

**Full Length Research Paper****Medicinal Plants Used for the Treatment of Malaria in Rukuba, Bassa Local Government Area of Plateau State, Nigeria****¹Kunle, Oluyemisi Folashade; ²Ali, Adejoh Adache and ¹Egharevba, Henry Omoregie**¹*Department of Medicinal Plant Research and Traditional Medicine (MPR&TM), National Institute for Pharmaceutical Research and Development (NIPRD), Idu, PMB 21 Garki, Abuja, Nigeria.*²*Faculty of Pharmaceutical Sciences, University of Jos, Jos, Nigeria.*****Corresponding Author: ¹Kunle, Oluyemisi Folashade******Abstract***

The global burden of death due to malaria continues to rise due to increasing resistance of the malaria parasite to chloroquine, the most affordable and commonly used drug for malaria in Nigeria. There are also reports of development of resistance against artemisinin-based combination therapy (ACT), which is currently the approved therapeutic treatment for malaria by the World Health Organisation (WHO). However, not much seems to have been done to document and exploit the untapped resources of indigenous medicinal plants used traditionally for the treatment of malaria. In this study, medicinal plants used as antimalaria therapy in Rukuba, Bassa Local Government Area of Plateau State in North Central Nigeria, were surveyed and reported. The existing knowledge, attitude and practices related to malaria recognition, control and treatment were documented. Eighteen plants belonging to thirteen different families were mostly used in these communities. The plant parts used included barks, roots, leaves or whole plant. The recipes also could be a combination of various species of plants or plant parts. Forms of preparation were decoction, infusion, concoction and tincture. The most frequently used plants were *Azadirachta indica* A. Juss, *Vernonia amygdalina* Del., *Carica papaya* L., *Allium sativum* L., *Khaya grandifoliola* C. DC., *Morinda lucida* Benth and *Rauwolfia vomitoria* Afz. This study also recommends standardization and sustainable herbal and environmental practices as ways toward achieving better resource utilization in the fight against malaria. These antimalaria medicinal plants could be sources of new hit/lead compounds in antimalaria chemotherapy.

Keywords: Antimalaria, medicinal plants, Rukuba, Bassa, Jos, Nigeria**Introduction**

Malaria is a global disease but is predominant in the tropics. The disease is endemic in Nigeria with about 97% of the population at risk of infection, spanning Sahel regions and high mountainous area of the plateau (FMOH, 2009). It accounts for nearly 110 million clinically diagnosed cases of fever per year, with an estimated annual infant and children under-five mortality of about 25% and 30% respectively (FMOH 2009). It is also responsible for an estimated maternal mortality of 11%. In addition to the direct health impact, the annual social and economic burden of the disease, in form of treatment cost, prevention cost and loss of man hours, is estimated to be about ₦132 billion (\$0.825bUSD). Global surveys have shown that 90% of the world's cases of malaria occur in sub-Saharan Africa and over one million deaths are recorded annually, most of which are children under five and pregnant women (WHO, 2000; World Malarial Report, 2005; Africa Union Memoir, 2005). The World Health Organization Tropical Diseases Research (WHO-TDR) puts the annual global burden at 300-500 million cases with about 44 million disability adjusted life years (DALYs) and 1.1 million deaths. WHO-TDR also puts the economic burden at 1.3 % reduction in annual economic growth rate for malaria endemic countries like Nigeria (WHO-TDR, 2002).

It is noteworthy that current research efforts on drug discoveries are focused on plants. There are records of age-long folkloric uses of plants as sources of therapeutic agents (Dalziel, 1956; Sofowora, 1982). It is estimated that over 80% of the world population depend on this form of healthcare (WHO Declaration of Alma-Ata, 1978). Scientists and traditional healers now agree that plants are sources of new drugs, and various concoction of plants and crude extracts are effectively used for prevention and treatment of malaria and other ailments in several parts of the world (Sofowora, 2008). Hence, the past decade has witnessed a significant increase in the global use of herbal medicines in response to the Alma-Ata declaration of 1978 for the inclusion of herbal medicines of proven efficacy and safety into the health care programme of developing countries (WHO Declaration of Alma-Ata, 1978; African Health Monitor report, 2003).

The resistance of Plasmodium spp. to drugs such as chloroquine and ACTs has become a serious problem in areas where malaria is

endemic and in malaria-free areas with occasional imported cases (Onori, 1984; Schilke, 2009). There is also a need to generate reliable scientific data to determine whether the plants currently used to treat malaria are actually effective and safe. In the long run, this should help to prevent deaths due to ignorance and the misuse of plants in self-medication. The effectiveness of these medicinal plants may hold the key to new and effective anti-malaria drugs in the future (UNESCO, 1998). Indigenous medicinal plants in Nigeria used in combating malaria need to be properly documented and projected in conferences and other scientific fora. The Bassa people of Jos, Nigeria, particularly those living in the interior Binchi area use plants to fight infectious diseases. This is mainly due to unaffordability of and lack of access to modern medicine, and attachment to their culture and tradition.

Malaria is known locally among the Bassa people and in Hausa as 'zazabi' or 'zazabi-chizosauro'. The Hausa words 'zazabi-chizosauro' refers to malaria symptoms suggestive of mosquito bite. The reported symptoms of malaria among the Bassa people include fever, headache, shivering and fatigue. The objectives of this study therefore were to survey and document existing knowledge, attitudes and practices related to malaria treatment and control in Bassa LGA of Plateau State, Nigeria and to document medicinal plants used in the process with a view towards aiding drug discovery research for new antimalarials from plant sources.

Materials and Methods

Study area

This study was carried out in Rukuba Chiefdom (around the coordinates, Latitude 10.10259 and Longitude 8.73011), Bassa Local Government Area of Plateau State in North Central Nigeria. Rukuba chiefdom is located approximately 30 km from Jos, the capital of Plateau State. It is made up of four Districts: Buhit, Kakket, Kishikar and Mafara. Two villages each from the four Districts were visited. They include Isica A and Isica B in Buhit District, Igbak and Binchi in Kakket District, Kasanda and Uhsiri in Kishikar District and Bassa and Agro in Mafara District. The villages have forest reserves that form part of existing vegetation.

Selection of respondents

Traditional healers were the main respondents and sources of information for the study. Contact with the local healers was facilitated with the assistance of a retired soldier in the community.

The male and female respondents were between ages 35 to 75 years. Informed consent was obtained before commencing the survey. Information was obtained through both informal, unstructured conversations and the use of questionnaires. The informal open discussion provided the opportunity for healers to talk about their specialties and experiences and to provide as much details as they wished. This flexible approach also eliminated the pressure to provide answers to rigid questions, which might have led to artificial responses.

Tools for data collection

Questionnaires were administered randomly to herb sellers and traditional healers, to obtain information on herbs and plant parts frequently used as malaria remedies. Questions on methods of herbal preparation, administration and duration of use were also asked. Information on medicinal plants was compiled according to local, generic and family names and parts of plants used.

Results

A total of 22 traditional healers from 8 villages across the four districts of Rukuba Chiefdom were interviewed. The distribution of the respondents and their age range is shown in Tables 1 and 2. Information relating to the identification of plants, the parts used in the preparation of remedies is shown in Table 3. The 'principal' antimalaria medicinal plants used as a single plant recipe, parts used and mode of preparation of recipes are shown in Table 4, while Table 5 depicts the plants used as adjuncts in combination with the principal antimalaria plants.

Table 1: Distribution of respondents in Rukuba Chiefdom

Districts	Villages	No. of respondents
Kakket	Igbak	3
	Binchi	3
Buhit	Isica a	5
	Isica b	2
Kishikar	Kasanda	4
	Uhsiri	2
Mafara	Agro	2
	Bassa	1

Table 2: Demographic structure of respondents showing age range and sex

Age range	Number of Respondents	% male	% Female
35-45	8	75	25
46-55	5	100	0
56-65	5	100	0
66-75	4	75	25

Table 3: List of medicinal plants and parts used for malaria treatment in Rukuba Chiefdom

S/No	Plants	Family name	Local names	Common names	Parts used
1	<i>Allium sativum</i> Linn.	Liliaceae	Tafarnuwa	Garlic	Bulb
2	<i>Anacardium occidentale</i> Linn.	Anacardiaceae	Cashew	Cashew nut tree	Barks, leaves
3	<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Abaraba	Pineapple	Unripe fruit
4	<i>Azadirachta indica</i> A. Juss	Meliaceae	Dogonyaro	Neem	Bark, leaves
5	<i>Carica papaya</i> Linn.	Caricaceae	Gwanda	Pawpaw	Leaves, fruits
6	<i>Citrus aurantiifolia</i> (Christm.) Swingle	Rutaceae	Lemukanana	Lime	Root, bark, fruit, stem-twigs, leaves
7	<i>Citrus aurantium</i> Linn.	Rutaceae	Lemutsami	Sour lime	Root, bark, fruit, stem-twigs, leaves
8	<i>Citrus paradise</i> Macfad.	Rutaceae	-	Grape	Fruit, stem-twigs, leaves, root
9	<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	Elephant grass	Lemon grass	Leaves
10	<i>Gossypium barbadense</i> Linn.	Malvaceae	Auduga	Cotton	Leaves
11	<i>Gossypium hirsutum</i> Linn.	Malvaceae	Auduga	Cotton	Leaves
12	<i>Khaya grandifoliola</i> C.DC.	Meliaceae	Madachi	Mahogany	Bark
13	<i>Magnifera indica</i> Linn.	Anacardiaceae	Mangoro	Mango	Bark, leaves
14	<i>Melicia excels</i> Wellw. C.C. Berg	Moraceae	-	Iroko	Root, bark
15	<i>Musa sapientum</i> Linn.	Musaceae	Ayaba	Banana	Fruits
16	<i>Psidium guajava</i> Linn.	Myrtaceae	Guava	Guava	Bark, leaves
17	<i>Vernonia amygdalina</i> Del.	Compositae	Chuaka	Bitter leaf	Leaves
18	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	-	Ginger	Rhizome

Table 4: Medicinal plants used as single recipe in malaria treatment

S/No.	Plants	Parts used	Method of extraction
1	<i>Allium sativum</i> Linn.	Bulb	Concoction, tincture
2	<i>Azadirachta indica</i> A Juss	Bark, leaves	Decoction
3	<i>Carica papaya</i> Linn.	Fruits, leaves	Infusion
4	<i>Khaya grandifoliola</i> C. DC.	Bark	Decoction, infusion
5	<i>Morinda lucida</i> Benth	Roots, leaves	Tincture, infusion
6	<i>Rauwolfia vomitoria</i> Afz.	Root	Infusion
7	<i>Vernonia amygdalina</i> Del.	Leaves	Infusion

Table 5: Medicinal plants that are used as adjunct in malaria recipes

S/No.	Plants	Uses
1	<i>Anacardium occidentale</i> Linn. (bark)	Coated tongue
2	<i>Chrysophyllum albidum</i> G. Don (bark)	Coated tongue
3	<i>Heliotropium indicum</i> Linn. (leaves)	Coated tongue
4	<i>Khaya grandifoliola</i> C. DC. (bark)	Coated tongue, blood supplement
5	<i>Mangifera indica</i> Linn. (bark, leaves)	Coated tongue
6	<i>Parquetina nigrescens</i> (Afz.) Bullock. (leaves)	Blood supplement
7	<i>Pycanthus angolensis</i> (Welw.) Warb. (bark)	Coated tongue
8	<i>Solanum nigrum</i> Linn. (leaves)	Coated tongue
9	<i>Sorghum bicolor</i> (L.) Moench (shoot)	Blood supplement

Discussion

The study revealed that the respondents were well aware of the signs and symptoms of malaria and could readily distinguish the ailment from other feverish conditions. Symptoms observed included high body temperature (hot skin), chills, joint pains, weakness, headache, lethargy, sneezing, loss of appetite, cough and vomiting. Consequently, the ability of these herbalists to treat and their knowledge of herbal prescription for malaria showed the prevalence of the disease and how it had been tackled with herbs over time. The study also showed that collection of these plants cut across various locations in the community. The traditional healers collect plants from gardens, roadsides, farms, mountain sides and forests.

The recipes used contained mainly plant leaves. Other parts used were stem bark, whole plant and roots. Preparations made from other plant parts like flowers, seeds, fruits or their combination were not common (Tables 3 and 4). Decoction was the preferred method of preparation followed by powder and a combination of decoction and powder. Other methods of preparation included infusion, concoction and tincture.

Herbs were administered orally and/or externally as washes, steam baths or ointment. Inhalation of steam was used in treatment of throat infections and fumigation was often used in the treatment of headache.

The healers, when preparing the remedies, sometime used different types of additives. Salt, food and drinks are used to improve taste of the preparation and thus increased patient compliance. Fats, oils and mud were used to make ointments or liniments for external use.

For most ailments, the dosage given depended upon the sex, age, duration of illness and physical condition of the patient. The doses varied from 1 teacup per day to 3-4 teacups 3 times a day for several days for oral administration. The same was noted when the treatment is a bath. A bath was often enough but other times several baths were required.

The array of medicinal plants used for malaria therapy in Rukuba, Bassa Local Government Area of Plateau State, showed great similarity with those used in other parts of Nigeria (Adebayo and Krettli, 2011) and Ghana (UNESCO, 1997). The most frequently used recipes included plants like *Azadirachta indica* A Juss, *Vernonia amygdalina* Del., *Carica papaya* L., *Allium sativum* L., *Khaya grandifoliola* C. DC., *Morinda lucida* Benth and *Rauwolfia vomitoria* Afz. More than 72% of the plants corresponded with those also reported for malaria ethno-therapy in Ogun State (Idowu *et al.*, 2010), and all the plants reported were used as antimalaria in Ondo State (Odugbemi *et al.*, 2007) (Table 3).

In preparation of herbal recipes for malaria therapy, a single plant or its combination with other plants could be used (Tables 4 and 5). The combination of these different plants were claimed to cure several ailments and dysfunctions in the body associated with malaria. For instance, plants claimed to cure coated tongue and those that replenish blood cells were added to the malaria recipe. More so, it was believed that the active principles of each plant in the preparation complemented one another in the fight against malaria parasite. Furthermore, selection of the different plants used was often based on the severity of the disease. The active principles of these plants were extracted by infusion, decoction, concoction or tincture (Table 4). The survey also revealed that the composition of herbal recipes prescribed differed based on the lineage, socio-political class, cultural group, occupation, status and age group of the respondents suggesting the pluralistic and diverse nature of traditional medicine (Singha, 1965). In addition, during administration of these preparations, recipes that were considered to be very potent were required to be taken in little quantity to avoid side effects like stomach disorders. Though the dosage was not very strict, the recipes were given in prescribed measures and specific dosage forms for effective performance. The parts used, mode of preparation, application and dosage were similar to those reported for southwest Nigeria (Idowu *et al.*, 2010; Odugbemi *et al.*, 2007). Significantly, majority of these plant preparations were very bitter in taste.

The challenges encountered during the course of this study varied and were diverse. Some respondents were unwilling to disclose or share information or knowledge considered sacred or secret. This agrees with a previous work reported by Kunle (2009). More often than not, this indigenous knowledge is the only source of livelihood for the practitioners. As a result, most of them are not willing to divulge the knowledge without any form of benefit. Language barrier also posed a great challenge in communication with most of the respondents even in the presence of an interpreter. There was demand for immediate financial reward before giving some information and services.

Conclusion

This study has highlighted medicinal plants used for malaria therapy by the Traditional Medicine Practitioners in Rukuba Community. All the plants listed have been in use in this community for centuries with no record of toxicity. Also most of these plants have been reported in literature to be safe or with insignificant toxicity when used as herbs or eaten as vegetable (Idowu *et al.*, 2010; Adebayo and Krettli, 2011). The findings suggest that some of these medicinal plants, which have been used ethnomedicinally throughout Nigeria, could be exploited for new antimalarial compounds, which could serve as leads for the discovery of new anti-malaria drugs.

Recommendation

The local Traditional Medicine Practitioners (TMPs) need to be educated on standardization of their products and practices, especially with regards to Good Manufacturing and Agricultural Practices, as well as sustainable use of herbal or medicinal plants. Furthermore, a lot needs to be done on sensitization of these rural dwellers on malaria prevention through healthy and sustainable environmental practices in order to reduce or eradicate environmental conditions favouring the breeding of mosquitoes as observed in all homes, which had open pits, wetlands and/or open wells in the compound.

Acknowledgement

This article is taken from a thesis submitted to the University of Jos for the award of a degree. The authors wish to acknowledge the Staff and Management of the University of Jos, Plateau State, Nigeria, for their support and contributions.

References

- Adebayo JO and Krettli AU (2011). Potential antimalarials from Nigerian plants: A review. *J. Ethnopharmacol.*, 133: 289-302
- African Health Monitor Report (2003). Traditional medicine, our culture, our future. Jan-Jun 2003, vol. 4, pp. 1.
- African Union Memoir (2005). "Unite against malaria, together we can beat malaria" on African Malaria Control Day.
- Dalziel JM (1956). *Useful Plants of West Tropical Africa*. Crown Agent for Oversea Government, London.
- Federal Ministry of Health (FMOH) (2009). A road map for malaria control in Nigeria - Strategic plan 2009-2013. National Malaria Control Programme, Abuja Nigeria. 1-5.
- Idowu OA, Soniran OT, Ajana O and Aworinde DO (2010). Ethnobotanical survey of antimalarial plants used in Ogun State, Southwest Nigeria. *Afr. J. Pharmacy and Pharmacol.*, 4(2): 055-060.
- Kunle OF (2009). Modes of compensation in exchange for indigenous knowledge. A case study of the Federal Capital Territory, Abuja, Nigeria. *Ethnobotanical Leaflet*, 13:1140-1147.
- Odugbemi TO, Akinsulire OR, Aibinu IE and Fabeku PO (2007). Medicinal plants useful for malaria therapy in Okeigbo, Ondo State, Southwest Nigeria. *Afr. J. Trad. CAM.*, 4 (2): 191-198.
- Onori E (1984). The problem of *Plasmodium falciparum* drug resistance in Africa south of the Sahara. *World Health Organization Bull.* 62(Suppl.): 55-62
- Research Initiative of Traditional Antimalaria Methods – Conference report (2005).
- Schilke JL (2009). Artemisinin-based combination therapy (ACTs) drug resistance trends in *Plasmodium falciparum* isolates in Southeast Asia". *Graduate School Thesis and Dissertation*, pp. 9-67.
- Singha SC (1965). *Medicinal Plants in Nigeria*. Apapa, Lagos, Nigeria: Published by the Nigerian National Press Ltd.
- Sofowora A (1982). *Medicinal Plants and Traditional Medicine in Africa*. John Wiley, Chichester.
- Sofowora A (2008). *Medicinal Plants and Traditional Medicine in Africa*. 3rd Ed., Spectrum Books Limited Ibadan, Nigeria, pp.22-30.
- United Nations Educational Scientific and Cultural Organization (UNESCO) (1997). Culture and health, orientation texts. World decade for cultural development, 1988-1997. Doc. CLT/DEC/PRO, Paris, France, pp.129
- United Nations Educational Scientific and Cultural Organization (UNESCO) (1998). Terminal Report. Promotion of ethnobotany and sustainable use of plant resources in Africa. Paris.
- WHO (1978). WHO Declaration of Alma-Ata. International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978.
- WHO (2005). *World Malaria Report*.
- WHO (2007). WHO facts sheet no. 94 revised May 2007, WHO press office Geneva.
- WHO-TDR Report (2002). TDR strategic direction for research in malaria.