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### Effectiveness of some medicinal plant decoction in the treatment of malaria in Nigeria

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#### Abstract

*The increase in the incidence of resistant forms of malaria parasites has led to a gradual loss of faith in modern drugs and confidence in the use of herbs in the treatment of malaria has been on the increase in Nigeria. Locally prepared decoctions from medicinal plants had been used for the treatment of malaria for centuries, but emphasis shifted from them when chloroquine, sulphonamides and the third generation line of treatment, artemisinin combination therapy were introduced. Recent evidence suggests confidence in the once abandoned herbs for the treatment of malaria including the resistant forms of malaria parasites. Medicinal plant parts obtained from *Psidium guava*, *Azadirachta indica*, *Carica papaya*, *Magnifera indica*, *Tilia europoea*, *Anacardium occidentale* and *Cymbopogan citrates* in a given proportion were boiled for three hours and about 300ml of the decoction taken 3 times daily for 4 to 7 days. Evidence from herbalists, herb sellers, individuals who have taken the drug and medical laboratory scientists suggest that the drug is very effective in the treatment of chloroquine resistant malaria.*

**Key words:** Malaria, Medicinal plants, Decoction

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#### INTRODUCTION

Malaria is a disease caused by parasites of the genus *Plasmodium*, which are transmitted to humans through the bites of female mosquitoes belonging to the genus *Anopheles* [1]. The symptoms of malaria are fever, headache, chills, shivering, loss of appetite, vomiting, general body weakness and joint pains [2]. Confirmation is by laboratory examination of blood for the presence of the parasites. Malaria has remained one of the five major life-threatening childhood conditions, resulting in an annual death toll of more than one million African children [3]. It is the commonest reason for hospitalization among children and it is a leading contributor to the

widespread problem of anaemia [4]. Effective management of malaria requires that the consumers and care-givers, seek, obtain, and use drugs appropriately [5]. This should be linked to timely decision, accessibility, correct use of the drugs and follow-up after prescription. Malaria in children under five years of age requires mothers to recognize early the symptoms of malaria, particularly fever. This recognition in addition to classification by caregivers is a key to intervention [6]. Despite the efforts exerted to provide effective anti-malarial drugs, some communities still suffer from getting access to these services due to many barriers [7]. Cost consideration, absence of side effects such as itches that occur in chloroquine and ineffectiveness of chloroquine [8] and some other anti-malaria drugs have led to widespread use of herbs for the treatment of malaria [9]. Varied combinations of these herbs in combination with different types of fruits and other substances have been used for the treatment of malaria, the main ones of which are *Azadirachta indica* and pineapple [9]. Anti-malarial medicine was extracted from the leaves of *Hydrangea macrophylla*, a common Japanese flower and was used to inhibit the growth of *Plasmodium falciparum* in mice [10]. The Peruvian *Cinchona* tree was one of the inherited anti-fever herbs that led modern science to the discovery of natural quinine as well as several synthetic quinolines, particularly chloroquine [11]. Malaria remains undefeated despite the inexhaustible list of inherited traditional anti-malarial herbs, purportedly used for hundreds of years by our ancestors. The majority of the rural populations are still using the herbs today [11]. The role of traditional healers in the management of severe malaria among children below five years of age has been positively discussed [2]. The aim of this work was to investigate the effectiveness of combination of seven herbs; *Azadirachta indica* (neem), *Psidium guava* (guava), *Carica papaya* (pawpaw), *Magnifera indica* (mango), *Tilia europaea* (lime), *Anacardium occidentale* (cashew) and *Cymbopogon citrates* (lemon grass) obtained from Delta State Nigeria for the treatment of malaria.

## MATERIALS AND METHODS

### Study area

Delta State is an oil producing state in Nigeria comprising mainly Igbo, Urhobo, Isoko, Ijaw and Itsekiri peoples. It is situated in the Niger Delta, South-South Geo-political zone of Nigeria with a population of 4,098,291 consisting of 2,674,306 males and 2,024,085 females as at 2007. It has a total land area of 16,842 sq. km, with approximately 122 kilometres of coastline bounded by the Bight of Benin on the Atlantic Ocean.



Map of Nigeria showing Delta State in black colour

### Ethnobotanical survey

The following techniques were used to obtain information about the species of plants used by the people to treat malaria and to determine the efficacy of the local antimalaria drug

1. Interviews with herbalists; ten herbalists, aged between 50 and 75 years in the different geographical areas of Delta state gave information about the use of herbs for the treatment of malaria. They also identified the plants as being the herbs they use for the treatment of malaria. They gave information about the mode of preparation of the drug and confirmed that they have used it for the treatment of malaria for more than 30 years and in some cases where the conventional drugs failed.
2. Interviews with herb sellers; 25 persons, 5 from each of the geographical areas were interviewed. Some of them were young girls, while others were middle aged and old persons. They prepared the dry herbs and wrapped them in small nylon bags for sale. The herb sellers corroborated the statements of the herbalists. Majority of the herb sellers inherited the trade from their parents who had been in the business for over 40 years.
3. Field interviews; 50 persons were interviewed using a questionnaire. They were able to identify the plants used for the treatment of malaria, but many of them could not mention the botanical names of the plants. All of them however confirmed that they have taken the herbs sometime ago when they had malaria especially the chloroquine resistant types of malaria. 10 of them had laboratory tests done to confirm the disease when treatment with chloroquine failed.
4. Interviews with Medical Laboratory Scientists; medical laboratory scientists in 5 medical laboratories volunteered to report on herbal treatment based on complaints received from the patients. Several patients on self medication who could not treat malaria with chloroquine and the sulphonamides had to treat themselves with local antimalarial herbs. Some of them could not say precisely the constituents of the herbs, but they said they bought them from the local market, while others said they all contained the following plants; *Azadirachta indica* (neem), *Psidium guava* (guava), *Carica papaya* (pawpaw), *Magnifera indica* (mango), *Tilia europoea* (lime), *Anacardium occidentale* (cashew) and *Cymbopogon citrates* (lemon grass) and that they could prepare the drug themselves by going to the bush to cut the plants used for the preparation of the drug.

### Identification of the plants

The plants used for the treatment of malaria were obtained from local herbalists and herb sellers in Delta State. Large quantities of them were subsequently collected from the bush and identified at the Department of Botany, Delta State University Abraka, Nigeria. The plants are readily available in Nigeria.

### Description of the plants

#### *Carica papaya* (Pawpaw)

*Carica papaya* is a large tree-like plant, with a single stem with spirally arranged leaves confined to the top of the trunk. It may grow up to 5 to 10 metres high. The lower trunk is conspicuously scarred where leaves and fruits were borne. The leaves are large, 50–70 centimetres diameter, deeply palmately with 7 lobes. The tree is usually unbranched.

#### *Anacardium occidentale* (Cashew)

*Anacardium occidentale* grows up to 10-12m, with a short, often irregularly shaped trunk. The leaves are spirally arranged, leathery textured, elliptic to obovate, 4 to 22 cm long and 2 to 15 cm broad, with a smooth margin. The flowers are produced in a panicle or corymb up to 26 cm long,

each flower small, pale green at first then turning reddish, with five slender, acute petals 7 to 15 mm long. The fruit is oval or pear shaped.

*Mangifera indica* (Mango)

The tree grows 35–40 m tall, with a crown radius of about 10 m. The leaves are alternate, simple, 15–35 cm long and 6–16 cm broad; when the leaves are young they are orange-pink, rapidly changing to a dark glossy red, then dark green as they mature. The flowers are produced in terminal panicles 10–40 cm long; each flower is small and white with five petals 5–10 mm long. The fruit is variable in size and color.

*Tilia europaea* (Common Lime)

*Tilia europaea* is a large deciduous tree up to 20–46 m tall with a trunk up to 2 m diameter. The leaves are 6–15 cm long and 6–12 cm broad, thinly hairy below with tufts of denser hairs in the leaf vein axils. The flowers are produced in clusters of four to ten. The fruit is a dry nut-like drupe 8 mm diameter, downy and faintly ribbed.

*Psidium guajava* (Guava)

The tree is about 33 feet high, with spreading branches and smooth, thin, copper-colored bark that flakes off, showing the greenish layer beneath. The trunk may attain a diameter of 10 inches. Young twigs are quadrangular and downy. The leaves, aromatic when crushed, are evergreen, opposite, short-petioled, oval or oblong-elliptic, somewhat irregular in outline with conspicuous parallel veins, and more or less downy on the underside. The fruit may be round, ovoid, or pear-shaped, 2 to 4 inches long, with 4 or 5 protruding floral remnants (sepals) at the apex; and thin, light-yellow skin, frequently blushed with pink.

*Azadirachta indica* (Neem)

*Azadirachta indica* is a tree in the mahogany family Meliaceae and can reach a height of 15-20 m. The branches are wide spread. The crown is roundish or oval and may reach the diameter of 15-20 m. The alternate, pinnate leaves are 20-40 cm long, with 20 to 31 medium to dark green leaflets about 3-8 cm long. The terminal leaflet is often missing. The petioles are short. Very young leaves are reddish to purplish in colour. The shape of mature leaflets is more or less asymmetric and their margins are dentate with the exception of the base of their basiscopal half, which is normally very strongly reduced and cuneate or wedge-shaped. The flowers are arranged axillary, normally in more-or-less drooping panicles.

*Cymbopogon citrates* (Lemon grass)

Lemon grass is a sweet scented perennial grass which rarely flowers. The narrow, ribbon-like, leafy stalks grow in clumps that reach 3 feet or more in height. The leaves swell slightly at the base to form a fleshy stolon or underground stem. The edges of mature leaves are rough and sharp.

**Plate 1. Photographs of the plants used for the treatment of malaria**



C. papaya

M. indica

T. europaea

P. guajava

A. indica

C. citrates

A. occidentale

### Preparation of the decoction

The plants were washed in water, dried, cut into small pieces, not more than 3cm in length and weighed (Table 1). They were put in a wide mouth container and about 7000ml of tap water added to them according to the prescription given by the herb sellers. These were boiled for 3 hours. Maintenance of the herbs was achieved by boiling the herbs twice daily for 10 - 30 minutes each. About 500ml tap water was added to the mixture daily.

### Dosage/Administration

About 300ml of the decoction was taken orally, 3 times daily for 4 to 7 days. It may be taken warm or hot.

**Table 1 Weights of plants immersed in 7000ml tap water**

Plant	Weight (Kg)
<i>Carica papaya</i>	1.05 ± 0.30
<i>Azadirachta indica</i>	1.15 ± 0.35
<i>Anacardium occidentale</i>	0.65 ± 0.15
<i>Tilia europaea</i>	0.45 ± 0.11
<i>Cymbopogon citrates</i>	0.65 ± 0.15
<i>Magnifera indica</i>	1.15 ± 0.35
<i>Psidium guava</i>	0.90 ± 0.21

### Symptoms of malaria

The symptoms of malaria are fever, headache, chills, shivering, loss of appetite, vomiting, general body weakness and joint pains. All the symptoms may not present in a single patient and if they do, the severity varies from one patient to the other.

**Table 2: Percentage of symptoms of malaria**

Fever	100%
Headache	100%
General body weakness	95%
Shivering	70%
Joint pains	65%
Loss of appetite	90%
Chills	70%
Vomiting	10% in adults, 50% in children

## RESULTS

Effectiveness of the herbs; the herbalists, herb sellers and individuals interviewed were unanimous that the herbs could be used for effective treatment of malaria. This was corroborated by the medical laboratory scientists based on verbal discussion with individuals who had laboratory tests done for malaria parasites before taken the decoction.

**Table 3 Effectiveness of the herbs**

Knowledge of the herbs	100%
Effectiveness in the treatment of malaria	90%
Effectiveness in the treatment of chloroquine resistant malaria	100%
Effectiveness in the treatment of other drug resistant malaria	95%
First line of treatment	30%
Second line of treatment	30%
Undecided choice in line of treatment	40%

*Dosage*; About 300ml of the decoction taken 3 times a day for 4 to 7 days will effectively cure malaria.

*Side effects*; side effects were not observed by all the persons interviewed. There were no incidences of itching, dizziness, dermatological conditions, vomiting, blurred vision or swelling in any part of the body.

### DISCUSSION

Persistence of malaria symptoms after treatment with modern antimalarial drugs has resulted in loss of faith in such drugs [12] and has led to increased tendency towards the use of herbs in the treatment of malaria in Nigeria. The use of herbs for the treatment of malaria is a folk medical procedure in Nigeria. Several researchers have reported the effectiveness of herbs for the treatment of malaria but the herbs used and the quantity vary from one region to another. A combination of *Azadirachta indica* and pineapple for the treatment of malaria has been described [9], while the leaves of *Hydrangea macrophylla* have been used for the treatment of malaria [10]. The use of herbs for the treatment of malaria had previously been confirmed and that majority of the rural populations are still using the herbs today [11]. He believed very strongly, that if the herbs never worked for our predecessors, malaria would have devastated Africa and the Missionaries would not have met a single person on the continent of Africa when they came. Measures to avoid mosquito bites such as use of insect repellent, wearing long sleeves and long pants, staying indoors and use of flying insect sprays or mosquito coils to clear rooms of mosquitoes and sleeping under bed-nets have been advised, but it has been very difficult to obtain absolute compliance with these measures. For this reason, malaria is still a major killer, particularly of children. Although the locals did not experience any side effect during the use of the herbs, this could not be scientifically proven in vivo because certain intakes can have a cumulative effect on the organs of the body and a gradual build up of such toxic substances can be life threatening. Therefore, this work will be followed by a chronic study using animal models for chronic toxicity studies. The effects of the herbs on pregnancy and neonates have also not been studied and could not be confirmed although some herbalists and herb sellers claimed the herbs could be used by pregnant women for the treatment of malaria. The antimalarial plants studied in this work had previously been described as useful medicinal plants for several disease conditions, when used alone or in combination with other plants. *Carica papaya* has been used for the treatment of various skin disorders and wounds, particularly burns [13] and as an antibiotic in the treatment of chronic skin ulcers [14] and for gastroenteritis, urethritis, otitis media [15]. *Mangifera indica* has been used as an antioxidant, antitumor, anti-allergic, anti-inflammatory, antidiabetic, antihypertensive, antihyperlipidemic, antitumor, antiviral, antifungal, antibacterial and

antiparasitic agent [16]. *Tilia europea* possesses depressant activity on the CNS and reinforces its use as a sedative in traditional medicine [17]. *Tilia europea* has been used to soothe nerves and to treat conditions associated with stress, including anxiety, insomnia, hysteria, colds, nasal congestion, throat irritation, headaches, sinus headache, migraine headache, palpitations, hypertension, incontinence, hepatitis, colitis, rheumatism, hemorrhage, abscesses (*ulcus cruris*), as well as a diuretic and antispasmodic agent [18,19]. Guava leaves have been used for the treatment of gastrointestinal disturbances such as vomiting, diarrhea, inhibition of the peristaltic reflex, gastroenteritis, spasmolytic activity, dysentery, abdominal distention, flatulence and gastric pain.<sup>17,20,21</sup> The leaves also have anti-microbial activity [22,23] and anti diabetic properties [24]. *Azadirachta indica* has antipyretic [25,26], antimalarial [27,28], antitumour [29], antiulcer [30], antidiabetic [31], antifertility [32], antimicrobial [33] and antifungal [34] properties. The leaves of *Anacardium occidentale* have antibacterial and antifungal properties [35], while the bark has been used for the treatment of snake bites from *Vipera russelii* [36]. Extracts of the fruits of *Carica papaya* are used for a variety of medicinal purposes ranging from treatment of ringworm, malaria to hypertension [37], while extracts of the unripe fruit have been used in treatment of diabetes [38,39]. The effectiveness of the herbs in the treatment of malaria is probably by synergy. Malaria is a common ailment in Nigeria and most sick persons do not go to the clinic because they can apply self-medication and advices are freely offered for every new method thought to be effective against malaria. Therefore, the use of these herbs for the treatment of malaria should be encouraged, but the practice should be standardized.

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