



## PRELIMINARY INSIGHTS INTO HERBAL REMEDIES USED FOR MALARIA TREATMENT IN BENUE SOUTH: ESSENTIAL UNDERPINNINGS



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### Abstract:

In this study, a searchlight was beamed at herbal remedies, plant parts, dosage and category of users of users of herbal treatment for malaria in Benue State. The result revealed that the most frequently used herbal remedies are neem (38.4%), guava (26.3%), and lime orange (24.2%). The sources of herbal treatments preferred by the respondents are; forest (26.3%), herb vendors in the market (11.1%), herbal homes (13.1%), home environment (49.5%). The study also showed that the amount expended on treatment varied from between NGN 0-NGN 1500. The distribution of the plant parts used in order of frequency is: stem/bark/leaves > twig and root bark > combination of every part > root and stem at 69.7%, 13.1%, 12.1% and 5.1% respectively. The distribution of dosage observed amongst the respondents is as follows: 3-4 cups/day; 29.2%, 5-6 cups/day; 25.2%; 1-2 cups/day; 29.2%, > 7 cups/day; 13.1%, and other forms of application such as bathing; 3.0%. The preferential order for duration of treatment is 3-5 days > 6-7 days > 1-2 days > more 8 days at 40.4, 32.2, 15.2 and 11.1% respectively. 84.9% of the respondents extract their herbs using hot water while 15.1% used gin. The order of category of users is as follows: Adult only (47.5%) > All age (35.4%) > children only (17.2%). The study showed that 71.7% of the respondents prefer to drink and bath with the herbal remedies, 28.3% drink it only. Regarding malaria prevention practices, 26.89% of the respondents prefer to cover their bodies with clothes, 23.55% sleep with windows closed or with net; 18.89% spray insecticides or use mosquito repellents; 14.00% sleep under ordinary net or long lasting insecticide treated nets; while 2.29% prefer to take prophylactic drugs and 0.89% use other methods not listed here. Use of herbal remedies remains a viable treatment option in African traditional medicine with several benefits to humans and even their animals. This is further accentuated by the recent discovery of resistance stains of malaria parasite to artemisinin, the drug of choice for malaria treatment.

### Keywords:

Malaria, Control, Plants, Herbal Remedies, Benue South, Nigeria

### Introduction

Malaria continues to ravage vulnerable populations across the globe posing a medical enigma even with remarkable advancement in modern medicine. The world malaria burden increased from an estimated 245 million incidents in 2020 to 247 million cases in 2021 (WHO, 2022). This surge is attributable, perhaps, to the disruption of services during the COVID-19 pandemic. The WHO African region contributes the greatest proportion (96%) of the global malaria disease burden. Nigeria continues to bear the highest malaria burden (cases-26.8%; deaths-31.9%) worldwide with cases and death rates topping an all-time high (WHO, 2022).

Even though treatable and curable, it is still a major public health challenge accounting for a large proportion of morbidity and mortality on the continent of Africa. According to African Union (AU) Malaria Progress Report (AUMPR, 2021), 96% of global malaria cases and 98% of malaria deaths occur on this continent. The causative organisms are protozoans referred to as *Plasmodium* parasites transmitted through the bites of female *Anopheles* mosquitoes.

In recent times, there seems to be a convergence of threats against malaria control measures one of which is multi-drug resistant strains of *Plasmodium*, particularly *P. falciparum*. Clinical resistance first line drugs of choice like artemisinin were reported in Southeast Asia, including in the Cambodia-Thailand border region (Na-Bangchang, 2010; Woodrow and White 2017). In 2021

Balikagala and co-workers confirmed the emergence of Artemisinin resistance in Africa, a devastating news for the continent and high burden nations like Nigeria; the site of most cases and deaths from *P. falciparum* malaria.

With weak health systems and sometimes total absence of a health facility in malaria heartlands, there seems to be increased dependence on herbal remedies for both presentation and cure of frank malaria disease. This study sought to explore the diverse and rich compliment of plant-based local remedies in use in the selected study communities. It is hoped that this botanical investigation will enrich the Nigerian phytomedicine data base and may lead to the discovery of new drug candidates to add to the malaria control tool box.

### Materials and Methods:

#### Study site

Benue State occupies a landmass of 34,059 square kilometres with a population of about 4,253,641 as at the 2006 census (Federal Republic of Nigeria [Frong], 2009) and by projection about 5,741,800 population. The State lies within longitude 7° 47' and 10° 0' East and Latitude 6° 25' and 8° 8' north; and shares boundaries with five other states namely: Cross-River to the south, Enugu to the south-west, Kogi to the west and Nassarawa to the north with Taraba to the east, The State also shares a common boundary with the Republic of Cameroun on the south-east. The south-eastern part of the State adjoining the Obudu-Cameroun mountain range, however, has a cooler

climate similar to that of the Jos, Plateau (Benue, 2014). Idoma and Tiv, are spoken predominantly. There are other ethnic groups, including Igede, Etulo and Abakwa. Jukun, Hausa, Akweya and Nyifon. The Tivs occupy fourteen (14) local government areas, while the Idomas and Igedes occupy the remaining nine (9) local government areas (Ado-Igumale, Agatu-Obagaji, Apa-Ugbokpo, Obi-Obarike-Ito, Ogbadibo-Otukpa, Ohimini-Idekpa-Okpiko, Oju-Oju, Okpokwu-Okpoga, Otukpo-Otukpo) which make up the total of twenty-three Local Government Areas (LGAs). Benue South Senatorial Area comprises of the nine (LGAs mentioned above and are the focus of this study.



Figure 1: Map of Benue State Showing Benue South Senatorial Area

Study Design and Sampling Strategy

Ethical Issues

Approval was obtained from the appropriate quarters, the Local Government and Institutional Review Board (IRB) of the Federal University of Health Sciences

Otukpo (FUHSO-IRB) before initiating community entry and advocacy visits to the selected communities.

Ethno-botanical Survey of Medicinal Plants

A cross sectional survey; an ethno-botanical survey of medicinal plants in the identified villages was carried out using a semi structured (both open and closed ended questions) questionnaire. A section of the survey questionnaire sought to elicit information on the various malaria preventive measures under taken in the selected study communities while another section presents multi-subsections focused on common plants, plant parts used, cost, method of preparation, dosage and administration of the medicinal herbs used for malaria treatment in the selected study communities.

Sample Size

The sample size for the household survey in the selected communities in the LGA was derived using the formula (Lemeshow et al, 1990):

$$n = \frac{z^2 p(1-p)}{d^2} \quad (1)$$

where n = sample size, Z = level of significance, p = the estimated prevalence of malaria in study LGA, d = sampling error that can be tolerated (0.05 or 5%).

Collection and Identification of Herbs/ Plants used as Herbal Remedies

The thrust of the study is collection and identification of herbs used as local malaria remedies. The herbal plant remedies were sourced and collected from their natural habitat with the help of local resource persons who are vast with the knowledge of local treatment of malaria. They were air-dried under a shade to prevent them from deteriorating, and then taken to the Department of Plant Science and Technology of the University of Jos for identification.

Result and Discussion

Result

Table 1: Frequency and Ranking Distribution of the local plants (ingredients), sources and cost of herbal treatment

	Oju	Obi	Ohimi ni	Ogbadi bo	Okpok wu	Apa	Otuk po	Ado	Agat u	Total Freq. n=450 (%)	Ranking
Local Plants used	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq		
Neem (dogonyaro)	3	5	4	5	3	6	3	4	5	38(38.4%)	1 <sup>st</sup>
Guava leaves	4	3	3	3	2	3	2	3	3	26(26.3%)	2 <sup>nd</sup>
Lime orange	3	2	2	3	3	3	2	3	3	24(24.2)	3 <sup>rd</sup>
Others	1	3	1	0	1	2	0	1	2	11(11.1)	4 <sup>th</sup>
<b>Sources of herbal treatment</b>											
Herb vendors in the market	2	1	1	2	1	1	1	1	1	11 (11.1%)	4 <sup>th</sup>
Herbal homes	3	2	1	2	1	1	1	1	1	13(13.1%)	3 <sup>rd</sup>
Forest/bush	1	5	1	3	4	5	1	3	3	26(26.3%)	2 <sup>nd</sup>
Home environment	5	5	7	4	3	7	4	6	8	49(49.5%)	1 <sup>st</sup>
Others											
<b>Cost of herbal treatment</b>											
Free	6	7	8	7	7	12	5	9	11	72(72.7%)	1 <sup>st</sup>
below ₦500	1	3	1	1	1	1	1	0	1	10(10.1%)	2 <sup>nd</sup>
₦500-₦1000	1	2	1	1	1	0	0	1	1	8(8.1%)	4 <sup>th</sup>
₦1000-₦1500	3	1	0	2	0	1	1	1	1	9 (9.1%)	3 <sup>rd</sup>
₦1500-Above	0	0	0	0	0	0	0	0	0	0	5 <sup>th</sup>

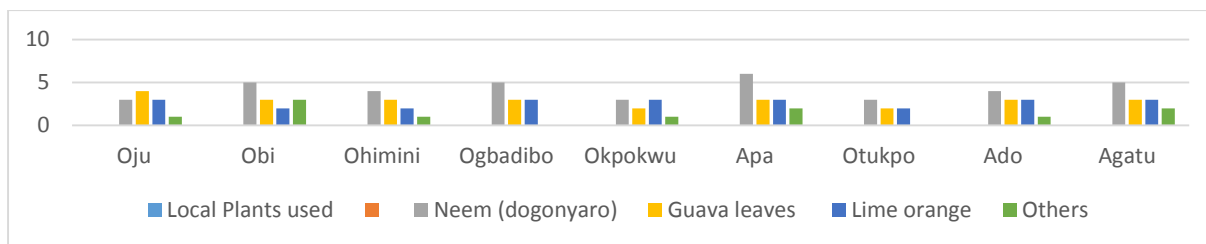


Figure 1: Herbal Plants Used for Treatment of Malaria

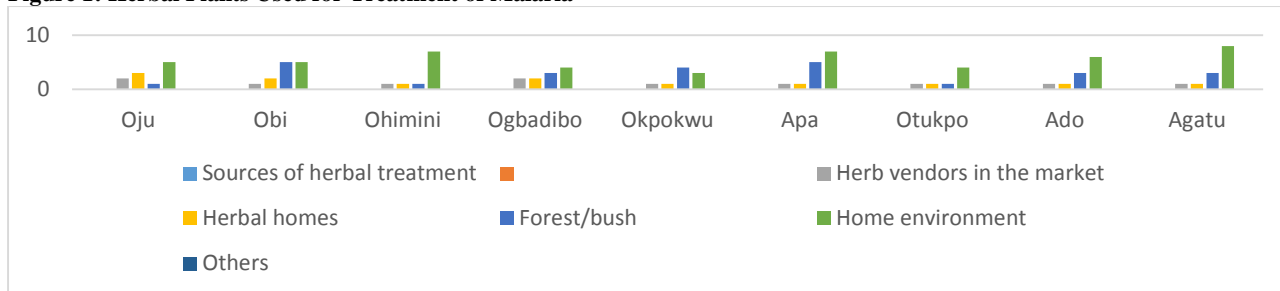


Figure 2: Distribution of Sources of Herbal Treatment

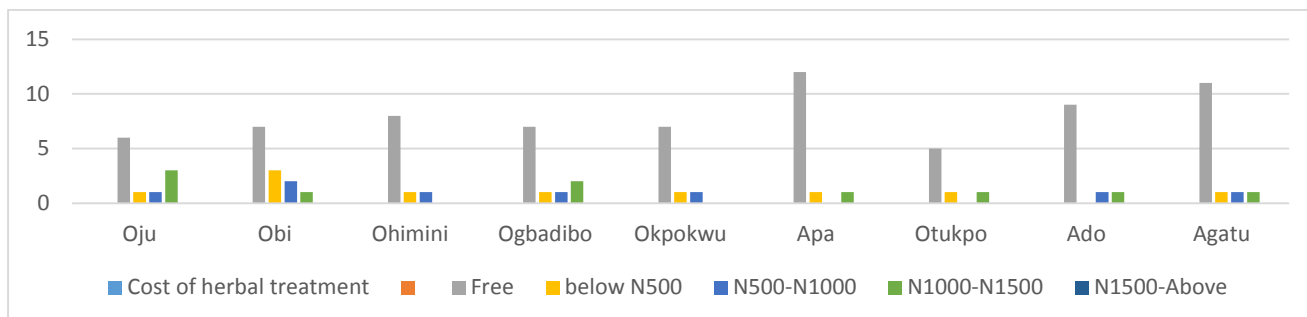


Figure 3: Cost of Herbal Treatment (Naira)

Table 2: Frequency and Ranking Distribution of the Plant Parts Used and Method of Preparation of Herbal Treatment

Part of Plants Used	Oju	Obi	Ohimini	Ogbadibo	Okpokwu	Apa	Otukpo	Ado	Agatu	Total Freq. n=450 (%)	Ranking
	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq		
Root and Stem	1	1	1	0	0	1	1	0	0	5(5.1%)	4 <sup>th</sup>
Twig and Rootbark	1	2	1	3	1	2	1	1	1	13(13.1%)	2 <sup>nd</sup>
Stembark and Leaves	7	7	5	6	7	10	5	10	12	69(69.7%)	1 <sup>st</sup>
Flower, Fruit, and Seed											
Combination of every part	2	3	3	2	1	1	0	0	0	12(12.1%)	3 <sup>rd</sup>
<b>Method of Preparation</b>											
Powder	-	-	-	-	-	-	-	-	-		
Extracted with cold water	-	-	-	-	-	-	-	-	-		
Extracted with hot water	10	11	8	10	7	12	5	9	12	84(84.9%)	
Extracted with gin	1	2	2	1	2	2	2	2	1	15(15.1%)	
Others											

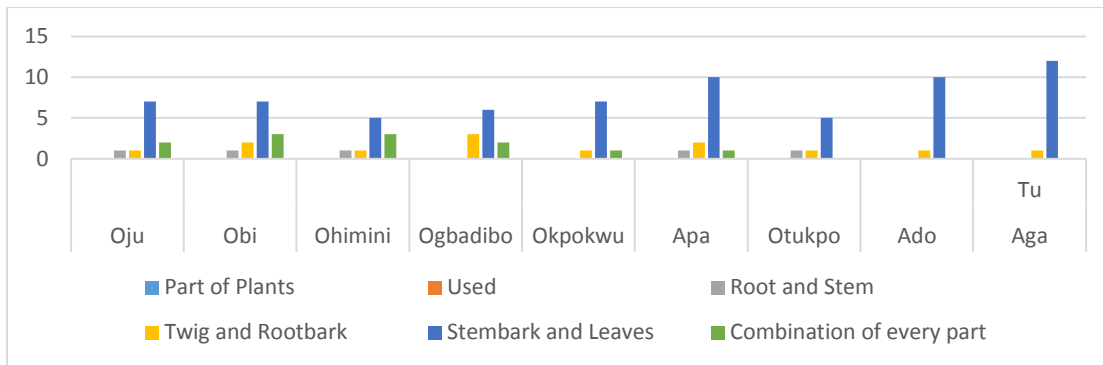


Figure 4: Part(s) of Plant Used

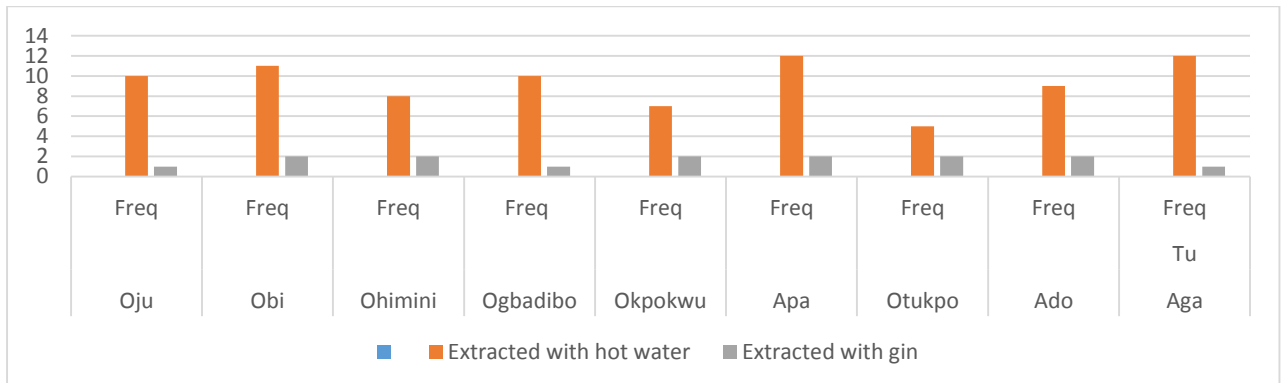


Figure 5: Method of Preparation of Herbal Remedies

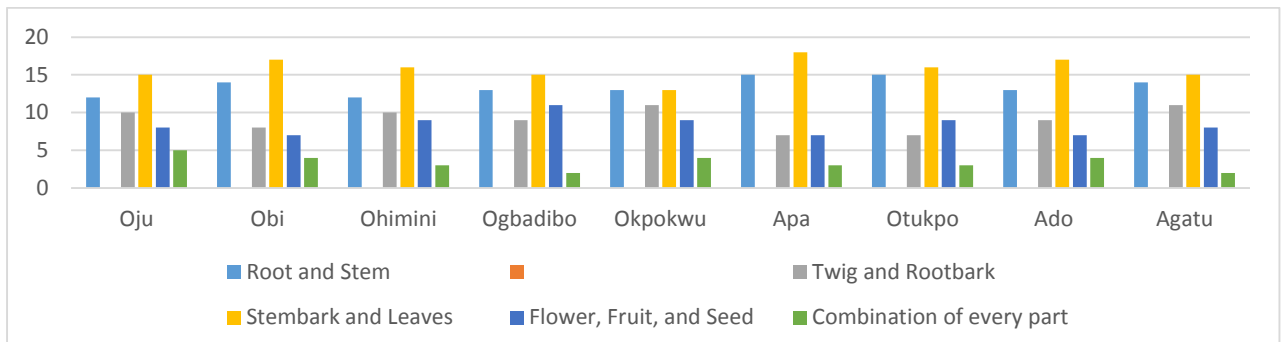


Figure 6: Part of Plants Used for Treatment of Malaria

Table 3: Frequency and Ranking Distribution of the Dosage and Duration of Treatment of Malaria using Herbal Remedies

	Oju	Obi	Ohimini	Ogbadibo	Okpokwu	Apa	Otukpo	Ado	Aga Tu	Total Freq. n=90 (%)	Ranking
<b>Dosage</b>	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq		
1-2 cups per day	3	5	2	3	2	5	3	3	3	29(29.2%)	1 <sup>st</sup>
3-4 cups per day	4	3	3	3	4	4	2	2	4	29(29.2%)	1 <sup>st</sup>
5-6 cups or teaspoons per day	2	4	3	2	2	3	1	3	5	25 (25.2%)	3 <sup>rd</sup>
More than 7 cups or teaspoons per day	1	1	2	2	1	2	1	2	1	13(13.1%)	4 <sup>th</sup>
Others (such as bath with)	1	0	0	1	0	0	0	1	0	3(3.0%)	5 <sup>th</sup>
<b>Duration of Treatment</b>											
1-2 days	3	2	1	1	1	2	1	2	2	15(15.2%)	3 <sup>rd</sup>
3-5 days	4	5	5	6	2	5	3	3	4	40(40.4%)	1 <sup>st</sup>
6-7 days	2	5	3	3	4	5	3	3	4	32(32.3%)	2 <sup>nd</sup>
More than 8 days	2	1	1	1	2	2	0	1	1	11(11.1%)	4 <sup>th</sup>

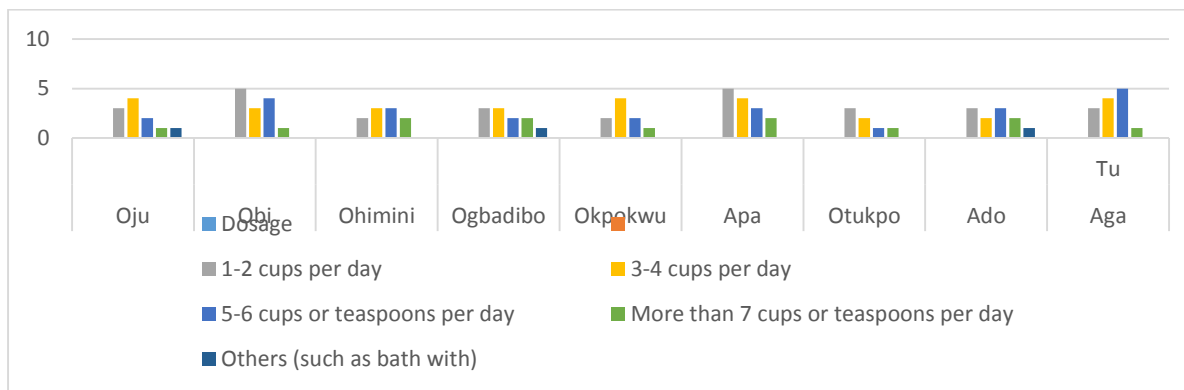


Figure 7: Dosage of Herbal Remedies

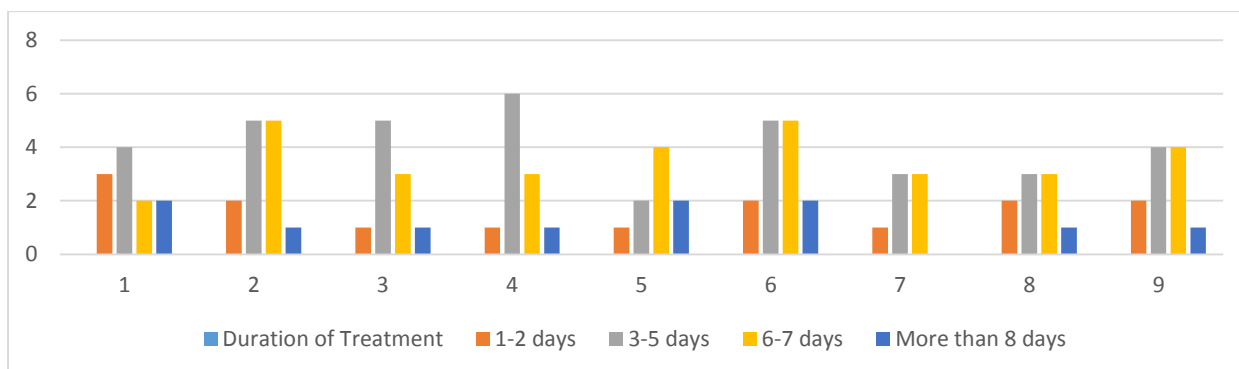


Figure 8: Duration of Administration of Herbal Remedies

Table 4: Frequency and Ranking Distribution of Category of Users and Method of Administration of Herbal Treatment

	Oju	Obi	Ohimini	Ogbadibo	Okpokwu	Apa	Otukpo	Ado	Aga Tu	Total Freq. n=90 (%)	Ranking
<b>Age Category of Users</b>	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq		
Infants only	-	-	-	-	-	-	-	-	-		
Children only	3	2	2	1	2	1	2	1	3	17(17.2%)	3 <sup>rd</sup>
Adult only	4	5	6	6	4	5	5	6	6	47(47.5%)	2 <sup>nd</sup>
All age groups	4	4	3	4	5	5	4	4	2	35(35.4%)	1 <sup>st</sup>
<b>Method of Administration</b>											
Drink only	7	7	8	9	10	6	8	6	10	71(71.7%)	1 <sup>st</sup>
Bath with only	-	-	-	-	-	-	-	-	-		
Drink and bath with	4	4	3	2	1	5	3	5	1	28 (28.3%)	2 <sup>nd</sup>
Prepare in soup form	-	-	-	-	-	-	-	-	-		
Steaming	-	-	-	-	-	-	-	-	-		

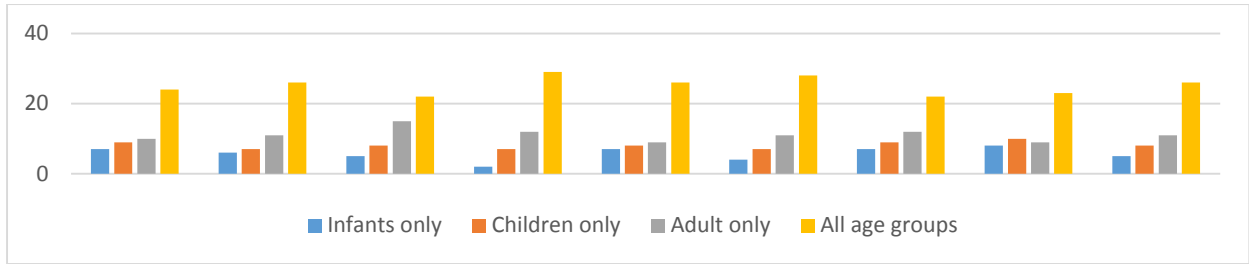


Figure 9: Age Distribution of Users of Herbal Remedies

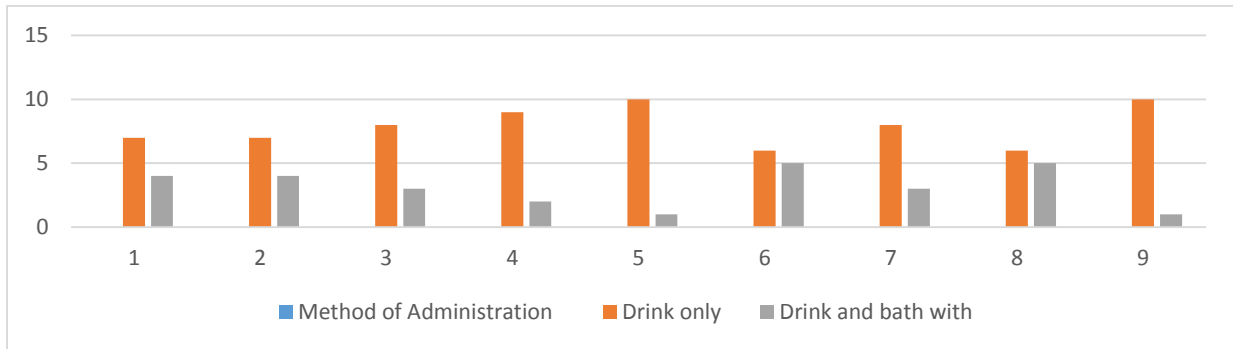
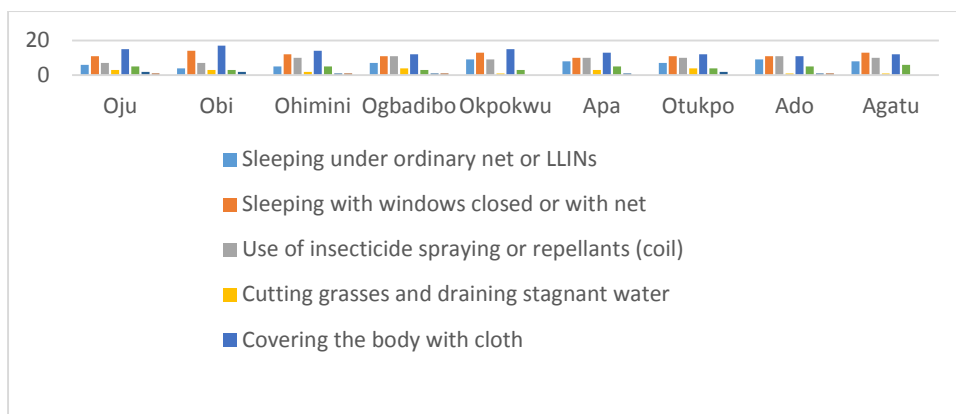


Figure 10: Method of Administration of Herbal Remedies

Table 5: Frequency and Ranking Distribution of the Extent of Usage of Malaria Prevention Measures

	Oju	Obi	Ohimini	Ogbadibo	Okpokwu	Apa	Otukpo	Ado	Aga Tu	Total Freq. n=450 (%)	Ranking
Usage of Prevention Measure(s)	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq		
Sleeping under ordinary net or LLINs	6	4	5	7	9	8	7	9	8	63 (14.00%)	4 <sup>th</sup>
Sleeping with windows closed or with net	11	14	12	11	13	10	11	11	13	106 (23.55%)	2 <sup>nd</sup>
Use of insecticide spraying or repellants (coil)	7	7	10	11	9	10	10	11	10	85 (18.89%)	3 <sup>rd</sup>
Cutting grasses and draining stagnant water	3	3	2	4	1	3	4	1	1	22 (4.89%)	6 <sup>th</sup>
Covering the body with cloth	15	17	14	12	15	13	12	11	12	121 (26.89%)	1 <sup>st</sup> and
Take herbal preparations/drinks e.g. <i>agbo</i>	5	3	5	3	3	5	4	5	6	39 (8.67%)	5 <sup>th</sup>
Take prophylactic (preventive) drugs	2	2	1	1	0	1	2	1	0	10 (2.22%)	7 <sup>th</sup>
Other	1	0	1	1	0	0	0	1	0	4 (0.89%)	8 <sup>th</sup>



**Figure 11: Malaria Preventive Measures used**  
**Discussion**

The result in Table 1 shows that the most frequently used herbal remedies are neem (38.4%), guava (26.3%), and lime orange (24.2%). Also Table 1 reveals the sources of herbal treatments embraced by the respondents to be; forest (26.3%), herb vendors in the market (11.1%), herbal homes (13.1%), home environment (49.5%), and other sources (0.0%). Also the amount expended on treatment varies from between NGN 0-NGN 1500.

Table 2 shows the distribution of the plant parts used and method of preparation of herbal treatment. In order of frequency: stem/bark/leaves > twig and root bark > combination of every part > root and stem at 69.7, 13.1, 12.1 and 5.1% respectively.

Table 3 represents the dosage and duration of treatment of malaria using herbal remedies. The result shows the distribution of dosage as follows: 1-2 cups/day; 29.2%, 3-4 cups/day; 29.2%, 5-6 cups/day; 25.2, > 7 cups/day; 13.1%, and other forms of application such as bathing; 3.0%. The preferential order for duration of treatment is 3-5 days > 6-7 days > 1-2 days > more than 8 days at 40.4, 32.3, 15.2 and 11.1% respectively.

Table 4 shows the category of users and methods of administration of herbal treatment. The order of category of users is as follows: Adult only (47.5%) > All age (35.4%) > children only (17.2%). Table 4 also shows that 28.3% of the respondents prefer to drink and bath with the herbal remedies, 71.7% drink it only.

An array of malaria preventive measures shown in Table 5 includes Covering the body with cloth (14.00%), sleeping with windows closed or with net (23.55%) / Long-lasting insecticidal nets (LLINs-14.00%) and use of insecticide spraying or repellants (coil-18.89%) which are in agreement with other reports (Amaechi and Ukpai 2013; Eugene-Ezebilo and Ezebilo, 2015). Our attention was drawn to the low use of LLINs (14.00%) because it is one of the major intervention tool driving the national elimination goal. Omudu and co-authors in 2015 reported that the proportion of untreated nets (69.5%) deployed by households in the state capital Makurdi, more than doubled that of Insecticide-Treated Bed Nets (ITNS-30.5%). A major concern previously reported in the same state is the wrong assumption that the chemical used to treat the net is lethal (Aju-Ameh, 2016). Health education was the main reason for an increase in knowledge of vector and use of bed nets which led to the decrease in malaria transmission an endemic urban area of Ecuador and Peru (Nieto & Carrasquilla, 1999); same is advised in this instance.

Use of herbs for healing by man and continued search for drugs in nature is as old as mankind itself (Petrovska,

2012; WHO, 2018). There are over 1200 plant species from 160 families in use for the treatment of malaria and fever (Willcox and Bodeker, 2004). The dataset reveals the use of various types of plant to treat malaria as in many African nations including Nigeria (Mahomoodally, 2013; Ozioma and Chinwe 2019; Falodun and Imieje 2013; Balogun, 2022). From the cost (Table 1) it is cheaper than most orthodox medicine, much more easily accessible to those in resource poor settings and infrastructure deficient areas especially hard to reach end of the road communities.

With the problems of increasing levels of drug resistance herbal medicines could be an important and sustainable source of treatment. With the emergence of corona Virus-Covid 19, (WHO, 2020; Rosenthal *et al.*, 2020) on the African continent there seems to be a return to the use of traditional local remedies to treat malaria, much of which are plant based, usually referred to as herbal concoctions; some of these herbs being part of their diet.

Being natural in origin, herbal remedies may be considered safer than orthodox medicine, however in these communities and to the best of our knowledge at this time, there are no known documented pharmacokinetics (PK) and pharmacodynamics (PD) of the components of these preparations. Therefore an essential underpinning would be the generation of gainful scientific information on the active ingredients for compounding purposes, efficacy, dosage and toxicity.

#### Statistical Analysis

Data from the investigations were sorted into related groups and subjected to statistical analysis using descriptive statistics, percentage and ranking were used to analyse the variables.

**Conclusion:** Use of herbal remedies forms part of the holistic nature of African traditional medicine with several benefits to humans and even their animals. The discovery and development of potential antimalarial candidates from natural sources should be encouraged.

#### Recommendation

LLINs integrity needs to be enhanced, emphasis on accurate steps in its usage should be clearly spelt out for the recipients to boost their confidence in its efficacy as an improved control tool. Net replacement exercise should be carried out a bit more frequently to replace worn out ones.



## References

- African Union Malaria Progress Report (2021) Retrieved October 13, 2022 <https://alma2030.org/wp-content/uploads/2022/02/malaria-progress-report-2021->
- Aju-Ameh, C. O., Awolola, S. T., Mwansat, G. S., and Mafuyai, H. B. (2016). Malaria related knowledge attitude and practices (MKAP) in fourteen communities in Benue state North Central Nigeria: Evidence for the Success of focal malaria control intervention programmes. *Int J Mosq Res*, 55, 11-4.
- Amaechi, E. C., and Ukpai, O. M. (2013). Knowledge, attitude and practices about malaria among mothers and care-givers in Aba South Local Government Area, Abia state, Nigeria. *Animal Research International*, 10(3), 1786-1791.
- Balikagala, B., Fukuda, N., Ikeda, M., Katuru, O. T., Tachibana, S. I., Yamauchi, M., ... & Mita, T. (2021). Evidence of artemisinin-resistant malaria in Africa. *New England Journal of Medicine*, 385(13), 1163-1171.
- Balogun J. A. (2022). Emerging Developments in Traditional Medicine Practice in Nigeria. In *The Nigerian Healthcare System: Pathway to Universal and High-Quality Health Care* (pp. 235-275). Cham: Springer International Publishing.
- Benue State (2014). About Benue State. Retrieved December 13, 2014 from [http://www.bcics.northwestern.edu/projects/reach/otukpo Benue .com.ng](http://www.bcics.northwestern.edu/projects/reach/otukpo%20Benue.com.ng)
- Eugene-Ezebilo, D. N., & Ezebilo, E. E. (2015). Home-based malaria management in children by women: Evidence from a malaria endemic community in sub-Saharan Africa. *Asian Pacific Journal of Tropical Disease*, 5(7), 532-538.
- Falodun A. and Imieje, V. (2013). Herbal medicine in Nigeria: Holistic overview. *Nigerian Journal of Science and Environment*, 12(1), 1-13.
- Frong (2006) Federal Republic of Nigeria. Official Gazette-Census. (Frong 2006) No.2, Vol 96. Abuja 2<sup>nd</sup> February 2009. <https://www.who.int/news-room/questions-and-answers/item/artemisinin-resistance>
- Mahomoodally, M. F. (2013). Traditional medicines in Africa: an appraisal of ten potent African medicinal plants. *Evidence-based complementary and alternative medicine*, 2013.
- Omudu, E. A., and Omobhund, M. E. (2015). Studies on Bed-Net Ownership and Utilization and other Mosquito Control Practices in Makurdi, Nigeria.
- Ozioma E. O. J. and Chinwe O. A. N. (2019). Herbal medicines in African traditional medicine. *Herbal medicine*, 10, 191-214.
- Petrovska B. B. (2012). Historical review of medicinal plants' usage. *Pharmacognosy reviews*, 6(11), 1.
- Rosenthal P. J., Joel G. B., Abdoulaye A. D., Chandy C. J., Moses R. K., Rose G.F Leke R.G.F., Moeti M.R., Nkengasong J., and Bausch D.G. (2020). "COVID-19: Shining the Light on Africa": [tpmd200380](https://doi.org/10.1186/s12916-020-02003-8).
- Willcox, M. L., and Bodeker, G. (2004). Traditional herbal medicines for malaria. *Bmj*, 329(7475), 1156-1159.
- Woodrow, C. J., and White, N. J. (2017). The clinical impact of artemisinin resistance in Southeast Asia and the potential for future spread. *FEMS microbiology reviews*, 41(1), 34-48.
- World Health Organisation (2018) Artemisinin1 resistance and artemisinin-based combination therapy efficacy-Status Report. Available from <https://iris.who.int/bitstream/handle/10665/274362/WHO-CDS-GMP-2018.18-eng.pdf?ua=1> Retrieved September 20, 2023
- World Health Organisation (2022) Malaria: Artemisinin partial resistance
- World Health Organization, 2020. 2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness and Response Plan for the Novel Coronavirus. Available at: <https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf>. Accessed May 25, 2020.