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Ethnobotanical Survey of Medicinal Plants Used for the Treatment of Malaria in Kano Metropolis.

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ABSTRACT

The ancient disease malaria is still severely challenging people's health particularly in African countries. Each year, more than one million people around the globe die due to malaria and more than two billion people in over hundred countries and regions are threatened by the disease. A comprehensive survey was carried out in Kano metropolis in order to document plants used traditionally for the management of malaria. Open-ended informal interviews were administered to the respondents consisting majorly the traditional medical practitioners (TMPs) and herb sellers. Forty (40) species of plants belonging to twenty two (22) families were identified. Herbal remedies were either prepared from dried or freshly collected plants while traditional solvent of choice was water. Decoction and infusion were the main methods of preparation. The study revealed that leaves formed the major part of plants for herbal preparations, followed by stem bark, roots and whole plant. The study has documented different traditional practices used for the treatment of malaria in the study area. Further studies should be undertaken to validate the antimalaria activity of plant species that have not yet been studied and to determine their chemical constituents.

Keywords: Malaria, Kano metropolis, water, decoction, infusion and chemical constituents.

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INTRODUCTION

Malaria is one of the major tropical diseases responsible for significant mortality especially among children and pregnant women. According to the World Health Organization, half the world's population is at risk of malaria and one to two million annual deaths can be attributed to malaria [1- 3].

A variety of antimalaria drugs are available, but most of the drugs used today are becoming less effective because of the problem of drug resistance [1 and 4].

Plasmodium falciparum, the most severe form of malaria parasite species, is responsible for the vast majority of deaths associated with the disease. Key interventions to control malaria include; prompt and effective treatment with artemisinin based combination therapies, use of insecticidal nets by people at risk and indoor residual spraying with insecticide to control the vector mosquitoes [1 and 5].

There is a deep concern that the parasite will soon develop resistance to even the so called artemisinin combined therapy (ACTs). Hence, the search for new, effective and affordable antimalaria drugs based on new mechanisms of action or with new structures is urgently needed to overcome the problem of rapid emergence of drug resistance and achieve long term clinical efficacy. Therefore, there is an urgent need to explore and utilize the naturally endowed rich biodiversity of indigenous communities through research that could translate to benefits for mankind. Such investigations on medicinal plants could provide useful leads for the synthesis of important active compounds [1, 3 and 5].

Due to the crucial role that plant derived compounds have played in drug discovery and development for the treatment of several diseases, the isolation of new bioactive compounds from medicinal plants based on traditional use or ethnomedical data appears to be a very promising approach [6].

Ethnobotanical survey is an important step in the identification, selection and development of the therapeutic agents from medicinal plants [6 and 7].

In African countries, approximately 80 % of the population uses traditional medicine for the treatment of various diseases and ailments like malaria, typhoid, ulcers, skin diseases, diabetes, reproductive problems and pains for various socio cultural and economic reasons. Ethnobotanical surveys have shown that traditional medicines have been found to be effective especially in the treatment of malaria which is of great concern to any African nation [8].

The present work was aimed to analyze the traditional use of medicinal plants in the treatment of malaria in Kano metropolis, a city located in the Northern part of Nigeria.

MATERIALS AND METHODS

Study Area

Kano is the capital city of Kano State in the Sahelian geographic region south of the Sahara. It is the commercial nerve centre of Northern Nigeria and it is the third largest city in Nigeria after Lagos and Ibadan. According to the 2006 census, Kano is the most populous state in Nigeria, with about 9, 383, 682 million people. The Kano Metropolitan area covers 499 km² and comprises eight Local Government Areas (Kano Municipal, Fagge, Dala, Gwale, Tarauni, Nassarawa, Ungogo and Kumbotso) with a population of 2, 828, 861 at the 2006 Nigerian census [9].

Ethnobotanical Survey

The main data sources consisted of a series of informal interviews and general conversation administered on the traditional medical practitioners (TMPs) and herb sellers. The interviews were done in their native language (Hausa language), while the information gathered was sorted, the data collected included the local names of plants and parts of the plants used. The plants were later identified and authenticated at the Ethnobotany Unit of Bioresources Development Centre Kano, National Biotechnology Development Agency (NABDA).

Statistical Analysis

Descriptive statistics such as pie chart and percentages were used in the analysis of the data.

RESULTS

Respondent Identity

A total number of twenty four (24) respondents were interviewed, with 75 % within the age range of 41-50 years, 8.3 % within the age range of 51-60 years, while 16.7 % were above 60 years. Majority of the respondents are married, 29 % were herb sellers and 71 % were traditional medical practitioners (Table 1). Also, majority of the respondents were primary school leavers and most of them claimed that they inherited their ethnomedicinal knowledge from their parents. All the respondents were Hausa speaking people.

Table 1: Demographic Characteristics of the Respondents on the Knowledge of Plants Used in the Treatment of Malaria

Variables	Specification	Percentage (%)
Age	41-50	75
	51-60	8.3
	>60	16.7
Marital status	Married	92
	Single	8
Sex	Male	95.8
	Female	4.2
Educational status	Tertiary	25
	Secondary	4.2
	Primary	70.8
Practice	Traditional practitioners	70.8
	Herb sellers	29.2

Ethnobotanical Survey

A total number of forty (40) plant species belonging to twenty two (22) families were described as being used for the treatment of malaria which includes shrubs and trees. Fabaceae, Moraceae, Euphorbiaceae, Anarcadiaceae, Poaceae and Mimosaceae were the most frequently mentioned families. The plant parts mostly used were leaves, root bark, stem bark and fruits (Table 2).

Table 2: Enumeration of Plants Used for the Treatment of Malaria in Kano Metropolis

S/N	Plant Name	Family	Local Name	Common Name	Part Used
1	<i>Acacia nilotica</i>	Mimosaceae	Gabaruwa	Acacia	Roots, stem bark and leaves
2	<i>Acacia seyal</i>	Mimosaceae	Dimshe	Shittim wood	Stem bark, roots and seeds
3	<i>Alchornea cordifolia</i>	Euphorbiaceae	Baushe	Xmas tree	Leaves
4	<i>Anarcadium occidentale</i>	Anarcadiaceae	Kashu	Cashew	Stem bark, leaves
5	<i>Annona senegalensis</i>	Annonaceae	Gwandar Daji	African custard apple	Stem bark, roots and leaves
6	<i>Argemone mexicana</i>	Papaveraceae	Karanko	Mexican poppy	Leaves
7	<i>Azadirachta indica</i>	Meliaceae	Darbejiya	Neem	Leaves

8	<i>Balanites aegyptiaca</i>	Balanitiaceae	Aduwa	Desert date	Stem bark, seeds
9	<i>Borreria verticillata</i>	Rubiaceae	Fasa kumburi	African borreria	Roots
10	<i>Cajanus cajan</i>	Fabaceae	Waken suya	Pigeon pea	Leaves
11	<i>Cardiospermum halicacabum</i>	Spindaceae	Garafuni	Balloon vine	Whole plant
12	<i>Carica papaya</i>	Caricaceae	Gwanda	Pawpaw	Leaves

Table 2: Enumeration of Plants Used for the Treatment of Malaria in Kano Metropolis

S/N	Plant Name	Family	Local Name	Common Name	Part Used
13	<i>Cassia singueana</i>	Fabaceae	Runfu	Scrambled egg	Roots
14	<i>Ceiba pentadra</i>	Melvaceae	Rimi	Kapok	Stem bark and leaves
15	<i>Citrus medica</i>	Rutaceae	Lemon tsami	Citron	Leaves
16	<i>Citrus sinensis</i>	Rutaceae	Lemo	Sweet orange	Leaves and fruits
17	<i>Commiphora kerstingii</i>	Burseraceae	Arrarabi	African myrrh	Stem bark
18	<i>Cretiva adansonii</i>	Capparaceae	Bududu	Sacred garlic pear	Leaves
19	<i>Cymbopogon giganteus</i>	Poaceae	Zana	Lemon grass	Whole plant
20	<i>Delonix regia</i>	Fabaceae	Dorawar turawa	Flamboyant	Leaves
21	<i>Dichrostachys cinererea</i>	Fabaceae	Dundu	Sickle bush	Seeds and leaves
22	<i>Dodonaea viscosa</i>	Sapindaceae	Fir-fir	Hop bush	Leaves
23	<i>Echinochloa stagnina</i>	Poaceae	Buruku	Burgu millet	Whole plant
24	<i>Eucalyptus globulus</i>	Myrtaceae	Turare	Tasmania blue gum	Leaves
25	<i>Ficus glumosa</i>	Moraceae	Kawari	Mountain fig	Roots, stem bark and leaves
26	<i>Ficus platyphylla</i>	Moraceae	Gamji	Gutta percha	Stem bark
27	<i>Ficus polita</i>	Moraceae	Durumi	Heart-leaved fig	Leaves and stem bark

Table 2: Enumeration of Plants Used for the Treatment of Malaria in Kano Metropolis

S/N	Plant Name	Family	Local Name	Common Name	Part Used
28	<i>Ficus thoningii</i>	Moraceae	Chediya	Fig	Leaves and roots
29	<i>Ipomoea asarifolia</i>	Convolvulaceae	Dumar rafi	Morning glory	Whole plant
30	<i>Jatropha curcas</i>	Euphorbiaceae	Bini da zugu	Barbados nut	Leaves and stem bark
31	<i>Khaya senegalensis</i>	Meliaceae	Madaci	Mahogany	Stem bark
32	<i>Mangifera indica</i>	Anacardiaceae	Mangwaro	Mango	Leaves
33	<i>Moringa oleifera</i>	Moringaceae	Zogale	Moringa	Leaves and roots
34	<i>Nigella sativa</i>	Ranunculaceae	Bakin algarib	Black seed	Seed

35	<i>Parkia biglobosa</i>	Fabaceae	Dorawa	African locust bean	Leaves and stem bark
36	<i>Phyllanthus amarus</i>	Euphorbiaceae	Baaba	Gale of wind	Whole plant
37	<i>Piliostigma reticulatum</i>	Fabaceae	Kalga	Abafe	Stem bark and roots
38	<i>Psidium guajava</i>	Myrtaceae	Goba	Guava	Leaves and stem bark
39	<i>Quassia undulata</i>	Sumaroubaceae	Takardar giwa	Quassia	Leaves
40	<i>Sclerocarya birrea</i>	Anacardiaceae	Danta	Marula	Stem bark

Characteristic of Recipes Used

It was observed that recipes were made from combination of different parts from more than one plant species including fruits and leaves mostly (Table 3), while some were made from single plant part. The most preferred mode of administration was oral, while decoction and infusion were the most preferred methods of preparation. The leaves are the most used plant parts in the treatment of malaria in Kano metropolis, followed by stem bark and roots (Figure 1).

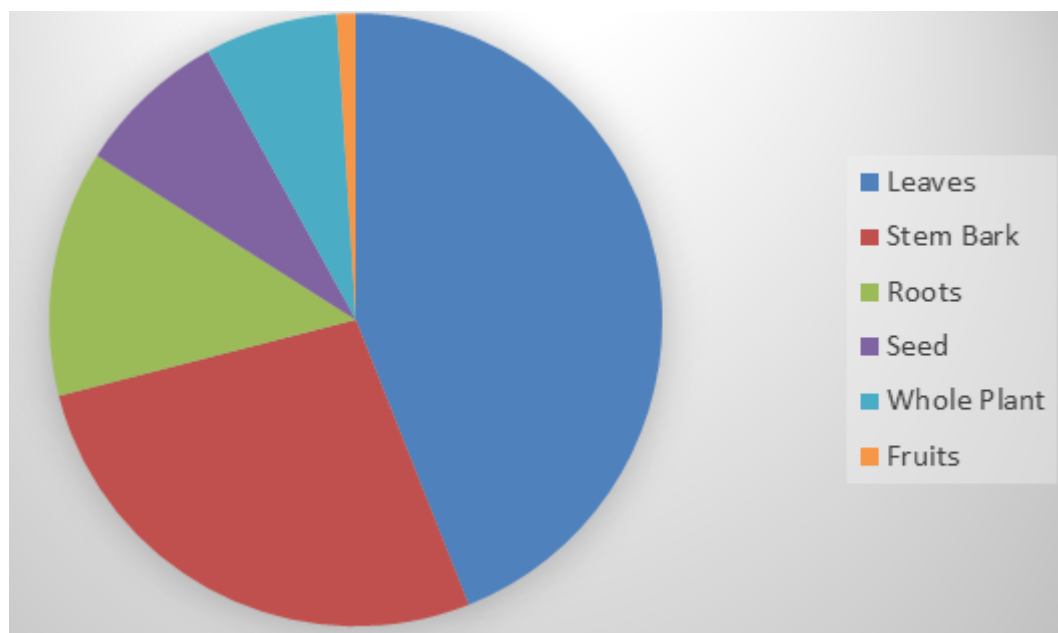
Table 3: Enumeration of Antimalaria Recipes, Methods of Preparation and Mode of Administration

S/N	Recipe	Mode of Preparation	Mode of Administration
1	<i>Azadirachta indica</i> (leaves) + <i>Carica papaya</i> (leaves)	Decoction	Oral
2	<i>Citrus sinensis</i> (leaves) + <i>Carica papaya</i> (leaves)	Decoction	Oral
3	<i>Moringa oleifera</i> (leaves) + Alum	Decoction	Oral
4	<i>Khaya senegalensis</i> (leaves) + <i>Mangifera indica</i> (leaves) + <i>Tamarindus indica</i> (leaves)	Infusion	Oral
5	<i>Delonix regia</i> (leaves) + <i>Artemisia absinthium</i> (whole plant)	Decoction	Oral
6	<i>Jatropha curcas</i> (leaves and stem bark) + Red potash	Decoction	Oral
7	<i>Cretiva adansonii</i> (leaves) + Red potash	Decoction	Oral
8	<i>Khaya senegalensis</i> (stem bark) + <i>Vitex doniana</i> (stem bark) + <i>Aframomum melegueta</i>	Decoction	Oral and steam bath
9	<i>Negella sativa</i> (seeds) + sugar + honey	Infusion	Oral, steam bath and bath
10	<i>Eucalyptus globulus</i> (leaves) + <i>Mangifera indica</i> (leaves)	Decoction	Oral
11	<i>Ficus platyphylla</i> (stem bark) + <i>Khaya senegalensis</i> (stem bark)	Decoction	Oral
12	<i>Cardiospermum halicacabum</i> (whole plant) + <i>Mangifera indica</i> (leaves)	Infusion	Oral
13	<i>Echinchloa stagnina</i> (whole plant) + <i>Psidium guajava</i> (leaves) + <i>Carica papaya</i> (leaves)	Decoction	Oral
14	<i>Dichrostachys cinenerea</i> (seeds and leaves) + <i>Tamarindus indica</i> (fruits)	Decoction	Oral

Table 3: Enumeration of Antimalaria Recipes, Methods of Preparation and Mode of Administration

S/N	Recipe	Method of Preparation	Mode of Administration
15	<i>Parkia biglobosa</i> (leaves and stem bark) + <i>Citrus sinensis</i> (leaves)	Infusion	Oral
16	<i>Ficus glumosa</i> + Red potash	Decoction	Oral
17	<i>Ipomoea asarifolia</i> (whole plant) + <i>Eucalyptus globulus</i> (leaves)	Infusion	Oral
18	<i>Ficus polita</i> (leaves and stem bark) + <i>Azadirachta indica</i> (leaves) + <i>Eucalyptus globulus</i> (leaves)	Decoction	Oral
19	<i>Ficus thoningii</i> (leaves and roots) + <i>Azadirachta indica</i> (leaves)	Decoction	Oral and steam bath

Figure 1: Percentage Occurrence of Plant Parts Used for the Treatment Malaria in Kano Metropolis



DISCUSSION

From the study, it was observed that *Azadirachta indica*, *Khaya senegalensis*, *Mangifera indica*, *Carica papaya* and *Psidium guajava* showed the highest incidence of encounter. Thus, these plant species could be considered as promising candidates for further scientific validation in the search for new, effective and affordable antimalaria drugs. The families, Fabaceae, Moraceae, Euphorbiaceae, Anarcadiaceae, Poaceae and Mimosaceae provided the highest proportion of antimalarial plants, making up 50 % of the total plants collected. Previous studies also indicate that the families Anarcadiaceae and Poaceae have many species used in malaria management [10]

Some of the plant species identified in this study have been confirmed to possess antimalaria activity, this includes; *Acacia nilotica*, *Anarcadium occidentale*, *Azadirachta indica*, *Cajanus cajan*, *Carica papaya*, *Cassia singueana*, *Ficus thoningii*, *Ficus platyphylla* and *Jatropha curcas* [11- 20]

The leaves formed the most frequently used plant parts in the treatment of malaria in Kano metropolis. The plant leaves are important ingredient in traditional treatment of various diseases as it occurred as a component in many herbal preparations. The use of leaves could be justified by the abundance

of chemical groups they contain. In fact, leaves are known as main synthesis site of secondary metabolites in plants and are the most commonly used plant parts by traditional medicine practitioners [21].

The use of freshly collected plant parts was preferred by most of the respondents. Studies had also shown that there were quantitative and qualitative differences in the essential oil components of fresh and dry plant materials [22 and 23].

The combination of different plants and parts in the preparation of antimalarial herbal remedy is not uncommon among respondents and it is believed that some plants enhance the action of other herbs. This can indicate an increase on permeability of the Plasmodium membrane to antiparasitic substances or an inhibition of pump mechanism of eliminating the drugs. Polyherbal therapy is said to be a current pharmacological principle having the advantage of producing maximum therapeutic efficacy with minimum side effects. Polyherbal therapies have the synergistic and agonistic/antagonistic pharmacological agents within themselves that work together in a dynamic way to produce therapeutic efficacy with minimum side effects [24, 25 and 26].

CONCLUSION

The study has documented different traditional practices used for the treatment of malaria in Kano metropolis. It has also provided the ethnomedicinal foundation for the pharmacological properties of notable medicinal plant species on malaria. Further studies should be carried out to validate the antiplasmodial activity of other plant species that have not yet been studied and to determine their chemical constituents.

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