S.M.K., (2001). Plants as source of drugs. Toxicon 39, 603–613.

Rawlins SC; Hinds A; Rawlins JM. (2008) *West Indian Med J* 57, 462–9.

Sofowora A (1996). Research on medicinal plants and traditional medicine in Africa. *Journal of Alternative Complement. Medicine*. 2 (3): 365-372.

Simbo DJ (2010). An ethnobotanical survey of medicinal plants in Babungo, Northwest Region, Cameroon *Journal of Ethnobiology and Ethnomedicine* 2010 6:8 https://doi.org/10.1186/1746-4269-6-8.

Weatherall DJ, Miller LH, Baruch DI, Marsh K, Doumbo OK, Casals-Pascual C, Roberts DJ (2002). Malaria and the red cell.Hematology Am Soc Hematol Educ Program. 2002:35-57.

WHO (1991). Tropical Diseases, Progress in Research 1990-91. Tenth Programme Report of the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR). Geneva: World Health Organization.

WHO. (2002). World Health Organisation fact sheet no. 271. World Health Organisation, Geneva.

WHO. (2008). World Malaria Report 2008. World Health Organization, Geneva, pp 7-15, 99-101.

World Health Organization (2010). Guidelines for the treatment of malaria (2nd ed.). Geneva: World Health Organization. p.ix. ISBN 978-92-4-154792-5.

WHO, 2012 World Malaria Report 2012

WHO (2013). 10 Facts on Malaria. World Health Organisation, Geneva

WHO. (2014) "Malaria Fact sheet N°94". . Archived from the original on 3 September 2014. Retrieved 28 August 2014.

WHO, 2015. Fact Sheet: World Malaria Report 2015.

Willcox, M.L., Bodeker, g., (2004). Traditional herbal Medicines for Malaria. British Medical Journal 329, 1156-1159.

APPENDIX

FEDERAL UNIVERSITY OYE EKITI, EKITI STATE

DEPARTMENT OF PLANT SCIENCE AND BIOTECHNOLOGY

TOPIC: AN ETHNOBOTANICAL SURVEY OF PLANT USED IN THE TREATMENT OF MALARIA IN ADO LOCAL GOVERNMENT OF EKITI STATE.

Dear Sir/Ma,

I am a final year student of the above named university and I am carrying out an Ethnobotanical survey. I am seeking information on traditional treatment of Malaria in this area from you. I promise to treat the information with confidentiality. The information you give will help me to complete this Academic Exercise, I hereby seek your cooperation to fill this questionnaire to the best of your ability.

KINDLY NOTE THE FOLLOWING:

1) Do not write your name
2) Tick the appropriate box
3) Please be honest with your answers.

SECTION A: PERSONAL DATA

1) GENDER: MALE ( ) FEMALE ( )
2) RELIGION: _____
3) AGE: _____
4) TRIBE: _____
5) EDUCATIONAL BACKGROUND: _____
6) HOW DID YOU ACQUIRE THE KNOWLEDGE:_____
7) DURATION OF PRACTISE: _____

3) I Yes, what plants/plant products do you use to treat malaria _____

_____

4) Please explain the recipes used:

(a) (i) Local names of the plant: _____

(ii) Part used (root, stem, bark, leaf, flower etc.) _____

(iii) Best time of collection: _____

(iv) Method of preparation: Infusion ( ), Decoction ( ), Concoction ( ), Powder ( )

other methods: _____

(v) Solvent used (e.g. Water, Alcohol, others): _____

(vi) State how it is administered and Dosage: _____

(vii) Is there any report of side effect from the administration of this preparation? _____

If YES, please state the side effects _____

(b) (i) Local names of the plant: _____

(ii) Part used (root, stem, bark, leaf, flower etc.) _____

(iii) Best time of collection: _____

(iv) Method of preparation: Infusion ( ), Decoction ( ), Concoction ( ), Powder ( )

other methods: _____

(v) Solvent used (e.g. Water, Alcohol, others): _____

(vi) State how it is administered and Dosage: _____

(vii) Is there any report of side effect from the administration of this preparation? _____

If YES, please state the side effects _____

5) Do you combine recipes for the treatment of Malaria? YES ( ) NO ( )

6) If yes, which one do you most frequently combine? Other plants_____

Animal_____ or Other materials_____

7) Do these preparation manage Malaria ( ) OR completely cure Malaria ( )