Folk use of herbal plants used in the treatment of malaria fever in Abeokuta North Local Government, Ogun, State. Nigeria

Research Paper

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ABSTRACT

Several strategies have been embarked upon to reduce the prevalence of malaria and to eliminate it in our communities. Survey of plants often used for the treatment of malaria in Abeokuta, Ogun State was carried out. 100 questionnaires were administered; 50 on Traditional Herbal Practitioners and the other 50 on malaria patients. Study was also carried out on plant parts used, methods of preparation and administration and duration of usage. Results of this study showed that a total of 71 plants belonging to 45 families were collated Rubiaceae, Compositae, Anacardiaceae, and Caesalpiniaceae were the most frequent. The most frequently mentioned plants were *Morinda lucida* (60.56%), *Azadirachta indica* (56.33%), *Cymbopogon citrates* (56.33%), *Sarcocephalus latifolia* (56.33%), *Alstonia boonei* (54.93%), *Carica papaya* (53.52%), *Khaya grandifolia* (52.11%), *Petivera alliaceae* (50.70%) *Tithonia diversifolia* (49.29%), *Mangifera indica* (46.48%). The most frequently used parts were leaves (22.53%) followed by combination of leaves and barks (23.94%). Various solvents for herbal preparation were mentioned out of which aqueous extract from fermented maize the most was frequently used. The herbal preparations (250-300ml) werenormally taken by oral application, 2-3times daily for at least 7 days.

Key words: Malaria, Herbal preparation, herbal practitioners, decoction, survey.

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INTRODUCTION

Malaria remains a chronic endemic disease in the tropics and subtropics. It is one of the world's commonest infectious diseases causing death of children under the age of 5 years and people of reproductive age in Africa (Sudhanshu *et al.,* 2003). The disease is prevalent in 91 countries currently with small pocket of transmission in a further eight. About 300,000,000 people are affected globally while 1- 2 million people die yearly as a result of the disease. The disease has become one of the greatest epidemic threats to African Health Sector (Sudhanshu *et al.,* 2003). In endemic area of Africa, most especially Nigeria, pregnant women are the main adult risk group for malaria. The attacks of malaria during pregnancy stage usually lead to severe anaemia and impairment of fetal nutrition which contribute to low birth weight, abortion, premature delivery, mental retardation, maternal death and 60% of miscarriages (WHO, 2000).

Malaria is believed to obstruct social and economic development in Nigeria and accounts for 40% of public health expenditure. The disease not only results in loss of life and low productivity because of illness and premature deaths and hinders children in their schooling and social development through absence from school and permanent neurological or other damage associated with severe episodes of the disease. In spite of control programmes in many parts of Nigeria there has been very little improvement in the control of malaria and infections due to appearance of drug and insecticides resistant strains of Plasmodium, rapid reproductive development, and widespread availability of fake antimalaria drugs (Kilama 2005). Nearly 80 % of the global population still depends upon the herbal drugs for their health care Satish and Ranjana 2013.

Thus, many communities who live in endemic areas

have started treating malaria by the use of indigenous plants in their local environments (Miliken, 1997) with the strong belief that if herbs used to treat malaria by our ancestors in Africa hundred of years ago were not effective, malaria would have destroyed Africa. This is because plant materials have been a major source of natural therapeutic remedies and are used to treat various infectious diseases including malaria in many developing countries Dike *et al.,* 2012.

Also, studies have documented over 1,200 plant species from 160 families used in the treatment of malaria or fever (Waako *et al.,* 2005).

Malaria has been reported treated successfully using plant secondary metabolites; a decoction of the root of *Sphenocentrum jollyanum*, *Zingiber officinale,* bark of *Khaya grandifoliola*, root and bark of *Rauvolfia vomitoria*, bark of *Alstomia congensis*, root and bark of *Senna sceptabilis*, root of *Zanthoxylum xanthoxyloides*, leaves of *Ocimum basilicum* and sp was reported active in the control of fever. This was achieved by drinking, bathing and steam inhalation the aqueous herbal preparations for 5-7 days or until symptoms of malaria disappear. Olowokudejo *et al.,* 2008; Olorunnisola *et al* .,2013.

However, to address this alarming health concern, there is an urgent need to carry out an ethnobotanical survey of plants, to search and exploit plants, for development of new drugs or vaccines suitable for the treatment, prevention and control of malaria (Kilama 2005; Waako *et al.,* 2005).

This study therefore was taken to collate herbal information from herbal practitioners (herb seller, Native doctor, herbalist and their malaria patients) on the use of herbs in the treatment of malaria fever, characterization and identification of malaria herbal plants, methods of preparation and how it was administered, and also to document traditional knowledge about malaria.

MATERIALS AND METHODS

Study Area

This study was carried out from April to Octoerb, 2010.The questionnaires were administered by systematic random sampling method in such a way that only every fifth numbered respondent was chosen.
The study was carried out in Abeokuta North Local Government, Ogun state, Nigeria. It is one of the 36 states of Federal republic of Nigeria in the southwest geopolitical zone. Ogun State lies approximately longitude between 2^0 31^0 and 4^0 31^0E, Latitude 6^0 31^0 and 8^0 N. It is bounded in the south partly by Lagos State and partly by Atlantic Ocean and shearing boundary with Oyo and Ondo State.

The population of the State is about 7.6 Million (2006 census estimation). There are 20 local Government areas in the State. As at the time the study, the population of

the study area was one quarter of 350,000 people which are predominantly Egbas with a sizable proportion of Yewas, Ijebus, Owu, Ondo, Ilesha, Ibadan, Ife, Ilorin and Remos. The main local occupations of the indigenes are farming, local textile (tie and dye) industry, trading and pottery.

STUDY SITES

Field trips were undertaken to different parts of Abeokuta such as Ilugun**,** Mokola, Alabata, Lafenwa, Agoka, Kuto, Arinlese, Iberekodo, Ajitadun, Elega, Bode and Opeji from April 2010 to October 2010. Site survey coincided with the wet season while it lasted. During the survey some homes, farms and market were visited and the indigenous people were interviewed for information on the plants of anti-malaria importance.

Informed consent

The purpose of the study was explained to the local traditional practitioners and herb seller. Approval to conduct the study was granted by the head of traditional herbal practitioners and the community leaders. Informed consent was obtained from each of the participants.

General questionnaire

Well structured questionnaires were administered randomly to Traditional herbal practitioners, herb sellers and malaria patients, to elicit information on commonly used herbs and parts frequently used for antimalaria remedies. Questions on diagnosis of malaria, names of plants, methods of herbal preparation, methods of administration and duration of treatment were also asked.

RESULTS

Respondents under this study (Traditional herbal practitioners (THPs) and patients) were characterized by males and females. Results indicated that 58 percent of the respondents were females while 42 percent were males. 54 percent of patients were females while 46 percent were males.

It was revealed that 38 percent of (THP) and 40 percent of patients had no formal education. 32 percent of (THPs) and 26 percent of patients attended primary school. Also, 24 percent of (THPs) and 20 of patients attended secondary school while 6 percent and 38 percent of (THPs) and patients attended higher institutions.

The (THPs) were classified into various group intervals such as below 30years, 31-40 years, 41-50 years, and 51

Table 1. Socio-economic characteristics of the respondents (Traditional herbal practitioners and Patients) in Abeokuta metropolis, Ogun State Nigeria.

Respondents	Characteristic	Frequency	%frequency	Mode
Traditional herbal practitioners	Gender (Sex)			
	Male	21	42	
	Female	29	58	58
Total		50	100.0	
Patients				
	Male	23	46	
	Female	27	54	54
Total		50	100.0	
Traditional herbal practitioners	Formal Education			
	None	19	38	38
	Primary	16	32	
	Secondary	12	24	
	Tertiary	3		
Total		50	100.0	
Patients	None	20	40	40
	Primary	13	26	
	Secondary	10	20	
	Tertiary	7	14	
Total		50	100.0	
Age group	Age interval			
Traditional herbal practitioners	Bellow 30yrs	3	6	
	31-40	13	26	
	41-50	15	30	
	51 and above	19	38	38
Total		50	100.0	
Patient	Age interval			
	Bellow 30yrs	25	50	50
	31-40	13	26	
	41-50	7	14	
	51 and above	5	10	
Total		50	100.0	
Ethnic group	Tribes			
Traditional herbal practitioners	Yoruba	48	96	96
	Hausa	-	-	
	Igbo	2	4	
Total		50	100.0	
Patient	Yoruba	36	72	72
	Hausa	2	4	
	Igbo	12	24	
		50	100	
Responses on the effects of herbs	Responses			
Traditional herbal practitioners	Effective	20	40	
	Very effective	30	60	60
Total		50	100.0	
Patient	Effective	16	32	
	Very effective	34	68	68
Total		50	100.0	

years and above. It was recorded that 6 percent of (THPs) and 50 percent of patients were below 30yeasr, 26 percent of (THPs) and patients were recorded at age group 31-40 years, 30 percent of (THPs) and14 percent of patients were recorded at age group 41-50 years while 38 percent (THPs) and 10 percent of patients were more than 51years of age.

This investigation cut across three ethnic groups (Yoruba, Hausa and Igbo). It was observed that largest percentage, (96%) of (THPs) and 72 percent of patients were Yoruba, followed by Igbo with 12 percent of (THPs) and 24 percent of patient while least percentage (2%), were Hausa. 40 (THPs) and 32 percent of patients claimed that herbal preparations were effective while 60% of (THPs) and 68% of patients claimed that herbal preparations were very effective remedy on malaria parasite (Table 1).

A total of 71 plants belonging to 45 families collated.

Table 2. Responses on medicinal plants used for malaria therapy in Abeokuta, Ogun Statae, Southwest Nigeria.

Scientific Name	Family Names	Local Names	Common Names	Parts used	% freq.
Abrus precatorius	Papalionoidea	Ojuologbo	Crab eye, rosary	Roots, seeds, leaves	12(16.90)
Acanthospermum hispidum	Compositae	Enungun-arugbo	Starrburr	whole plant	26(36.61)
Aframonium melegueta	Zingiberaceae	Atare	Alligator pepper	Leaves, seeds	5(7.04)
Allium cepa	Alliaceae	Alubosa	Onion	Leaves, seeds	7(9.89)
Allium sativum	Liliaceae	Ayu	Garlic	Bulb	8(11.27)
Alstonia boonei	Apocynaceae	Ahun	Stool wood	Root, bark/leaves	39(54.93)
Anacardium occidentale	Anacardaceae	Kaju	Cashew nut tree	Bark/leaves	14(19.71)
Ananas comosus	Bromeliaceae	Ope-Oyinbo	Pineapple	Unripe fruits	24(33.80)
Argermone	Papaveraceae	Mafowokon	Mexican poppy	Latex , roots, seeds	5(7.04)
Azadirachta indica	Meliaceae	Dogoyaro	Neem	Barks, leaves	40(56.33)
Bambosa vulgaris	Poaceae	Oparun	Bamboo	Leaves	24(33.80)
Baphia nitida	Papilionaceae	Irosu	Cam wood	Leaves	26(36.61)
Bridelia ferruginea	Euphorbiaceae	Iran odan		Bark, leaves	4(5.63)
Cajanus cajan	Leguminosae	Otili	Pigeon	Leaves	5(7.04)
Canna indica	Cannaceae	Ido	Indian shot	Leaves	6(8.45)
Capsicum frutescens	Solanaceae	Ata-ijosi	Cayenne	Fruits	14(19.71)
Carica papaya	Caricaceae	Ibepe	Pawpaw	Leaves, unripe fruits	38(53.52)
Cassia fistula	Caesalpinoideae	Aridan tooro	Golden shower tree	Barks	26(36.61)
Ceiba pentandra	Bambacaceae	Araba	Kapok tree	Leaves	11(15.49)
Chromolaena odorata	Compositae	Ewe akintola	Siam	Root s, leaves	30 (42.25)
Chrysophyllum albidum	Sapotaceae	Agbalumo	African star apple	Bark, leaves	21(29.58)
Citrum aurantium	Rubiaceae	Osa-ganinganin	Grape	Fruit, leaves	24(33.80)
Citrus aurantifolia	Rubiaceae	Osan-wewe	Lime	Leaves, fruit	31(43.66)
Citrus paradise	Rubiaceae	Osa- girepu	Grape	Fruit, leaves	17(23.94)
Curcuma long	Ziginberaceae	Laali- pupa	Turmeric	Rhizome	28(39.43)
Cymbopogon citratus	Poaceae	Kooko- Oba	Lemon grass	Leaves	40(56.33)
Diospyros mesiliformis	Ebeneaceae	Igi dudu	Ebony tree	Bark, leaves	5(7.04)
Enatia chlorantia	Annonaceae	Osapa, Awopa	African yellow wood	Barks	5(7.04)
Funtumia Africana	Apocynaceae		Funtumia	Root	18(25.35)
Garcinia kola	Guttiferae	Orogbo	Bitter kola	Seeds/roots//fruits	29(40.84)
Gossypium barbadense	Malvaceae	Owu	Cotton	Leaves	31(43.66)
Gossypium hirsutum	Malvaceae	Ela owu	Cotton	Leaves	27(38.02)
Harungana madagascariensis	Hypericaceae	Ako-ire	Dragons blood tree	Bark/leaves	4(5.63)
Heliotropium indicum	Boraginaceae	Ogberi-aluko	Heliotrope	Whole plant	8(11.27)
Hyptis suaveolens	Labiatae	Jogbo	bush tea-bush	Leaves	7(9.89)
Khaya grandifolia	Meliaceae	Ogawo	Mahogan	Barks	37(52.11)
Lawsonia inermis	Lythraceae	Laali	Hennapla	Leaves /barks	29(40.84)
Lecaniodiscus cupanioides	Sapindaceae	Akika	Ginger lily	Roots	14(19.71)
Lophira alata	Ochnaceae	Ponhan	Iron wood,	Leaves	12(16.90)
Mangifera indica	Anacardiaceae	Mangoro	Mango	Barks/leaves	33(46.48)
Melicia excels	Moraceae	Iroko	Iroko	Roots/ barks	16(22.54)
Mondia whitei	Periplocaceae	Irisigun	White's ginger	Whole plant,	22(39.98)
Morinda lucida	Rubiaceae	Oruwo	Brimstone tree	Bark/leaves	43(60.56)
Morinda morindiodes	Rubiaceae	Ponju owiwi	Morinda	Roots/barks/leaves/fruits	29(40.84)
Musa sapientum	Musaceae	Ogede omena	Banana	Fruit	4(5.63)
Nauclea latifolia	Rubiaceae	Egberesi	African peach	Root /bark/leaves	5(7.04)
Occimum gratissimum	Labiatae	Efirin- nla	Tea bush	Leaves	27(38.02)
Parquetina nigrescens	Periplocaceae	Ogbo	African parquetina	Whole plant	26(36.61)
Pergularia daemia	Asclepiadaceae	Atufa, irisigun	Trellis-vine	Root /leaves	15(21.13)
Persea Americana	Lauraceae	Pia	Avocado pear	Barks/leaves	9(12.68)
Petiveria alliaceae	Phytolaccaceae	Awopa	guinea henweed	Barks	36(50.70)

Table 2. Contd**.**

Phyllantus amarus	Euphorbiaceae	Ehinolobe	Phyllantus plant	Whole plant	24(33.80)
Physalis angulata	Solanaceae	Koropo	angular winter cherry	whole plant	7(9.89)
Psiduim guajava	Myrtaceae	Guofa	Guava	Barks/leaves	11(15.49)
Pycnanthus angolensis	Myristicaceae	Akomu	Pycnanthus	Barks	2(2.82)
Rauwolfia vomitora	Apocynaceae	Asofeyeje	serpent wood, swizzler stick	Roots/ leaves	18(25.35)
Commelina virginica	Commelinaceae	Godogbo	Day flower	Roots	1(1.41)
Sarcocephalus latifolia	Rubiacae	Egbesi	African peach	Leaves	40(56.33)
Senna podocarpa	Caesalpiniaceae	Asunwon ibile	_____	Barks/leaves	19(26.76)
Senna siamea	Caesalpiniaceae	Kasia	Senna	Barks	26(36.61)
Solanum nigrum	Solanaceae	Odu	Nightshade	Leaves	2(2.82)
Sphenocetrum jollyyanum	Menispermaceae	Akerejupon	_____	Roots	7(9.89)
Spondias mombin	Anacadiaceae	Yeye	Plum hog	Leaves/Barks	16(22.530
Terminalia catappa	Combretaceae	Furuntu	Almond	Leaves	8(11.27)
Theobroma cacao	Sterculiaceae	Koko	Cocoa tree	Leaves /barks	7(9.89)
Tithonia diversifolia	Compositae	Jogbo agbale	Tree marigold	Leaves/ bark	35(49.29)
Treculia Africana	Asteraceae	Afon	African breadfruit	Barks	5(7.04)
Trema orientalis	Ulmaceae	Afefe	pigeon wood	Leaves/barks	24(33.80)
Vernonia amygdalina	Compositae	Ewuro	Bitter leaf	Leaves	31(43.66)
Xylopia aethiopica	Annonaceae	Erinje Eeru	African pepper,	Fruits/bark/leaves/ roots	3(4.22)
Ziginber officinale	Ziginberaceae	Ajo, Atale	Ginger	Rhizome	1(1.41)

The most frequent families were Rubiaceae, compositae, Anacardiaceae, and Caesalpiniaceae**.** The most frequently mentioned plants were *Morinda lucida* (60.56%), *Azadirachta indica* (56.33%)*, Cymbopogon citratus* (56.33%), *Sarcocephalus latifolia* (56.33%), *Alstonia boonei* (54.93%), *Carica papaya* (53.52%), *Khaya grandifolia* (52.11%*), Petivera alliaceae* (50.70%) *Tithonia diversifolia* (49.29%), *Mangifera indica* (46.48%) (Table 2).

Herbal remedies can be prepared from either freshly collected or dry plant samples. The plant parts recorded being used for malaria treatment were leaves, barks, fruits, seeds, roots, bulbs, rhizomes and combination of plant parts*.* Apart from monotherapy, some of the physicians claimed that some of the plants can still be combined in twos, threes and even in fours as they believed the combinations increase the medicinal potentials of the herbal preparations (Table 3). The most frequently used parts were leaves (22.53%), followed by combination of leaves and barks (23.94%) (Table 4).

Respondents also clamed that when herbal remedies contain two or more plants parts recipe, seeds, fruits and barks were first usually placed at the bottom of the cooking pots followed by the fragile parts mostly leaves on the top of the pot. Various solvents for herbal preparation mentioned were water, aqueous extract from fermented maize, alcohol, oil palm and palm wine. Majority of respondents showed preference to aqueous extract from fermented maize, followed by water and alcohol, palm wine and palm oil.

Respondents were aware of malaria and were able to distinguish it from other fevers on the basis of recognized symptoms such as fever, occasional joint pain, Irregular headache and lethargy (Table 4).Respondents claimed that 58 percent of malaria cases was caused by mosquitoes, 28 percent claimed they were caused by dirty homestead, 26 percent claimed by drinking dirty water, 38 percent claimed they were caused by dense bush, while 36 percent, 6 percent and 2 percent claimed they were caused by pool of stagnant water, swamp and cold breeze and smoking respectively (Table 5).

Some of the respondents used various strategies such as use of mosquito net, clearing environment, use of mosquito coil, use of plant unpleasant fragrance, burning logs to create smokes and good personal hygiene to control malaria (Table5).

DISCUSSION

The largest percentage of respondents under this study were females. The percentage of male patients was similar to that of female. This indicates that both sexes are vulnerable to the disease. Unlike in the olden days when majority of herbal practitioners and patients were illiterates and poor, patients took herbal preparations as a result of poverty.

This research revealed that largest percentage of both Traditional herbal practitioners and patients were educated. This is an indication that the level of literacy among patients and herbal practitioners are now increasing. Many of the patients regardless of their educational and financial status employed the use of

Table 3. Plants used alone and in combination with others for treatment of malaria.

Single plant recipes	Parts	Method of extraction	Source of information
Nauclea latifolia	Barks,roots	Tincture, Decoction	THP and PA
Morinda lucida	Root ,leaves	Tincture, infusion	THP and PA
Enantia chlorantha	Barks	Decoction, tincture, infusion	THP
Cymbopogon citrates	Leaves	Decoction	THP and PA
Alstonia boonei	Barks	Infusion, tincture, decoction.	PA
Curcuma longa	Rhizome	Tincture, decoction	THP
Allium sativum	Bulbs	Concoction ,tincture	THP
Carica papaya	Fruits	Infusion	THP and PA
Tithonia diversifolia	Leaves	Infusion	THP
Azadirachta indica	Barks	Decoction	THP and PA
Vernonia amygdalina	Leaves	Infusion	THP and PA
Rauvolfia vomitoria	Roots	Infusion	THP
Funtumia Africana	Roots	Infusion	THP
Leconiodiscus cupanioides	Roots	Infusion	THP
Khaya grandifoliola	Bark	Decoction ,infusion	THP
Plants that are used in combination of two			
Alstonia boonei,Capsicum fructescens	Barks, fruits	Decoction, infusion	THP and PA
Gossypium barbadense,Citrus aurantifolia	Leaves, fruits	Decoction, infusion	THP and PA
Vernonia amygdalina,Citrus aurantifolia	Leaves, fruits	Decoction, Infusion	THP and PA
Enantia chlorantha Alstonia boonei	Barks	Decoction, tincture, infusion	THP and PA
Chrysophyllum albidum,Citrus aurantifolia	Leaves, barks and fruits	Concoction	THP and PA
Lecaniosdiscus cupanoides,Citrus aurantifolia	Roots ,fruits	Decoction	THP
Carica papaya,Pisdium guajava	Leaves	Decoction, infusion	THP and PA
Mangifera indica, Solanum nigrum	Barks, leave	Decoction	THP and PA
Plants that are used in combination of three			
Chromolaena odorata,Physallis angulataTithonia diversifolia	Leaves	Decoction	THP and PA
Funtumia Africana,Enantia chlorantha ,Zanthoxylum zanthoxyloides	Roots ,bark,	Decoction	THP and PA
Gossypium barbadense,Occimum gratissimum,Citrus aurantifolia	Leaves, fruits	Decoction	THP and PA
Enantia chlorantha, Alstonia boonei,Diospyros mespiliformis	Barks	Concoction	THP
Curcuma longa,Cymbopogon citrates Citrus aurantifolia	Rhizomes ,leaves	Infusion, concoction	THP
Plants that are used in combination of four			
Vernonia amygdalina,Occimum gratissimum Azadirachta indica,Cymbopogon citrates	Leaves	Concoction	THP

Table 3. Contd.

Canna indica,Citrus paradise Ananas comosusCitrus aurantifolia	Leaves , fruits	Concoction	THP
Plants that are used in combination of five			
Curcuma longa Harungana madagascariensis Rauvolfia vomitoria Mangifera indica Psidium guajava	Barks ,leaves	Concoction	THP and PA
Sphernocentrum jollyyanum Citrus aurantifolia Cymbopogon citratus Lawsonia guineensis Carica papaya Citrus aurantium	Leaves , fruits	Concoction	THP and PA
Citrus aurantifolia Chrysophyllum albidum Mangifera indica Anarcadium occidentale Sorghum bicolor	Leaves, fruits	Concoction	THP and PA
Occimum gratissimum Anarcadium occidentale, Lecaniodiscus cupanioides Curcuma longa Citrus aurantifolia	Foliage leaves	Concoction	THP

Key: THP = Traditional herbal practitioners, PA= Patients, THP and PA= Traditional herbal practitioners and Patient.

herbs as recipes to combat malaria parasite. This may be an indication that the use of herbal preparations in the treatment of various diseases including malaria is gaining values. Herbal practice has become a prominent profession as this study revealed that people now embark wholly on herbal practice even at their prime age for their livelihood. Largest percentage of the Traditional herbal practitioners were recorded at age 51 and above; this contradicts the belief that herbal practice is fetish, meant for the lazy and tends to disappear in the younger generation (Johnsy *et al.,*2013).

This study, however, collated a total of 71 plants belonging to 45 families out of which Rubiaceae, Compositae, Anacardiaceae and Caesalpiniaceae were the most frequent cited plant families. The most frequently mentioned plants were *Morinda lucida* (60.56%), *Azadirachta indica* (56.33%)*, Cymbopogon citratus* (56.33%), *Sarcocephalus latifolia* (56.33%), *Alstonia boonei* (54.93%), *Carica papaya* (53.52%), *Khaya grandifolia* (52.11%*), Petivera alliaceae* (50.70%%) *Tithonia diversifolia* (49.29%) and *Mangifera indica*(46.48%). The observation of *M. lucida* as the most frequently used plant in this study may be because of the known antimalaria properties attributed to anthraquinones and rnnthranquinols

isolated from the plant (Koumaglo *et al.,* 1992; Sittie *et al.,* 1999. Several studies have also confirmed that *S. 1atifolius, Aistonia boonei, Petivera alliacea, M. indica* and *Khaya grand,fàlia* were characterized by significant antimalaria properties (Awe *et al.,* 1998; Pedro and Antonio, 2001; Agbedahunsi *et al.,* 1998).

Both monotherapy and combination different plants and parts in the preparation of antimalaria herbal remedy is common among respondents sampled in Abeokuta metropolis and it is believed that some of the plants collected can perform better when their pyhtochemical ingredients are in synergy with that of other plants Nasir *et al.,* 2011. Herbal remedies can be prepared from either freshly collected or dry plant samples from the field. The plant parts recorded being used for malaria treatment were leaves, barks, fruits, seeds, roots, rhizomes. When the herbal remedies contain two or more plants parts, strong parts such as seeds, fruits and barks are placed first at the bottom of the cooking pots follow by the fragile parts. It was also claimed that apart from single application of herbal preparations, majority of the respondents claimed to have combined the plants for malaria treatment. The respondents claimed to employ herbal preparations for malaria treatment because majority of them were traders

and peasant farmers. Leaves (22.53%) were recorded as the most frequently used single plant parts while rhizomes and bulbs were the least used single plant parts. Also, combination of leaves and barks (23.94%) was recorded as most common recipe combination used in the treatment of malaria Abu *et al.,* 2009. This may support the reports that herbal preparations are more potent in the treatment of disease when the plant secondary metabolites of plants are in combined form (Odutuga *et al.* 2010; Adikwu *et al.* 2010). The combinations of different plants and parts had been claimed by the respondents to have cured several diseases and dysfunctions associated with malaria in the body. It was reported that majority of the plants when prepared were very bitter in taste, more so, it is believed that each active principle of the component parts making up the recipe complement one another to fight against malaria parasite. Also, selection of these components for recipe combination depends largely on the severity of diseases.

Solvents such as water, alcohol, palm wine, palm oil and maize fermented water were mentioned as being used for herbal preparation. The active principles of the plants are often extracted by mainly infusion, decoction and tincture (Taylor, 2004; Kasali *et al.,* 2014).

Table 4. Plant part commonly used for the treatment of malaria in Abeokuta.

Plant part combination (single part)	Frequency	% frequency	Mode
Leaves	16	22.54	22.54
Barks	7	9.85	
Root	4	5.63	
Rhizomes	2	2.82	
Bulbs	2	2.82	
Unripe Fruits	3	4.23	
Combination of two plant parts			
Leaves and seeds	2	2.82	
Bark and leaves	17	23.94	23.94
Leaves and unripe fruits	4	5.63	
Root and leaves	3	4.23	
Combination of three plant parts			
Roots, seeds, leaves	1	1.41	
Latex, roots and seeds.	1	1.41	
Seeds, roots and fruits	1	1.41	
Combination of four plant parts			
roots, barks, leaves, fruits	2	2.82	
Whole plant			
All plant parts	6	8.45	8.45

Table 5. Factors reported by the respondents to be responsible for malaria, symptoms and methods of prevention.

Factors	Frequency	% Frequency	Mode	Source of information
Mosquitoes	29	58	58	PA
Dirty homestead	14	28		THP and PA
Drinking dirty water	13	26		THP
Dense bush	19	38		THP
Pool of stagnant water	18	36		THP and PA
Swamp	3	6		THP
Cold breeze	3	6		THP
Smoking tobacco	1	2		PA
Total	100			
Symptoms of malaria				
Fever	17	34		THP and PA
Feeling chill	14	28		THP and PA
Occasional joint pain	11	22		THP and PA
Irregular headache	8	16		THP and PA
Vomit	9	18		THP and PA
Lethargy	8	18		THP
General body weakness	12	24		PA
Loss of appetite	6	12		THP
Coughing	5	10		THP
Shivering	10	20		PA
Practices employed by the respondents to guard against malaria arrack				
Use of mosquito net	36	72	72	PA
Clear environment	17	34		THP and PA
Use of mosquito coil	13	26		PA
Use of plant unpleasant fragrance	19	38		THP
Burn logs to create smokes	13	26		THP
Good personal hygiene	2	4		THP and PA
Total	100			

However, aqueous extract from fermented maize was given more preference than water, palm oil, palm wine and alcohol. Laboratory studies had also confirmed the efficacy of one solvent over another as solvent of

extraction in relation to the antimalaria property of the plant. For example, the methanolic extracts of *Flueggea virosa, Maytenus undata* and *Maytenus putter lickioides* had higher percentage of chemosuppression of parasitaemia in vivo than the water extract of the plants while the water extracts of *Harungana madagascariensis* and *Warburgia stuhlmannii* had higher chemosuppression of parasitaemia than the methanolic extracts in vivo (Muthaura *et al.,* 2007).

Some of the respondents preferred soaking to boiling as they believed that excess boiling of the preparations may disrupt the original medicinal compositions of the plants**.** And that the choice of solvent and the type of plant parts to be used in preparing the herbal remedy determine method of extraction to be employed. The herbal preparations were reported to be consumed usually by oral application (250-300ml), 2 to 3 times daily for 3-9days as similarly reported by Omosun *et al.,* 2013. Bathing and steam inhalation were other methods of treating malaria, and this dosage continues until the symptoms of the parasite persist Olorunnisola *et al.*,2013. Also, most of the respondents believed that herbal remedies can be consumed as much as possible since they could not quantify the amount of antimalaria constituents extracted from the plant parts. (Idowu, *et al.,* 2009). Studies had however proved that some antimalarial herbs have dose dependent effect, for example high levels of chemosuppression were produced at high doses of the leaf and root-bark extracts of *Vernonia amvgaaiina* (Abosi and Raseroka. 2003). *Morinda lucida* for example, frequently used plant was observed for its in vitro cytotoxicity and the stem bark was extremely toxic (Ajaiyeoba *et al.,* 2006). This study revealed that indigenous plants that can be exploited for the development of new antimalaria dugs are common in Abeokuta communities. The plants are similar to those used for malaria therapy in Ghana (UNESCO,1997) and Sierra leone (Agbovie et al., 2002.

Conclusion

This study has attempted to highlight medicinal plants claimed to be used or associated with malaria therapy by individuals in Abeokuta, Southwest, Nigeria. These medicinal plants may probably contain yet undiscovered anti-malaria properties, which can serve as a need for a multidisciplinary approach to develop potentially effective drugs while noting dangerous drugs and practices that should be discarded.

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