



Journal of Medicinal Plants Studies

Herbal Medicinal Treatment of Malaria in Aliero Local Government Area, Kebbi, Nigeria

Sanjay Singh^{1*}, Rupashree Singh²

1. Dr. Sanjay Singh, FWACP (Fam Med), Family Medicine Department, Usmanu Danfodiyo University Teaching Hospital, P.M.B. 2370, Sokoto Nigeria. [Email: ssinghuch@yahoo.co.in, Tel: +234-8052623021]
2. Department of Biological Sciences, Kebbi State University of Science and Technology, P.M.B. 1144, Aliero, Nigeria. [Email: singhrupashree@yahoo.com, Tel: +234-8050400440]

With the increasing levels of malaria parasite drug resistance, the herbal knowledge of indigenous communities for malaria treatment can play an important role in identification of any new antimalarial plants that is yet to be discovered. Information was collected by interviewing indigenous people, using a semi-structured questionnaire. Collected plant samples were identified with the help of taxonomist, herbarium materials, and taxonomic keys in the flora of Nigeria. A total of 119 respondents were interviewed, comprising of homemade herbal medicine user 105 (88.2%) and traditional healers 14 (11.8%). Nineteen plants species belonging to 15 families were identified. The most frequently mentioned species were *Azadirachta indica* (72.2%), *Magifera indica* (63.0%), *Citrus aurantifolia* (48.7%), *Carica papaya* (31.9%), and *Psidium guajava* (22.7%). These plants can be a potential source for the development of new antimalarial drug. Therefore, the most frequently mentioned species should be considered for further research to standardize and validate their safety and efficacy.

Keyword: Herbal, treatment, malaria, Aliero, Kebbi, Nigeria

1. Introduction

In malaria endemic countries, traditional herbal medicine is the most frequent option to treat malaria with on average of a fifth of patients^[1]. It has been used to treat malaria since ancient time and surely if it was not effective, malaria would have devastated Africa^[2]. The World Health Organization (WHO) defines herbal medicines to include herbs, herbal materials, herbal preparations and finished herbal products that contain as active ingredients parts of plants, or other plant materials, or combinations thereof^[3]. There are 1200 plant species from 160 families used to treat malaria^[1].

In 1977, the World Health Assembly (WHA) drew attention to the potentials, efficacy and utilisation of herbal medicine in the national health care systems of member countries.^[4]

According to World Health Organization, about 60% of the world's people use herbal medicine for treating their sicknesses^[5]. In Ghana, Mali, Nigeria and Zambia, the first line of treatment for 60% of children with high fever resulting from malaria is the use of herbal medicine at home^[6]. The dependence of people on indigenous herbal medicine are influenced by factors such as acceptability, less communication means, poverty, cost-effectiveness, ignorance, accessibility and unavailability of modern health facilities^[7].

Until now, the world has relied on plants for the best malaria drugs: chloroquine from Cinchona tree; and Artemisinin from Chinese salad plant, *Artemisia annua*^[1]. The malaria parasite has developed resistance against most malaria drugs including the popular Artemisinin-based

Combination Therapy (ACT) in some region ^[8]. The rapid spread of resistance parasite, makes it necessary to search for more effective herbal antimalarial compounds.

The herbal knowledge of indigenous communities for malaria treatment can play an important role in identification of any new antimalarial plants that is yet to discover. Thus, this study was to document the knowledge and the uses of medicinal plants used by the indigenous communities for malaria treatment in rural Kebbi, which can be a part of an initiative to document baseline data for future pharmacological and phytochemical studies.

2. Method and Materials

2.1 Study area

The study was carried out in Aliero, Sabiel, Kashim-zama and Jiga of Aliero Local Government Area. Aliero is approximately located at latitudes 4°23'S and 12°26'40"N and longitudes 3°6'W and 4°27'35"E. It was created in 1996, with a total land mass of 412.25 sq. km ^[9] and has a total population of 67,078. ^[10]

2.2 Study design

The study was a community based cross-sectional study, conducted during March to June, 2013. A structured questionnaire was used to interview the households care giver and the traditional healers who use herbal medicine for the treatment of malaria. Out of 200 randomly selected households, 50 from each study area, 105 reported the use of herbal medicine for the treatment of malaria. Only one adult was interviewed per household. There were 14 traditional healers discovered from the study area who use herbal medicine for malaria treatment. The interviewees were the primary care giver of households. The questionnaire was prepared in English language but translated and communicated in local languages when necessary.

2.3 Data collection

Ethnomedicinal data were collected through general conversations with the informants. The questionnaires were used to obtain information on

medicinal plants with their local names, parts used, mode of preparation and administration. Informants were asked to come to field and show the plants. The species mentioned by the informants were taxonomically identified with the help of a taxonomist, herbarium materials, and taxonomic keys in the Flora of Nigeria.

2.4 Ethical clearance

The study was approved by Kebbi State University of Science and Technology. A written informed consent was obtained from the community representatives. The research objectives and methods were explained to every respondents and consent was obtained before inclusion as participants. Respondents were given the right to refuse to take part in the study as well as to withdraw any time during the interview. Privacy and confidentiality were maintained throughout the study.

2.5 Data analysis

The data were entered in Microsoft excel data sheets and analyzed using Epi Info, version 3.5.3. Descriptive statistics were carried out to measure relative frequencies, percentages, averages, and relative frequencies of the variables.

3. Results

3.1 Baseline characteristics of respondents

A total of 119 respondents were interviewed. This population comprised of homemade herbal medicine user 105 (88.2%) and traditional healers 14 (11.8%). Out of 105 primary caregivers selected for the study, there were 100 (95.2%) females and 5 (4.8%). All 14 traditional healers were men. Islam was the predominant religion of all respondents. Baseline characteristics of the respondents are given in table 1.

3.2 Treatment of malaria using homemade herbal medicine

Out of 105 (52.5%) homemade herbal medicine user, *Azadirachta indica* leaves was the most frequently mentioned 72 (68.6%) species. Accessibility of herbal medicine was around the house, reported by 90 (85.7%) respondent. Lack of money is the most common

factor that influences herbal treatment seeking behaviour according to 74 (37.0%) respondent. The efficacy of herbal medicine was reported by 83 (79.0%) respondents. According to 92 (87.6%)

respondent, they got better after the herbal treatment and according to 95 (90.5%) reported that there is no side effect of herbal medicine (Table2).

Table 1: Baseline characteristics of the respondents

Variables	Households' primary caregiver (%) n= 105	Traditional healer (%) n=014
Religion		
Christian	008 (007.6)	001 (007.1)
Islam	097 (092.4)	013 (092.9)
Sex		
female	100 (095.2)	000 (000.0)
male	005 (004.8)	014 (100.0)
Age		
18-28	022 (020.9)	000 (000.0)
29-49	078 (074.3)	002 (014.3)
>50	005 (004.8)	012 (085.7)
Ethnicity		
Fulani	005 (004.8)	000 (000.0)
Hausa	092 (087.6)	014 (000.0)
Igbo	007 (006.7)	000 (000.0)
Yoruba	001 (000.9)	001 (007.1)
Education level		
non	043 (040.9)	013 (092.9)
Primary	011(010.5)	000 (000.0)
Secondary	045(042.9)	000 (000.0)
tertiary	006 (005.7)	001 (007.1)

3.3 Herbal medicine used by the respondents

The result of the study revealed, the use of 19 species of ethnomedicinal plant belonging to 15 families by the respondents for the treatment of malaria. For each species, botanical name, local name, parts used, methods of preparation, administration are listed in table 3. The leaves of these plants were the most commonly used parts for anti-malarial treatment. The most frequently mentioned species were *Azadirachta indica* (72.2%), *Magifera indica* (63.0%), *Citrus aurantifolia* (48.7%), *Carica papaya* (31.9%), and *Psidium gujava* (22.7%). The most common method of preparation of these anti-malarial remedies was by preparing a decoction of the plant parts in water and made from single species.

The family, common name and habit of each reported plant species are listed in table 4. The information on previous report of the use of the reported plant species for malaria treatment and the reference that proved its antimalarial properties has been provided in table 5.

4. Discussion

Nature has gifted Africa with a lot of herbal medicines, which indigenous people acquire, preserve and pass to their next generation. A remarkable high diversity of ethnomedicinal plant species was documented to treat malaria from the study area. In this study 19 plant species used for the treatment of malaria were documented. Of these identified plant species for the treatment of

malaria, 18 species were reported previously (Table 5). The five most commonly mentioned species were *Azadirachta indica*, *Magifera indica*, *Citrus aurantifolia*, *Carica papaya*,

Psidium gujava. The above three species have been reported in most of the similar studies (table 5).

Table 2: Treatment of malaria using homemade herbal medicine

Variables	Frequency (%)
Reported plant part for homemade herbal preparation	
<i>Magifera indica</i> (mango) leaves and bark	62 (59.0)
<i>Psidium gujava</i> (guava) leaves	13 (12.4)
<i>Carica papaya</i> (pawpaw) leaves	27 (25.7)
<i>Citrus aurantifolia</i> (lime) leaves	44 (41.9)
<i>Azadirachta indica</i> (neem) leaves	72 (68.6)
Accessibility and usage of herbal medicine	
Cheap	10 (09.5)
Moderate	05 (04.8)
Around the house	90 (85.7)
Efficacy of herbal medicine	
Bad	02 (02.0)
Good	83 (79.0)
Very good	20 (19.0)
Factors influencing herbal treatment seeking behavior	
Lack of money	74 (37.0)
Born here with it	15 (07.5)
Effective	50 (25.0)
Easy access	59 (29.5)
Hospital is far	09 (04.5)
Adverse effect:	
No effect	95 (90.5)
Mild sometimes	10(09.5)
Got better after the treatment:	
Yes	92 (87.6)
No	13 (12.4)

Since plant kingdom has proven an effective source of antimalarial drugs in the past, these plant species may be a reservoir for discovery of new effective drugs against malaria. It is therefore, important to investigate the antimalarial properties of the most frequently reported medicinal plant in order to determine their potential as sources of new antimalarial drugs by phytochemical analysis. World Health Organization (WHO) has formulated guidelines^[11] concerning basic elements of legislation and

registration of herbal remedies. These guidelines contain basic criteria for assessment of quality, safety and efficacy of herbal medicines and important requirements for labelling and package insert for consumers' information. There have been reports of in vitro and in vivo analyses of previously investigated plants with significant anti-malarial properties (Table 5) and warrant further advance investigation and controlled clinical trials to be a potential source for the development of new antimalarial drug.

Table 3: Indigenous medicinal plants used to treat malaria

Local name	Botanical name	Parts used	Mode of preparation	Administration
Ayaba	<i>Musa sapientum</i>	leaf	decoction	oral and bath
Dogonyaro	<i>Azadirachta indica</i>	leaf/stem bark/ root	decoction	Inhalation, oral and bath
Gwanda gida	<i>Carica papaya</i>	leaf/fruit	infusion/ concoction	oral
Gwaba	<i>Psidium gujava</i>	bark/leaf	decoction + potash	oral and bath
Kanju	<i>Anacardium occidentale</i>	leaf/stem	decoction	inhalation, oral and bath
Lemu sami	<i>Citrus aurantifolia</i>	leaf/fruit	decoction/juice	oral
Mangoro	<i>Magifera indica</i>	leaf/stem bark	decoction	oral and bath
Sabara	<i>Guiera senegalensis</i>	leaf	decoction	oral and bath
Sangaa sangaa	<i>Senna occidentalis</i>	leaf	decoction	oral and bath
Tsamiya	<i>Tamarindus indica</i>	leaf	decoction	oral and bath
Zoogale	<i>Moringa oleifera</i>	leaf	decoction	oral and bath
Kirya	<i>Prosopis africana</i>	leaf/stem bark	drying then grinding	oral with hot water
Faru	<i>Lanea acida</i>	stem bark	drying then grinding	mixed in food
Kaiwaa	<i>Anogeissuss leiocapus</i>	stem bark	infusion	oral
Oruwo	<i>Vernonia amygdalina</i>	leaf/bark	decoction/infusion	oral
Magaryaa	<i>Morinda lucida</i>	root	decoction/infusion	oral
Kaiwaa	<i>Ziziphus abyssinica</i>	bark/leaf	decoction	oral
Tsààtsà	<i>Diospyros mesiliformis</i>	stem bark	drying then grinding	mixed in food
Owu	<i>Gossypium arboreum</i>	leaf	decoction	oral

The majority of the respondents believed that there was no adverse effect of herbal medicine for the treatment of malaria. This confirms the findings from previous studies.^[12, 13] Although, the effectiveness of *Psidium guava*, *Azadirachta indica*, *Carica papaya*, *Magnifera indica*, and *Anacardium occidentale* has been proved earlier^[12]. A few respondents reported mild adverse effects. There have been reports of adverse effect

of some antimalarial plants.^[14, 15] Despite the belief of indigenous community that herbal medicines are effective and safe, it is necessary to standardize and validate their safety, efficacy and recommended doses according to the scientific methods.

Leaves were found to be the most reported plant part used for the preparation of various herbal medicines in the study area. The preference of

leaves on other plant parts could be due to ease of preparation and the presence of more bioactive ingredients in leaves developed in response to herbivorous organisms [16].

Table 4: Family, Common name, and habit of mentioned plant species

Botanical name	Family	Common name	Habit
<i>Musa sapientum</i>	<i>Musaceae</i>	Banana	Tree
<i>Azadirachta indica</i>	<i>Meliaceae</i>	Neem	Tree
<i>Carica papaya</i>	<i>Caricaceae</i>	Pawpaw	Tree
<i>Psidium gujava</i>	<i>Myrtaceae</i>	Guawa	Tree
<i>Anacardium occidentale</i>	<i>Anacardiaceae</i>	Cashew	Tree
<i>Citrus aurantifolia</i>	<i>Rutaceae</i>	Lime	Tree
<i>Magifera indica</i>	<i>Anacardiaceae</i>	Mango	Tree
<i>Guiera senegalensis</i>	<i>Combretaceae</i>	Moshi Medicine	Shrub
<i>Senna occidentalis</i>	<i>Leguminosae</i>	Coffee senna	Tree
<i>Tamarindus indica</i>	<i>Fabaceae</i>	Tamarind	Tree
<i>Moringa oleifera</i>	<i>Moringaceae</i>	Horseradish/drumstick tree	Tree
<i>Prosopis africana</i>	<i>Fabaceae</i>	Iron tree	Tree
<i>Lanea acida</i>	<i>Anacardiaceae</i>	Atina bateri	Tree
<i>Anogeissus leiocarpus</i>	<i>Combretaceae</i>	Chewstick tree	Tree
<i>Vernonia amygdalina</i>	<i>Asteraceae</i>	Bitter leaf	Tree
<i>Morinda lucida</i>	<i>Rubiaceae</i>	Brimstone tree	Shrub
<i>Ziziphus abyssinica</i>	<i>Rhamnaceae</i>	Catch thorn	Tree
<i>Diospyros mesiliformis</i>	<i>Ebeneaceae</i>	Ebony tree	Tree
<i>Gossypium arboreum</i>	<i>Malvaceae</i>	Tree cotton	Tree

Table 5: Frequency and earlier report of the mentioned plant species

Botanical name	Freq in THHM n= 14	Freq in HHM n= 105	Previous studies on herbal malaria treatment (reference no)	Previous studies reported as antimalarial properties (reference no)
<i>Musa sapientum</i>	06	-	17,18 ,22,25	-
<i>Azadirachta indica</i>	14	72	2, 12,17-21, 23-26	35-39
<i>Carica papaya</i>	11	27	2,12,17-23,25,26	34,46
<i>Psidium gujava</i>	14	13	2,12,17- 23,25,26	33,46
<i>Anacardium occidentale</i>	06	-	12,17,19,21,23, 25,26	-
<i>Citrus aurantifolia</i>	14	44	17,21,22,25	-
<i>Magifera indica</i>	13	62	2,17-23,25,26	32,46,55
<i>Guiera senegalensis</i>	08	-	25,28	48,49,53
<i>Senna occidentalis</i>	08	-	18,24	-

<i>Tamarindus indica</i>	04	-	20,24	-
<i>Moringa oleifera</i>	03	-	30	51
<i>Prosopis africana</i>	03	-	17, 30	47
<i>Lanea acida</i>	02	-	-	-
<i>Anogeissus leiocarpus</i>	05	-	29,30	47,52
<i>Vernonia amygdalina</i>	12	-	2,17-19,21,22,24-26	14,40-46
<i>Morinda lucida</i>	11	-	2, 17,22, 23,26	31, 54
<i>Ziziphus abyssinica</i>	01		-	-
<i>Diospyros mesiliformis</i>	02	-	22	50
<i>Gossypium arboreum</i>	03	-	2,27	-

Freq: Frequency; THHM: Traditional healer herbal medicine; HHM: Homemade herbal medicine

A substantial population of study area has been using herbal medicine for malaria treatment due to its effectiveness, easy access, and their poverty. In this regards, the necessary attention should be given by government and non-governmental organizations to invest in future related research.

5. Conclusion

The study has revealed abundant indigenous knowledge on herbal medicine for the treatment of malaria that can be a potential source for the development of new antimalarial drug. Therefore, the most frequently mentioned species should be considered for further research to standardize and validate their safety and efficacy.

6. Acknowledgment

We wish to thank the villagers of Aliero, Sabiel, Kashim-zama and Jiga in Aliero Local Government community who participated in the study. I am grateful to their Chairman for his cooperation and logistic support during the study period

7. References

1. Willcox ML, Bodeker G. Traditional herbal medicines for malaria. *BMJ* 2004; 329:1156–1159.
2. Idowu OA, Soniran OT, Ajana O, Aworinde DO. Ethnobotanical survey of antimalarial plants used in Ogun State Southwest Nigeria. *Afr J Pharm Pharmacol* 2010; 42(2):055-066.
3. WHO: WHO Traditional Medicine Strategy. Geneva: World Health Organization 2002, 2002–2005.
4. Gyasi RM, Mensah CM. Public Perceptions of the Role of Traditional Medicine in the Health Care Delivery System in Ghana. *GJHS* 2011; 3(2):40-19.
5. WHO. General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine WHO/EDM/TRM/2000.1. World Health Organization, Geneva 2000.
6. WHO. Promoting the Role of Traditional Medicine in Health System: A Strategy for the African Region. World Health

- Organization Regional Office for Africa 2001.
7. Tiwari AK, Mehta R. Medicinal plants used by traditional healers in Jashpur district of Chhattisgarh India. LSL 2013; 1:31-41.
 8. Cui L, Wang Z, Miao J, Miao M, Chandra R, Jiang H *et al.* Mechanisms of in vitro resistance to dihydro artemisinin in *Plasmodium falciparum*. Microbiol 2012; 86(1):111-28.
 9. Research & Statistics Department, Ministry of Budget & Economic planning, Birnin Kebbi, Kebbi State. Statistical Year Book. ISSN 1118-7956, 2007.
 10. Federal Republic of Nigeria Official Gazette, Abuja 2009; 96(2).
 11. WHO. Guidelines for the assessment of herbal medicines. WHO/TRM/91.4. World Health Organization, Geneva, 1991.
 12. Avwioro G. Effectiveness of some medicinal plant decoction in the treatment of malaria in Nigeria. Annals of Biological Research 2010; 1(2):230-237.
 13. Wambebe C. Regulatory framework for local production of medicines in Africa. Latin American Caribbean Bulletin of Medicinal Aroma Plants 2009; 8:1-6.
 14. Abosi AO, Raseroka BH. *In vivo* antimalarial activity of *Vernonia amygdalina*. Br J Biomed Sci 2003; 60(22):89-91.
 15. Ajaiyeoba EO, Abiodun OO, Falade MO, Ogbole NO, Ashidi JS, Happi CT. *In vitro* cytotoxicity studies of 20 plants used in Nigerian antimalarial ethnomedicine. Phytomed 2006; 13:295-298.
 16. Bhattarai S, Chaudhary RP, Taylor RSL. Ethnomedicinal plants used by the people of Manang district, central Nepal. J Ethnobiol Ethnomed 2006; 2:41.
 17. Odugbemi TO, Akinsulire OR, Aibinu IE, Fabeku PO. Medicinal plants useful for malaria therapy in Okeigbo, Ondo state, Southwest Nigeria. Afr J Trad CAM 2007; 4 (2):191-198.
 18. Oluranti AC, Jane UOC, Micheal UO. Ethnobotanical survey of medicinal plants used in the treatment of malaria in Sokoto state north western Nigeria. IJRDS 2012; 1(6):292-304.
 19. Omosun G, Okoro IA, Ekundayo E, Ojimekwe PC, Ibe O. Ethnobotanical study of medicinal plants useful for malaria therapy in eight local government areas of Abia State Southeast Nigeria. Adv Med Plant Res 2013; 1(2):39-44.
 20. Sam GH, Mensah MLK, Kofi A, Zahree S. Plants traditionally used in treating malaria, typhoid fever and piles in the Wa municipality and Wa east (Funsu) District of the Upper West Region of Ghana. Adv Environ Biol 2011; 5(10):3352-3358.
 21. Ighere DA, Ajiboye TO, Edagbo DE, Borokini TI, Alowonle AA, Michael CGA. Ethno-botanical survey of local herbs used for the treatment of malaria fever among the urhobo people in Delta state Nigeria. IJCR 2011; 3(11):336-339.
 22. Kadiri M, Ojewumi AW, Adegboye OO. Folk use of herbal plants used in the treatment of malaria fever in Abeokuta North Local Government Ogun State Nigeria. DRJHP 2013; 1(2):10-19.
 23. Dike IP, Obembe OO, Adebisi FE. Ethnobotanical survey for potential anti-malarial plants in south-western Nigeria. J Ethnopharmacol 2012; 144(3):618-626.
 24. Bahekar S, Kale R. Herbal plants used for the treatment of malaria- A Literature Review J Pharmacognosy Phytother 2013; 1(6):141-146.
 25. Ene AC, Atawodi SE, Ameh DA, Kwanashie HO, Agomo PU. Locally used plants for malaria therapy amongst the Hausa, Yoruba, and Ibo communities of Maiduguri north-

- eastern Nigeria. *Indian J Traditional Knowledge* 2010; 9(3):486-490.
26. Ibrahim HA, Imam IA, Bello AM, Umar U, Muhammad S, Abdullahi SA. The potential of Nigerian medicinal plants as antimalarial agent: A review. *International Journal of Science and Technology* 2012; 2(8):600-605.
 27. Ajaiyeoba EO, Oladepo O, Fawole OI, Bolaji OM, Akinboye DO, Ogundahunsi OA. Cultural categorization of febrile illnesses in correlation with herbal remedies used for treatment in Southwestern Nigeria. *J Ethnopharmacol* 2003; 85:179–185.
 28. Iwalewa EO, Lege-Oguntoye L, Rai PP, Iyaniwura TT, Etkin NL. *In vitro* anti-malarial activity of leaf extracts of *Cassia occidentalis* and *Guiera senegalensis* in *Plasmodium yoelii nigeriensis*. *W Afr J Pharmacol Drug Res* 1990; 9:19–21.
 29. Muhammad S, Amusa NA. The important food crops and medicinal plants of North-western Nigeria. *Res J Agric & Biol Sci* 2005; 1:254–260.
 30. Shuaibu MN, Wuyep PA, Yanagi T, Hirayama K, Tanaka T, Kouno I. The use of microfluorometric method for activity-guided isolation of antiplasmodial compound from plant extracts. *Parasitol Res* 2008; 102:1119–1127.
 31. Awe SO, Makinde JM. Effect of petrol eumether fractions of *Morinda lucida* on *Plasmodium berghei* in mice. *Pharm Biol* 1998; 36:301–304.
 32. Awe SO. Anti-plasmodial and antipyretic screening of *Mangifera indica* extract. *Phytother Res* 1998; 12:437.
 33. Nundkumar N, Ojewole JAO. Studies on the anti-plasmodial properties of some South African medicinal plants used as anti-malarial remedies in Zulu folk medicine. *Methods Find Exp Clin Pharmacol* 2002; 24:397–401.
 34. Bhat PG, Surolia N. *In vitro* anti-malarial activity of extracts of three plants used in the traditional medicine of India. *Am J Trop Med Hyg* 2001; 65:304–308.
 35. Alshawsh MA, Mothana RA, Al-shamahy HA, Salah F, Lindequist AU. Assessment of anti-malarial activity against *Plasmodium falciparum* and phytochemical screening of some Yemeni medicinal plants. *Evid Based Complement Alternat Med* 2009; 6:453–456.
 36. Dhara R, Zhang K, Talwar GP, Gargb S, Kumara N. Inhibition of the growth and development of asexual and sexual stages of drug-sensitive and resistant strains of the human malaria parasite *Plasmodium falciparum* by Neem (*Azadirachta indica*) fractions. *J Ethnopharmacol* 1999; 61:31–39.
 37. Udeinya IJ. Anti-malarial activity of Nigerian neem leaves. *Trans R Soc Trop Med Hyg* 1993; 87:47.
 38. Udeinya IJ, Brown N, Shu EN, Udeinya FI, Quakeyie I. Fractions of an antimalarial neem-leaf extract have activities superior to chloroquine, and are gametocytocidal. *Ann Trop Med Parasitol* 2006; 100:17–22.
 39. Sofowora A. Medicinal plants and traditional medicine in Africa. Ibadan, Nigeria: Spectrum Books Limited. 1993.
 40. Masaba SC. The antimalarial activity of *Vernonia amygdalina* Del. (Compositae). *Trans R Soc Trop Med Hyg* 2000; 94:694–695.
 41. Tona L, Cimanga RK, Mesia K, Musuamba CT, De-Bruyne T, Apers S. *In vitro* antiplasmodial activity of extracts and fractions from seven medicinal plants used in the Democratic Republic of Congo. *J Ethnopharmacol* 2004; 93:27–32.
 42. Titanji VPK, Zofou D, Ngemenya MN. The antimalarial potential of medicinal plants used for the treatment of malaria in Cameroonian

- Folk Medicine. Afr J Trad CAM 2008; 5(3):302-32.
43. Zofou D, Tene M, Ngemenya MN, Tane P, Titanji VPK. *In vitro* antiplasmodial activity and cytotoxicity of extracts of selected medicinal plants used by traditional healers of western Cameroon. Malar Res Treat 2011 Volume 2011, Article ID 561342, 6 pages.
 44. Iwalokun BA. Enhanced antimalarial effects of chloroquine by aqueous *Vernonia amygdalina* leaf extract in mice infected with chloroquine resistant and sensitive *Plasmodium berghei* strains. Afr Health Sci 2008; 8(1):25-35.
 45. Sha'a KK, Oguiche S, Watila IM, Ikpa TF. *In vitro* antimalarial activity of the extracts of *Vernonia amygdalina* commonly used in traditional medicine in Nigeria. Science World Journal 2011; 6(2):5-9.
 46. Ayoola GA, Coker HAB, Adesogun SA, Adepoju-Bello AA, Obaweya K, Ezennia EC. Phytochemical screening and antioxidant activities of some selected medicinal plants used for malaria therapy in south-western Nigeria. TJPR 2008; 7(3):1019- 1024.
 47. Isimi C, Obidike I, Aboh M, Emeje M. Anti-plasmodial activity of the mixed stem bark extracts of *Anogeissus leiocarpus* and *Prosopis africana* and *in vitro* evaluation of its tablet dosage form. J Herbs Spices Med Plants 2011; 17(4):419-435.
 48. Fiot J, Sanon S, Azas N, Mahiou V, Jansen O, Angenot L. Phytochemical and pharmacological study of roots and leaves of *Guiera senegalensis* J.F. Gmel (Combretaceae). J Ethnopharmacol 2006;106 (2):173-178.
 49. Ancolio C, Azas N, Mahiou V, Ollivier E, Di-Giorgio C, Keita A. Antimalarial activity of extracts and alkaloids isolated from six plants used in traditional medicine in Mali and Sao Tome. Phytother Res 2002; 16(7):646-9.
 50. Adzu, Salawu OA. Screening *Diospyros mespiliformis* extract for antimalarial potency. Int J Biol Chem Sci 2009; 3(2):271-276.
 51. Kohlera I, Jenett-Siems K, Siemsb K, Herna'ndezc MA, Ibarrac RA, Berendsohnd WG. *In vitro* Antiplasmodial Investigation of Medicinal Plants from El Salvador. Z Naturforsch 2002; 57:277-281.
 52. Akanbi OM, Omonkhua AA, Cyril-Olutayo CM, Fasimoye RY. The antiplasmodial activity of *Anogeissus leiocarpus* and its effect on oxidative stress and lipid profile in mice infected with *Plasmodium berghei*. Parasitol Res 2012; 110(1):219-26.
 53. Jigam AA, Akanya HO, Dauda BEN, Ogbadoyi EO. Antiplasmodial analgesic and anti-inflammatory effects of crude *Guiera senegalensis* Gmel (Combretaceae) leaf extracts in mice infected with *Plasmodium berghei*. J Pharmacognosy Phytother 2011; 3(10):150-154.
 54. Obih PO, Makinde JM, Laoye JV. Investigation of various extracts of *Morinda lucida* for antimalarial actions on *Plasmodium berghei* in mice. African J Medical Science 1985; 14:45-49.
 55. Bidla G, Titanji VPK, Joko B, El-Ghazali G, Bolad A, Berzins K. Antiplasmodial activity of seven plants used in African folk medicine. Indian J Pharmacol 2004; 36(4):244-250.