

# Malaria Endemicity: A Survey of Antimalarial Herbal Products in Ijebu Ode, Nigeria

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## Abstract

*Empirical evidence has shown that approximately 80% of the global population uses herbal medicines as primary care, especially in developing nations, particularly Nigeria. Despite this, an estimated 95% of global cases of malaria occur in Africa, with Nigeria accounting for approximately 27%. Therefore, the current study investigated the prevalence of antimalarial herbal medicinal products in Ijebu-Ode for the fight against malaria endemicity. It explored their regulatory registration and active plant components, considering the documented evidence of their use for treating malaria. A cross-sectional study was adopted in the collection of empirical data and analyzed in SPSS (version 23.0), while spatial data were analyzed in ARC-GIS, and the results were graphically presented using pictorial variables. The results revealed the availability of approximately 18 different antimalarial herbal products, of which 72.2% were registered with regulatory agencies. Similarly, the herbal products were shown to contain more than one plant species as their active component (Azadirachta indica (83.3%), Nauclea latifolia (55.6%), and Enantia chlorantia (44.4%), which may be responsible for multiple indications (typhoid (83.3%), yellow fever (38.9%), and cold (33.3%). The results of this study provide valuable insights for developing evidence-based policies to standardize and regulate herbal remedies, particularly for combating malaria and other endemic conditions. These findings have implications for public health and the development of effective strategies to address the challenges posed by malaria in Nigeria and other similar regions.*

**Keywords:** Antimalarial, Herbal medicine, Herbal product, Herbal remedies, Traditional medicine.

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## **INTRODUCTION**

The steady rise and acceptance of herbal remedies have been empirically demonstrated in both developing and developed countries (with about 80% of the global population estimated to use herbal medicines as a primary level of care (Woo et al., 2012; Ekor, 2014; Khan & Ahmad, 2019; Mehmood et al., 2019). This trend is similarly observed in Nigeria, where herbal medical practice constitutes a fundamental component of the healthcare system for most low- and middle-income populations. Herbal medicines have been extensively documented for the management of endemic diseases such as malaria (Adibe, 2009; Oreagba et al., 2011), typhoid (Bekoe et al., 2017), and other chronic ailments such as epilepsy (Danesi & Adetunji, 1994), hypertension (Amira & Okubadejo, 2007), diabetes mellitus (Ogbera et al., 2010), cancer (Fakeye et al., 2009), sickle cell anemia, and asthma (Oshikoya et al., 2008).

However, despite the widespread use of herbal medicines, an estimated 234 million cases of malaria, according to the World Malaria Report (2022), are in Africa, accounting for 95% of the global cases, with Nigeria accounting for approximately 27% and 31% of global malaria cases and deaths in 2021, respectively. This has been attributed to the ineffectiveness in the use of chloroquine in fighting malaria (World Malarial Report, 2005), resulting in the use of herbal medicines by respondents (Oreagba et al., 2011). Notably, the literature has documented efficacy as one of many reasons for using herbal cures by most locals (Oreagba et al., 2011; Agyei-Baffour et al., 2017). Regardless, the control of herbal medical practice remains a key challenge in Nigeria and other developing countries regarding safety and efficacy, as is the case for conventional Western medicines (Barnes, 2003).

To address these challenges and integrate herbal medicine into mainstream healthcare, Nigeria implemented the Traditional Medicine Policy and Regulatory Framework in 2006. Consequently, there has been an increase in the local production of refined packaged herbal medicines (Wambebe, 2009), leading to the proliferation of these products in Nigerian markets for various ailments. Thus, the current study investigates the prevalence of anti-malarial herbal medicinal products on the Nigerian market in the fight against malaria endemicity by exploring their registration compliance with the regulatory agency and the various active plant components, considering documented evidence of their use for treating malaria. However, most studies in the field of the studies on herbal medicine in Nigeria have only focused on the use of ethno-medicinal plants for management of diverse indications (Odugbemi et al., 2008; Aguoru & Ogaba, 2010; Idu et al., 2010; Dambatta & Aliyu, 2012; Sodipo, & Wannang, 2015, Halimat et al., 2017). Therefore, this study makes a major contribution to research on herbal therapy by offering some important insights into the prevalence of herbal products for the management of malaria. Additionally, by examining the potential of antimalarial herbal products as an additional or supplementary treatment for malaria, the study proves instrumental in emphasizing the pharmacologic potentials of herbal remedies in the fight against malaria, and thus serves as a basis for further scientific research into their pharmacological properties against malarial parasites.

For the purposes of this study, the term "herbal product" refers to all plant-based packaged products containing raw or processed ingredients from one or more plants used or intended for use in treating malaria.

## **MATERIALS AND METHODS**

### **Study Area**

The study was conducted in Ijebu Ode, which is about 60 km northwest of Lagos and the second-largest city in Ogun State, southwest Nigeria, with a land area of 192 km<sup>2</sup> and with a

reported population of 154,032 (National Bureau of Statistics (NBS), 2007) (Figure 1). According to the World Population Review (2022), Ijebu Ode has a rapidly expanding and widely dispersed suburban region, with an estimated current population of 367,749 and a population growth rate of 3.36%. The City lies within the tropical lowland rain forest zone and is situated at approximately 7°N latitude. It experiences a variety of meteorological conditions, including wet and dry seasons, with mean annual rainfall between 1523 mm and 2340 mm and an average temperature range of 25°C and 32°C (Bakare et al., 2015). Natural vegetation comprises a great variety of species arranged in a complex vertical structure with an emergent layer of large trees, including iroko (*Chlorophora*), mahogany (*Khaya entandrophragma*), afara (*Terminalia*), obeche (*Triplochiton*), African walnut (*Lovoa trichilioides*), and ekki (*Lophira alata*) (Bakare et al., 2015), which form the basis of the major source of herbal plant varieties in the locality.

**Data Collection and Analysis**

The prevalence of herbal anti-malarial medicines in the research area was examined using a descriptive correctional survey. All available pharmacies, drug stores, and mobile herbal product sellers in Ijebu Ode City were surveyed in a purposive sampling. The availability of any antimalarial herbal products in any of the drug stores was then confirmed through an oral interview. Consequently, any available antimalarial herbal product (of various brands) was bought, resulting in the acquisition of a total of 18 antimalarial herbal medicinal products with indications for the management of malaria. Thus, primary data on indications, active plant components, registration status, expiration, and contraindications, among other information, were gathered from the product inner and outer labels. The collected data was analyzed descriptively with a statistical software package (SPSS, version 23.0), and the results were graphically presented using tables and charts.

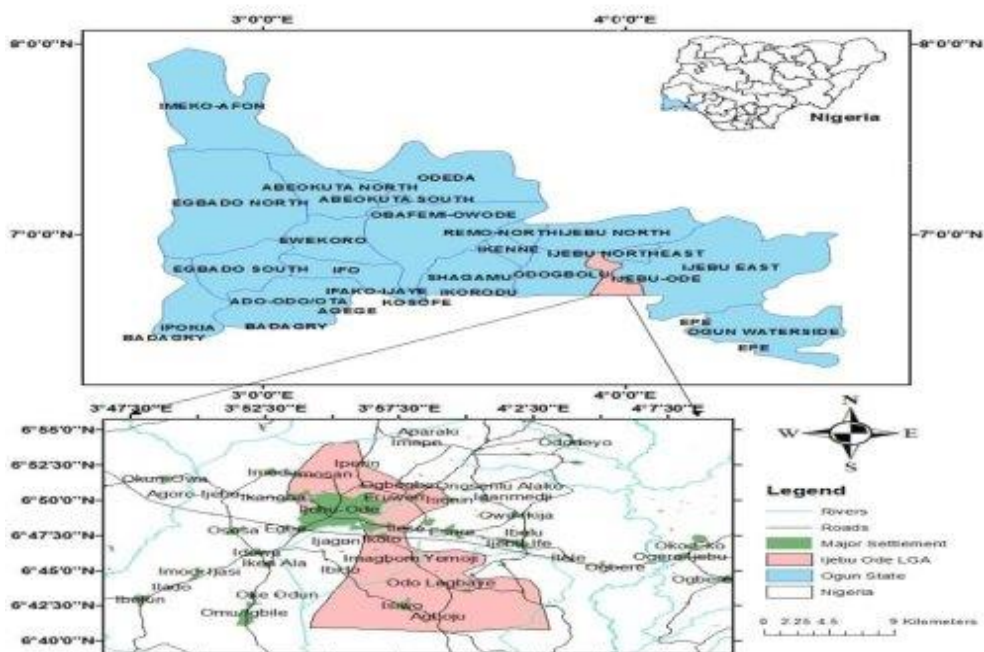


Figure 1: Spatial Map of Ijebu Ode (Otto et al., 2022)

RESULTS

Table 1: Essential Attributes of Antimalarial Herbal Products (N = 18)

| Attributes                     | Frequency(F) | Percent(%)   |
|--------------------------------|--------------|--------------|
| <b>Regulatory Registration</b> |              |              |
| Registered                     | 13           | 72.2         |
| Unregistered                   | 5            | 27.8         |
| <b>Total</b>                   | <b>18</b>    | <b>100.0</b> |
| <b>Contraindications</b>       |              |              |
| Yes                            | 7            | 38.9         |
| No                             | 11           | 61.1         |
| <b>Total</b>                   | <b>18</b>    | <b>100.0</b> |
| <b>Dosage/Administration</b>   |              |              |
| Teaspoonful                    | 14           | 77.8         |
| Measuring cup                  | 4            | 22.2         |
| <b>Total</b>                   | <b>18</b>    | <b>100.0</b> |
| <b>Number of Indications</b>   |              |              |
| 1 - 5                          | 12           | 66.7         |
| 6-10                           | 3            | 16.7         |
| > 10                           | 3            | 16.7         |
| <b>Total</b>                   | <b>18</b>    | <b>100.0</b> |
| <b>Expiration Date</b>         |              |              |
| Yes                            | 18           | 100.0        |
| No                             | 0            | 00.0         |
| <b>Total</b>                   | <b>18</b>    | <b>100.0</b> |

Assessing the major attributes of the antimalarial herbal remedies for malaria treatment, as indicated in Table 1, shows that 72.2% of the herbal therapies were registered with the National Agency for Food and Drug Administration and Control (NAFDAC), compared with 27.8% with no evidence of regulatory registration. Similarly, there was a huge variation in contraindications, with more than half of the herbal remedies (61.1%) indicating contraindications, while 38.9% did not. Moreover, for dosage, a significant number (77.8%) of the herbal remedies were measured via teaspoonfuls, while the cup (ml) was 22.2% (Table 1).

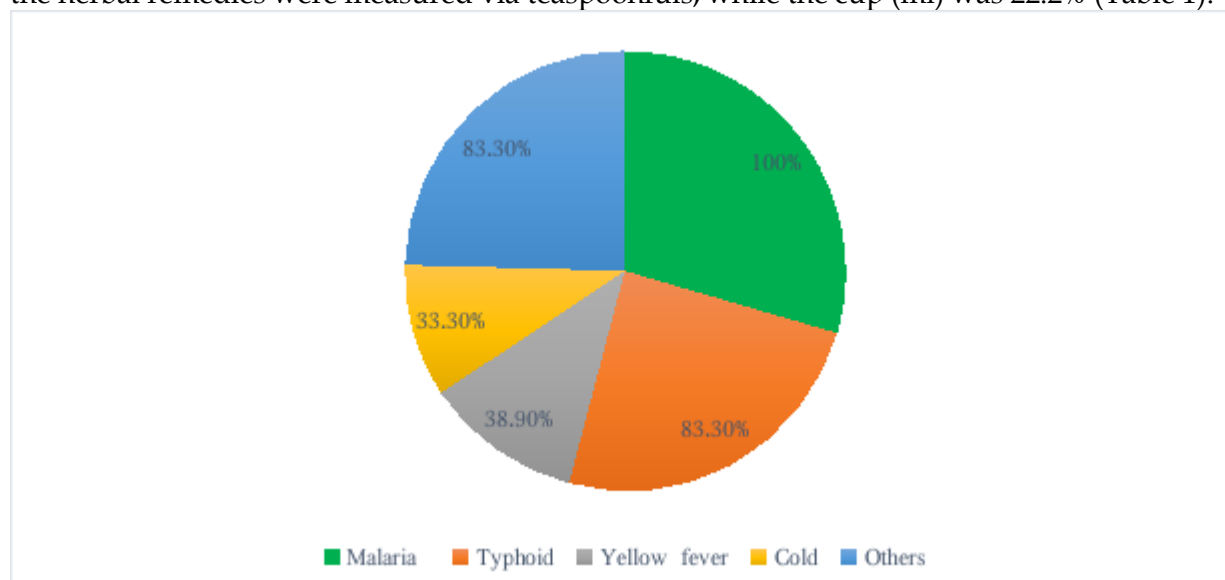


Figure 2: Indications for which anti-malarial herbal medicinal remedies were recommended

Figure 2 illustrates the number of illnesses for which antimalarial remedies were recommended, with malaria indicated in all (100%) herbal remedies. Other indications

included typhoid (83.3%), yellow fever (38.9%), cold (33.3%), and other sundry illnesses (83.3%).

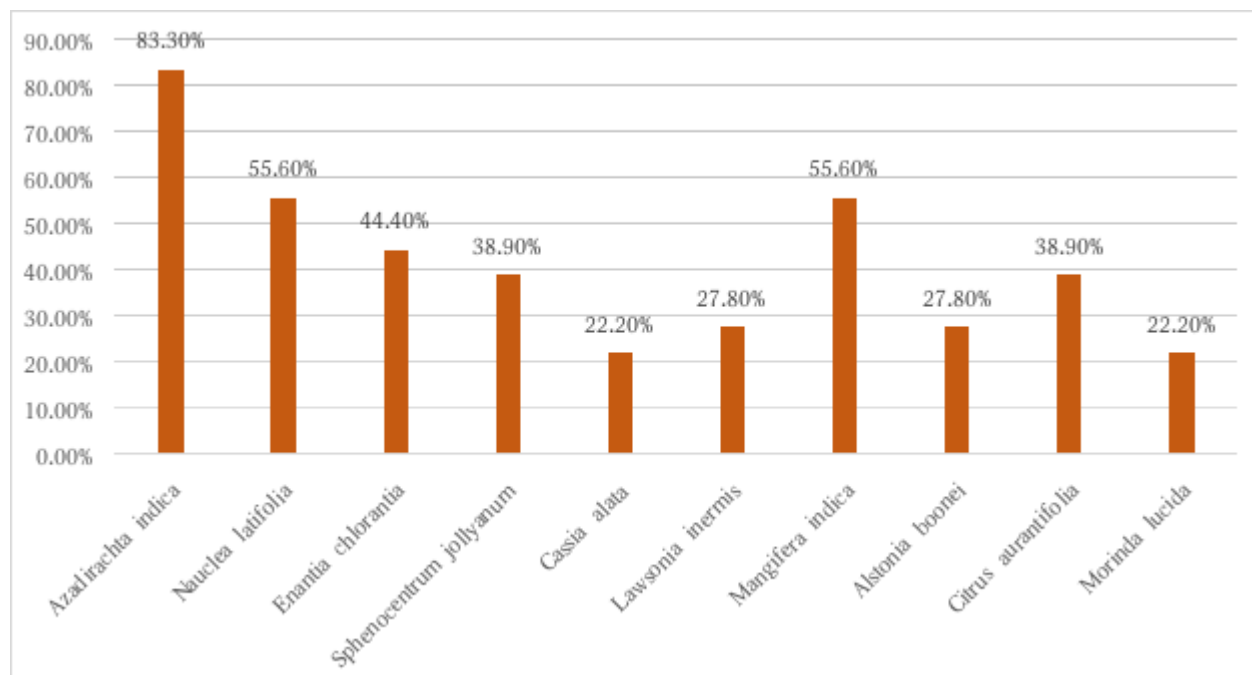


Figure 3: Distribution of Active Components of Antimalarial Herbal Remedies

Analysis of data on the composition of the various active components of the antimalarial herbal products (Figure 3) indicated that most of the products contained *Azadirachta indica* (83.3%), followed by *Nauclea latifolia* and *Mangifera indica* (55.6%), *Enantia chlorantia* (44.4%), and *Sphenocentrum jollyanum* and *Citrus aurantifolia* (38.9% each).

## DISCUSSION

The findings of the study demonstrated that although all the herbal products (100%) were primarily indicated for the treatment of malaria, antimalarial remedies were simultaneously indicated for the management of various other ailments such as typhoid (83.3%), yellow fever (38.9%), and cold (33.3%) (Figure 2), of which 72.2% had NAFDAC registration numbers, suggesting some degree of regulatory compliance. However, all antimalarial herbal products clearly indicate that “these claims have not been evaluated by NAFDAC,” suggesting lack of adequate prove of safety or effectiveness. The findings observed in this study mirror those of previous studies that examined the use of herbal cures for the simultaneous management of many ailments (Abt et al., 1995; Idu et al., 2010; Oreagba et al., 2011; Boadu & Asase, 2017). This may be prompted by enhanced patronage, as studies have shown cultural belief in the frequency of herbal remedies to cure many ailments as one of many reasons for their high preference (Fakeye et al., 2009). Another possible explanation is that some herbal plants have multipurpose medicinal properties, resulting in multiple indications for their herbal preparations. For instance, evidence has suggested that some of the recurring plant species in this study have been reported to exhibit multipurpose therapeutic actions: *Azadirachta indica* (Falconer, 1994), *Enantia chlorantia* (Tene et al., 2016), and *Mangifera indica* (Kalita, 2014). Nevertheless, it is worth noting that the supposed efficacy of these products in the management of these other indications has not been proven and therefore requires further investigation.

It is therefore obvious why most of these herbal preparations are multi-indicated, as further analysis revealed that all the antimalarial herbal preparations contain more than one plant species as their active component, with 66.7% comprising between 1 and 5 plant species as the active ingredients, while 16.7% contain between 5 and 10 and more than 10 active ingredients, respectively (Table 1). This result is consistent with that of Bekoe et al. (2017). Of these, *Azadirachta indica* (83.3%) was the most common active component of the surveyed herbal preparations. The others were *Nauclea latifolia* (55.6%), *Enantia chlorantia* (44.4%), *Sphenocentrum jollyanum*, and *Citrus aurantifolia* (38.9%) (Figure 3). This finding agrees with that of Bekoe et al. (2017), who demonstrated the aforementioned as the most recurring plant active constituents of herbal medicines in Ghana. It seems possible that this may be because most herbal preparations were developed for multiple indications. For example, one study reported that most Ghanaian herbal users believe that herbal medicine can address many ailments, which subsequently influences the high composition of plant species in the product (Bekoe et al., 2017).

Moreover, regarding dosage, findings indicated that a sizable proportion (77.8%) of the herbal remedies were measured using a teaspoonful, while only 22.2% were measured using a measuring cup (ml) (Table 1). These results are in agreement with those of Bekoe et al. (2017). This, to an extent, addresses one of many drawbacks of local herbal mixtures, which is the lack of appropriate measurement of the dose, causing incorrect measurement and consequently an inaccurate dose, which could either result in poor efficacy or harm due to overdose. Regrettably, none of these products had any measuring tools (either teaspoons or measuring cups) in the package, which may give room for mismeasurements from the use of the wrong measuring tools. As such, the inclusion of a calibrated measuring spoon or cup (ml) enhances adequate dosage and hence the efficacy and safety of the remedies.

Similarly, the study also suggested considerable variation in contraindications, with more than half of the herbal remedies (61.1%) being contraindicated in pregnancy, nursing mothers, ulcer patients, and children below five years of age. This diminishes the potentially harmful effects associated with herbal remedies when used with other medications or among vulnerable populations, as indicated in this study. The present findings seem to be in agreement with other studies that found that all the anti-typhoid herbal products in Ga East Municipality, Ghana, were contraindicated in pregnancy, nursing mothers, and children below the age of either 6 or 12 years (Bekoe et al., 2017). This is helpful in avoiding counterreactions and harm to the aforementioned group of herbal users because herbal therapy, like many regularly prescribed orthodox therapies, has been reported to pose health risks to fetuses, pregnant and nursing mothers, infants, and older children (Drew, 1997), and according to Abt et al. (1995), the absence of clearly labelled safety precautions for herbal products is a major concern relating to their use. Hence, the inclusion of contraindications to herbal products has proven very useful, as many studies have shown high utilization of herbal medicine by pregnant women (Fakeye et al., 2009) and others (Astin, 1998), on the premise that herbal cures are natural means of being safe, whereas several studies have linked acute renal failure (Abt et al., 1995) and hepatic failure (Oshikoya et al., 2007) to herbal medicine usage.

By examining the possibility of using antimalarial herbal products as an alternative or supplemental treatment for malaria, this study expands the range of pharmacological choices available for treating malaria and offers crucial insight into the prevalence of antimalarial herbal medicines. Thus, the present study provides practical evidence that can be used to develop active interventions aimed at encouraging the active integration of herbal therapy

into orthodox medical practice. The findings from this study may also be helpful to policymakers in developing evidence-based policies for the standardization and regulation of herbal remedies in the fight against malaria and other endemic conditions. However, it is noteworthy that the present study was based on a survey of the prevalence of herbal therapy in the fight against malaria endemicity, considering documented evidence in treating malaria. However, further studies focusing on the toxicity and pharmacological activities of the various active components are needed to ascertain the efficacy and safety of these herbal cures in the management of malaria and other endemic conditions.

## CONCLUSION

Thus, the current study investigates the availability of antimalarial herbal medicinal products on the Nigerian market in the fight against malaria endemicity. The results suggested that although all the herbal products (N18; 100%) were primarily indicated for the management of malaria, the antimalarial products were simultaneously indicated for the treatment of other ailments, such as typhoid (83.3%), yellow fever (38.9%), and cold (33.3%), of which 72.2% were registered with regulatory agencies. This is because all herbal preparations contain more than one plant species as their active component, of which *Azadirachta indica* (83.3%), *Nauclea latifolia* (55.6%), and *Enantia chlorantia* (44.4%) were the most common active components, which may be responsible for the multiple indications. These research conclusions can guide the establishment of evidence-based policies that integrate herbal medicines with conventional medical procedures to improve public health interventions against malaria endemicity.

## COMPETING INTEREST

The authors disclose no conflicts of interest.

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