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Traditional and Herbal Malaria Treatment in Africa: An Ethnobotanical Analysis

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Abstract
Most people in developing countries rely on traditional medicines, but their use varies by location. The current investigation set out to learn more about previously used herbal remedies for malaria. Different parts of the plant, their common names and morphology, the methods used to prepare and administer them, the dosage, and the duration of treatment were all documented. A survey of traditional healers' usage of herbal remedies for malaria has been conducted for ethnopharmacological research. It has been determined that traditional healers use antimalarial medicines derived from either a single plant preparation or a mixture of plant preparations. Recent findings from various studies on the ethnobotanical methods used, the plants used, the extraction procedure, and the necessary precautions when taking herbal medicines are compiled in the present paper.

1. Introduction

Malaria is a significant public health issue that affects more than 200 million people worldwide. It claims the lives of more than 400,000 people each year, the vast majority of whom are young children living in various nations. *Plasmodium malaria*, *Plasmodium falciparum*, *Plasmodium Knowles*, *Plasmodium vivax*, and *Plasmodium Ovalle* are responsible for malaria. *Plasmodium falciparum* malaria is the most dangerous form of the disease and is responsible for the large majority of deaths caused by malaria worldwide. Plasmodium is most commonly spread by the four species of the Anopheles mosquito: *Anopheles gambiae*, *Anopheles funestus*, *Anopheles arabinoses*, and *Anopheles mouchette*. These are recognised as transmission-causing all year round. Due to its widespread distribution throughout the tropics and subtropics, malaria poses a significant threat to health.

Humans have utilised medicinal herbs since ancient times to maintain health and stave off disease. Malaria is only one of many illnesses successfully combatted through this time-honored practice. This understanding of how to employ medicinal plants to treat illnesses has helped shape contemporary pharmacology and created numerous carpets with botanical roots. Organic chemicals obtained from plants have been acknowledged for a long time as one of the most trustworthy and promising sources of novel structural components that can be used in treating diseases [1–3]. The World Health Organization (WHO) reports that there were a total of 212 million cases of malaria around the globe in the year 2015, with an estimated 429 thousand

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fatalities as a result of the disease. In 2015, ninety percent of malaria cases and ninety-two percent of all deaths from the disease were recorded in Sub-Saharan Africa. The WHO revealed in 2018 that statistics for the years 2015–2017 showed no appreciable improvement in the reduction of malaria cases globally during this time. One of the finest places to look for a plant chemical that may be utilised as a model or a starting point for creating antimalarials is ethnopharmacology. The practice of traditional medicine still has a significant influence on health care. Roughly eighty percent of the world's population continues to satisfy their fundamental medical requirements with products derived from plants that are used in traditional medicine [4,5]. Since the beginning, people have looked to nature for the basic essentials they require, particularly medicines. In 1985, the World Health Organization estimated that sixty-five percent of the world's population utilised medicinal substances that were derived from plants. In some cases, the treatment of many ailments can be accomplished with the use of a single herb. Despite the fact that there are around 300,000 different species of terrestrial flora, only about 6% of higher plants and about 15% of the phytochemical elements of plants have been the subject of research into their potential pharmaceutical effects. Because of this, natural products play an important part in the process of developing bioactive compounds as well as pharmacological treatments.

2. Ethnobotanical Practices

Most antimalarial medications now in use have their roots in natural ingredients. In the past, compounds from natural medicines, such as quinine, artemisinin, and many others, were refined. Natural antimalarial compounds are abundant in the environment thanks to plant chemicals' wide range of valences. The benefits of adopting plant-based medications include safety, efficacy, cultural preferences, affordability, and ease of supply. Despite the numerous obstacles faced while trying to find drugs from natural sources, particularly medicinal plants, it is possible to forecast that natural compounds separated from such sources will play a crucial role in the quest for novel medications. The active ingredient of *Artemisia annua*, artemisinin, was used by Chinese herbalists to treat fever. Out of the many plant parts utilised for the preparation of herbal recipes, leaves were the most often used plant component [5,6]. The decoction is the way of making herbal recipes that is most frequently used. It's also possible to use aqueous alcohol for infusions and extractions, albeit this method is far less common. The three solvents most frequently used in herbal remedies are water, fermented maize aqueous extract, and palm wine. Water is by far the most prevalent. Although the plants used to treat malaria and discovered in this study had different growth patterns, trees were the most common. *Ananas comosus*, *Anacardium occidentale*, *Azadirachta indica*, *Camellia sinensis*, *Carica papaya*, *Citrus aurantifolia*, *Cymbopogon citratus*, *Enanatia chlorantha*, *Mangifera indica*, and *Vernonia amygdalina* were the ten most commonly mentioned species.

Several ethnobotanical studies have noticed that traditional medicinal plants are not selected randomly; rather, certain plant families are consistently used. The medicinal flora of a given region is typically dominated by a small number of the local plant families, as determined by various statistical methodologies. Similarly, ethnobotanists have quantified the extent to which these preferences are shared across cultures to conclude the selection of species for medicinal purposes and the relative weights of knowledge transfer versus independent factors, shared selection criteria, and other considerations like the discovery of efficiency in affecting species selection [7,8]. Polar and apolar solvents extract different anti-plasmodial components from the plant. These extracts, however, are cytotoxic. The same ingredients or other elements may be responsible for the antiplasmodial action and the cytotoxic impact. In the latter scenario, more active and less harmful compounds can be isolated using a bio-supervised extraction. Pentane extract from *Abrus precatorius* also demonstrated an IC50 value of less than 20 g/ml. The aerial portions of *Abrus precatorius* contain isoflavanquinone, which has antimalarial and antitubercular properties. This plant is utilised as a folk remedy in China for various inflammatory disorders. The pentane extract may have been enhanced with these chemicals, and their existence might account for its action [9].

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2.1Herbal Medicine Preparation Technique

The most frequent preparation technique is decoction. In 340 A.D., a leaf decoction from a plant was discovered to be efficient and used as an antipyretic. Occasional chills, a defining feature of malaria, are primarily brought on by the parasite's synchronised asexual growth and erythrocyte rupture [10-12]. This is likely due to the method's ease of usage, as no other ingredients are required beyond the herbs and water. Furthermore, as trees made up most of the plants encountered, the portions may be rather resilient and require boiling to release the active substance. Decoction also enhances the herb's scent, making it more tolerable. Because the concentrations of two compounds found in *Aloe vera*, aloin and aloe emodin, were substantially lower than that of the crude extract, the anti-plasmodial activity of the crude extract may have been generated by the synergistic influence of many components as opposed to a single active ingredient. This is because the concentrations of both of these compounds were substantially lower than that of the crude extract [13-15]. A large number of other components in an extract of a plant can sometimes result in a low concentration of the bioactive component of the plant. This can hide the extract's true potential as an antimalarial medication until the chemical that causes the bioactivity of the plant can be isolated. Because of this, it is necessary to separate the bioactive components present in medicinal plants. Even though they are regularly used in a mixture for traditional consumption, several plants have shown anti-plasmodial activity in vitro or in vivo against *Plasmodium berghei*. This is although they are frequently consumed in traditional consumption. Water was the most common medium for extraction, and maceration at a low temperature was the most common preparation method. Because the extraction procedure takes a long time and the patient is already experiencing disease symptoms, it is conceivable that the remedies will only contain small quantities of the active component. This is because the extraction process takes a long time [16,17].

Except for *Momordica foetida*, *Momordica balsamina*, and *Capsicum annuum*, most plant components used to cure malaria are maintained as dry powders in sealed vials. This is not the case with these three plants. The most important part of the therapeutic component is the water extract that's created by dissolving the granules in either warm or cold water. Because the fruit of the *Capsicum annuum* plant is so intensely astringent, it is best to consume it in its entirety without chewing [18,19]. Momordica balsamina and Momordica foetida, which are preventive vegetables, are made from plant material that has been freshly gathered and ingested with meals. There are a few different treatments that use different combinations of plants to treat the condition. In a few cases, many healers utilise a wide variety of plant constituents to treat their patients. When adding the powder, one whole, one half, and one quarter of a teaspoon or a tablespoon was to be put at a time.

2.2Preventive measures for consumption

To create safe and effective standardised herbal remedies, the toxicity and efficacy of conventional drugs should be rigorously confirmed. This is a difficult undertaking because of the complicated chemical makeup of herbal extracts, the lack of knowledge on whether or not ingested chemical compounds are converted to active pharmaceuticals and the possibility that many chemical compounds work synergistically. A lack of information on the toxicity and active components likely is to blame for the poor acceptance and adoption [20,21]. Because of the availability of (i) increasingly densely sampled phylogenetic trees depicting our rapidly expanding understanding of the evolutionary history of plants and (ii) a suite of tools and phylodiversity metrics, taxon-based approaches to examining the distribution of medicinal species within the context of an area's flora are rapidly being replaced. This is because (i) medicinal species are increasingly important to human health and (ii) our knowledge of the evolutionary history of plants. To put it another way, using these trees and methods, one may examine how widely distributed a particular trait is over the entire tree of life, not just among the few branches that have been formally recognised and assigned family names by taxonomists [7,22,23].

The plant components that traditional healers employed the most were leaves. The survival of individual plants is not much threatened by routine leaf harvesting. This promotes the regular and secure use of leaves in herbal remedies. Roots and barks of

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plants, however, are typically employed by traditional healers as a second and third plant component, respectively. The existence of a plant species may be at danger if roots or bark are often used in herbal remedies. The continued availability of these medicinal plant resources depends on carefully implementing harvesting methods and conservation measures [24–26]. The half-life (IC50) values for *Vernonia colorata* aqueous extracts were all lower than 15 g/ml. IC50 values for ethanol extracts ranged from 10 to 20 g/ml, whereas those for aqueous extracts were 80 to 100 g/ml, indicating that the former were more potent [9,27]. These inconsistent findings might most likely be attributed to the plant's time of year or crop season, which may impact the fluctuation in chemical concentrations. It is demonstrated that *Vernonia colorata* has antiplasmodial capabilities, however they need to be thoroughly investigated. The vismione IC50 value was determined to be 0.088 g/ml after being isolated from *Vismia guineensis*. The findings support this theory, showing that a *Vismia guineensis* crude extract significantly suppresses plasmodium growth, pointing to the parasite as the cause of malaria. It is imperative to conduct biological and toxicological investigations on the plants, especially those identified as not having been screened, to ensure the safety of the people in the study region using medicines derived from these plants. Public health professionals and policymakers need to have information about the effectiveness and safety of locally consumed plants to make informed decisions and provide guidance to the populations in the research area about the safety of the plants they use. It is essential to encourage communities to conserve medicinal plants like *Khaya senegalensis* to continue being used sustainably. This will prevent the overexploitation of plants in the grove's protected areas [10,28].

3. Conclusion & Future Scope

Traditional medical wisdom and the use of treatments derived from plants continue to play a significant role in the prevention and treatment of malaria. *Aristolochia albida*, *Toddalia Asiatica*, and *Cassia Abbreviata* were the next most often mentioned plants. These plants are also referred to as species of medicinal herbs in literature. Surprisingly, there wasn't much overlap in how the same species was used in the same town. Results from other ethnobotanical studies may be crucial in supporting the conventional usage of herbal treatments and in pointing the way toward novel active principles. The Retrospective Treatment Outcome Study is an additional strategy for enhancing conventional treatments (RTO). Herbal medicine may become more widely used in countries with less expensive healthcare systems, like India's and China's, if comprehensive toxicological research, clinical investigations, and randomised controlled trials are done. Traditional uses of plants as medicines and the associated knowledge are being lost at an alarming rate, along with other biomes in many parts of the world. These losses are the result of both natural and man-made factors, while the exact nature of the dangers may vary from one location to another. It is generally agreed upon that medicinal plants and other medicines applied in traditional cultural systems have a pharmacological effect or other empirical bases to support their application.

On the other hand, it seems that symbolic notions with a bit of scientific background are the predominant concepts in plants in several instances. The level of ethnobotanical knowledge can be linked to the inherent potential for health care, and the state of the surrounding ecosystems' protection can affect plant availability, which in turn affects the preservation of regional traditional ecological knowledge. Both of these factors are connected to the inherent potential for health care. Furthermore, single herbs are recommended for the majority (52% of all herbal formulations published) of malaria treatment. It's important to highlight that past research in many sectors has also revealed a lot of mono-component recipes; in reality, the alleged benefits of mixing multiple herbs have never truly been examined. Since Plasmodium is becoming increasingly resistant to current antimalarial medications, additional research into polymedication in phytotherapy would be of interest.

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