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Full Length Research Paper

Ethnobotanical survey of antimalarial plants used in Ogun State, Southwest Nigeria

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An ethnobotanical survey of herbal medicine used for treatment of malaria fever in 17 communities in Ogun State, Southwest Nigeria was carried out. According to the results, 38 plant species belonging to 24 families were used in herbal antimalarial recipes. Among the plants mentioned, the most frequently used were *Morinda lucida* (7.87%), *Lawsonia inermis* (7.41%), *Citrus medica* (6.94%), *Sarcocephalus latifolius* (6.48%) and *Morinda morindiodes* (6.48%). Investigations were carried out on the plant part (leaf, stem or root) used, method of preparing herbal antimalarial remedies and how it is administered. Result showed that irrespective of plant and part (leave, fruit, stem bark or root bark) or combinations of the plant parts, water and aqueous extract from fermented maize were the main medium of herbal antimalarial preparations. Treatment regimens of malaria generally included drinking, bathing and steam inhalation of the aqueous herbal preparations for 4 - 10 days or until symptoms of malaria disappear. About 65% of all the plants mentioned in the survey have been documented to have toxic effect on the liver and kidney of experimental mice. Continuous consumption of these plants could therefore have pathological effects on the consumers. Hence, this show the need for more research in order to identify lead compounds in indigenous antimalarial plants with less or no toxicity.

Key words: Survey, ethnobotanical, antimalarial, herb.

INTRODUCTION

Malaria is one of the major tropical parasitic diseases responsible for significant morbidity and mortality especially among children and pregnant women. It is estimated that 1 - 2 million people die yearly as a result of malaria (Sudhanshu et al., 2003). Africa faces the greatest impact of this disease (Parija, 2008). Malaria is becoming more resistant to a number of current drugs and is on the increase because of the global warming process (Martin and Lefebvre, 1995). Thus, many communities who live in endemic areas, have started to look for malaria remedies in plants in their local environments (Miliken, 1997). It is believed strongly that if the herbs used to treat malaria by our ancestors in Africa hundred of years ago were not effective, malaria would have destroyed Africa. More so, Missionaries that came to Africa would not have met a single person on the continent of Africa (Elujoba, 2005). The two main groups of modern antimalarial drugs – artemisinin and quinine derivatives are known to have their source from herbs. Studies have documented over 1,200 plant species from 160 families used in the treatment of malarial or fever (Willcox and Bodeker, 2004). Ethnobotanical survey is an important step in the identification, selection and development of the therapeutic agents from medicinal plants. In ethnobotany and natural products chemistry, the mode of preparation and administration of herbal preparations are often crucial variables in determining efficacy in pharmacological evaluation (Levine, 1981; Lewis et al., 1998; Albers–Schonberg et al., 1997). In Southwestern Nigeria, studies have been carried out to document utilization of phytomedicines for treatment of fevers (Ajaiyeoba et al., 2003). Etkin (1997) also documented antimalarial plant used by the Hausa in Northern Nigeria. But these plants are taken orally by indigenes without any consideration of possible toxic effect of components in such plants. There is no record of the indigenous antimalarial herbs commonly used in Ogun State, their modes of preparation and consumption pattern.

The objective of the present study was to obtain information on the use of herbs in the treatment of malarial fever, the plant part(s) used, method of preparing herbal antimalarial remedies and how it is administered.

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The overall contribution is to document potential antimalarial herbs from the Nigerian flora.

MATERIALS AND METHODS

Study areas

The study was conducted in the Southwest of Nigeria. A total of 17 communities were visited consisting of 6 urban and 11 rural communities from 3 local government areas (Odeda, Abeokuta South and Sagamu Local Government Areas (LGAs).

Odeda local government is a rural community. The residents are mostly farmers. Majority of the town lacks the usual social amenities and has a low – density population. The community links Ogun State to Oyo state. Abeokuta South and Sagamu Local Government Areas on the other hand, are communities of civil servants and traders, and densely populated. The community has social amenities such as electricity supply and pipe borne water. The residents of these areas belong majorly to the Yoruba ethnic group.

Informed consent

The purpose of the study was explained to the local traditional herb sellers, farmers, mothers and community and opinion leaders in the local government areas. Consent to conduct the study was given by the traditional herbs sellers and community leaders. Informed consent was obtained from each of the participants. An approval for the study was obtained from the traditional heads of the communities.

General questionnaire

A semi – structured questionnaire was administered randomly to farmers, mothers, herb sellers, community leaders and elders in the community to obtain information on commonly used herbs and parts frequently used for antimalarial remedies. Questions on methods of herbal preparation, method of administration and duration of use were also asked.

Sampling method

The study covered a period of three months from March 2008 to June 2008. Systematic random sampling method was employed in which only odd numbered respondents were chosen.

Data analysis

Data obtained from the questionnaires were entered into the computer and analysed using Epi6-info version 6.04 (CDC, Atlanta GA, USA) (Dean et al., 1994).

RESULT

Demography

A total of 104 randomly selected respondents were interviewed which include farmers, mothers, herb sellers, community leaders and elders. The ages of respondents ranged between 40 – 90 years. Majority of the respondents were females (64.42%) including mothers, herb sellers and farmers, while the males (35 – 58%) were community leaders, elders and farmers (Table 1).

Table 1. Demography structure of survey respondents showing age and sex.

Age (Years)	N (%)
40-50	21 (20.2)
51-60	26 (25.0)
61-70	33 (31.7)
71-80	18 (17.3)
81-90	6 (5.8)
Total	**104**
Sex	**N (%)**
Male	37 (35.58)
Female	67 (64.42)
Total	**104**

The plant parts frequently used and mentioned in this study are stated in Table 3. The frequency of occurrence of various herbs mentioned during the botanical survey is presented in Table 2. The most commonly mentioned plants were *Morinda lucida* (7.87%), *Lawsonia inermis* (7.41%), *Citrus medica* (6.94%), *Sarcocephalus latifolius* (6.48%) and *Celastrus indica* (6.43 %). Among the top frequently mentioned plants, three plants belong to the family RUBIACEAE (*Morinda lucida, Rytigynia nigerica* and *S. latifolius)*. Other families in this category are Anarcardiaceae, Zingibercenae, Compositae, Apocynaceae, Fabaceae and Meliaceae. Level of toxicity was based on reports of documented studies.

Herbal preparation

Herbal remedies can either be prepared from dry plant "ingredients" or freshly collected samples from the field. Respondents however affirmed that either plant material is efficient depending on accessibility to plant species as some plants are not easily seen within the locality. Hence, they are collected fresh or bought and preserved dry. In rural communities, it is common practice for dwellers to prepare herbal remedies in local clay pots. This is strongly preferred to aluminum pots.

Arrangement of plant part(s) ingredient

When remedies consisted of more than 2 plant parts and recipes, seeds, fruits and stem barks were placed at the bottom of the cooking pots followed by the fragile part like leaves on the top.

Traditional solvent of choice

The various solvents for herbal preparations mentioned are water, aqueous extract from fermented maize and alcohol.

Table 2. Responses on common antimalarial plants and parts used in Ogun State.

S/N	Vernacular name	Botanical name	Plant pt(s)	Frequency (%)	Antim. activity	Toxicity
1	Oruwo	*Morinda lucida* L.	S.B., L.	7.87	Significant	Toxic
2	Laali	*Lawsonia inermis* L.	L	7.41	Minimal	Toxic
3	Osan were	*Citrus medica*	L., F.	6.94	Slightly sign.	Not toxic
4	Egbesi	*Sarcocephalus latifolius* (Smith) Bruce	S.B., L.	6.48	Significant	Toxic
5	Ponju owiwi	*Morinda morindiodes* Bark.	A.P.,R.B.	6.48	Significant	No info.
6	Ewe tea	*Cymbopogon citrates* (DC) Stapf	L	6.48	Slightly sign.	Not toxic
7	Ahun	*Alstonia boonei* De Wild.	S.B., L	5.56	Significant	Minimal
8	Awopa	*Petivera alliacea* L.	S.B.	4.17	Significant	Toxic
9	Mangoro	*Mangifera indica* L.	S.B., L	4.17	Significant	Minimal
10	Ata ile pupa	*Zingiber officinale* Roscoe.	U. S.	3.44	Slightly sign.	Negligible
11	Oganwo	*Khaya grandifolia*	S.B.	3.32	Significant	Minimal
12	Koko	*Theobroma cacao* L.	S.B.	3.32	Slightly sign.	Minimal
13	Owu	*Gossypium arboretum* L.	L	3.32	Slightly sign.	Minimal
14	Dangoyaro	*Azadirachta indica* A. Juss	L	3.32	Significant	Negligible
15	Oparun	*Bambosa vulgaris*	L	3.32	No activity	Negligible
16	Akintola	*Chromolaena odorata* L.	A.P.	2.85	Slightly sign.	Not toxic
17	Orinbo arinka	*Lecaniodiscus cupanioides* Planch.	L., S.B.	2.85	Slightly sign.	Toxic
18	Orogbo	*Garcinia kola* (Heckel)	S.B.	1.39	Slightly sign.	Toxic
19	Goba	*Psidium guajava* L.	L	1.39	Minimal	Minimal
20	Aridan tooro	*Cassia fistulosa* Lam.	S.B	1.39	Slightly sign.	Minimal
21	Efinrin	*Ocimum gratissium*	L	1.39	Minimal	Negligible
22	Furuntu	*Terminalia catappa* L.	L	1.39	No info.	No info.
23	Otili	*Cajanus cajan* Millsp.	L	1.39	Significant	Not toxic
24	Alubosa	*Allium cepa* L.	L., S.	1.39	Minimal	Not toxic
25	Elegun oko	*Rytigynia nigerica* (S.Moore)	R.B.	1.39	Minimal	Minimal
26	Ehin olobe	*Phyllantus amarus*	L	0.93	Slightly sign.	Not toxic
27	Afon	*Treculia Africana* De Wild.	S.B.	0.93	Minimal	Minimal
28	Ewuro	*Vernonia anygdalina* Del.	L	0.93	Significant	Negligible
29	Asofeyeje	*Rauvolfia vomitoria* Afzel.	L	0.93	Slightly sign.	Negligible
30	Ibepe	*Carica papaya* L.	L	0.93	Minimal	Minimal
31	Mafowokon	*Argermone mexicana* Linn.	L	0.46	Significant	Toxic
32	Irosu	*Baphia nitida* Lodd.	S.B., L	0.46	No info.	Not toxic
33	Atare	*Aframonium melegueta*	S.B	0.46	No info.	Not toxic
34	Piya	*Persea americana*	S.B., L	0.46	No info.	Toxic
35	Olorin	*Xylopia aethiopica* Dunal.	Seed	0.46	Minimal	Toxic
36	Ponhan	*Lophira alata*	S.B.	0.46	Minimal	Toxic
37	Oju ologbo	*Abrus precatorius* L.	L	0.46	Minimal	Toxic
38	Iyeye	*Spondias mombin*	L., S.B.	0.46	Minimal	Not toxic

L- leaf, S.B- stem bark, R.B- root bark, A.P- aerial parts, U.S- underground stem, No info.- no information, Freq.- frequency. Toxicity of plants as reported by Ajaiyeoba et al. (2006); Davis (1978); Bird (1991); Robert (2009); Uko et al. (2001); Yemitan and Adeyemi (2005); Aguwa (1987); Oze et al. (2007); Adedapo et al. (2005); Bakhiet and Adam (2004); U.S. Department of Health and Human Services (2006); Raintree Nutrition (2008).

A higher percentage of those interviewed especially in rural communities showed preference to aqueous extract from fermented maize (98%) followed by water (90%) and alcohol (20%) (Figure 1). This notion was further confirmed in the interview with herbs sellers in urban communities. All the respondents generally believe that alcohol is only used for the preparation of remedies consisting mainly hardy plant parts like stem bark, root and seeds.

Traditional extraction methods

The two main preparation methods are boiling in water or aqueous extract from fermented maize and steeping/ soaking in the solvents mentioned or alcohol. More

Table 3. Frequency of Plant Parts commonly used for antimalarial remedy.

Plant part	Frequency N (%)
Leaf	120 (71.0)
Stem	81 (48.0)
Root bark	13 (7.6)
Fruits	4 (2.5)
Seed	4 (2.5)
Underground stem	4 (2.5)
Total	**226 (134.1)**

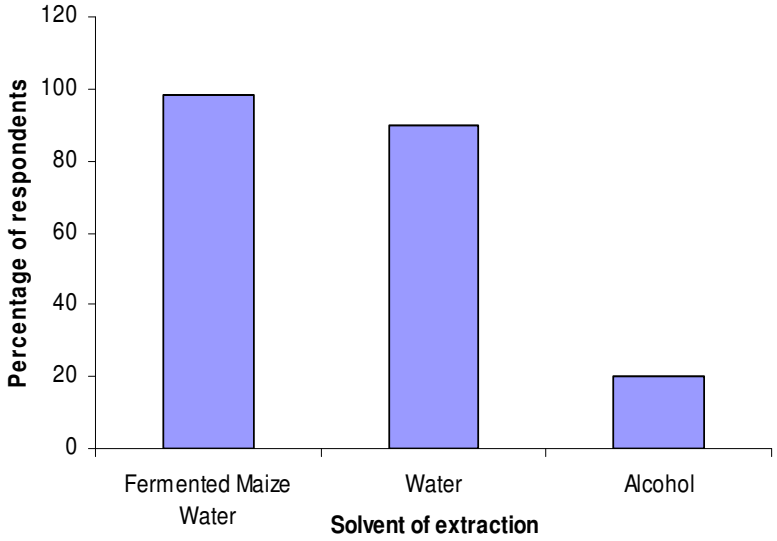

Figure 1. Medium of herbal extraction as commonly used by respondents.

preference was shown to boiling than soaking. Boiling is usually done using either water or aqueous extract from fermented maize starch but more preference was given to aqueous extract from fermented maize as this is believed to be more efficient. Alcohol was never used as solvent when boiling herbal “ingredients”. Duration of boiling ranged from 1 - 2 h on burning fire wood or cooking stove till a change in color of the solvent is observed indicating “full dissolution of active ingredients into the solvents” as some stated.

Soaking, a second choice of preparation was given less preference unlike boiling.

Solvents used can either be water, aqueous extract from fermented maize or alcohol. This method is preferred by its users as they believe that the ingredients will be extracted without the “ingredients” from the plant been exposed to heat which they believe could somehow have effect on the efficacy of the herbal recipes. Plant part are cut into small piece and soaked in corked bottles or containers for 2 to 3 days.

Soaked herbal remedies are always available in house-holds irrespective of obvious symptoms of malaria and most times are used for prophylactics than treatments.

Method of administration

All the respondents preferred drinking a cup-full (about 5 cl) of aqueous alcoholic preparations 2 to 3 times daily or as much as possible till symptoms of malaria disappear. About 40% of respondents suggested bathing and steam inhalation of the aqueous preparations for 4 – 10 days especially when high fever is observed in patients. It was also observed that majority of those interviewed use antimalarial herbal remedies as prophylactics and the frequency of consumption depends on the severity of infection.

DISCUSSION

From the list of herbs frequently used and the plant parts in Table 1, *M. lucida* is a widely known plant possessing antimalarial properties attributed to anthraquinones and anthranquinols isolated from the plant. (Koumaglo et al.,

1992; Sittie et al., 1999; Adewunmi and Adesogan, 1984). *L. inermis* is also used by some respondents as 'blood tonic', thus believing that it has a dual effect. Studies also confirmed that *S. latifolius*, *Alstonia boonei*, *Petivera alliacea*, *Mangifera indica* and *Khaya* grandifolia have significant antimalarial properties (Guede et al., 2005; Awe et al., 1998; Pedro and Antonio, 2001; Agbedahunsi et al., 1998), but little is known about *Morinda morindiodes* which was also frequently mentioned and has a frequency of 6.48% as shown in Table 1. 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 (Alexandros, 2007).

The use of either freshly collected herbal recipes or preserved (dry) plant parts seems not to make any difference in its perceived efficacy to the respondents. This was confirmed in the study as respondents showed no peculiar preference to one. However, studies had shown that there were quantitative and qualitative differences in the essential oil components of fresh and dry plant materials (Okoh et al., 2008; Fatemeh et al., 2006) Thus, dry plant materials might not be as potent as freshly collected herbs. Pharmacological laboratory studies have also employed the drying of plant parts during the preparation of plant extracts.

There is no scientific reason backing the preference to the use of clay pots for herbal preparations, but some of the respondents said that preference is given to the use of clay pots because clays pots have been in use before the advent of aluminum pots and even cheaper than aluminum pots.

Respondents also showed preference for the arrangement of plants parts in cooking pots although this has not been studied in relation to plant / herb efficacy. However, respondents believe that plant 'ingredients' are soaked better in that arrangement especially when boiling is to be employed.

Preference for solvent of herbal remedy is because of the belief that some solvents are efficient than others and depending on the plant parts. However, aqueous extract form fermented maize was shown more preference than water and alcohol. Laboratory studies had also confirmed the efficacy of one solvent over another as solvent of extraction in relation to the antimalarial property of the plant. For example, the methanolic extracts of *Flueggea virosa*, *Maytenus undata* and *Maytenus putter lickioides* had higher percentage of chemosuppression of parasitaemia *in vivo* than the water extract of the plants. While the water extracts of *Harungana madagascariensis* and *Warburgia stuhlmannii* had higher chemosuppression of parasitaemia than the methanolic extracts *in vivo* (Muthaura et al., 2007).

Boiling as a method of preparation was frequently mentioned than soaking (Figure 1). This is partly because of the choice of solvent and the type of plant parts to be used in preparing the herbal remedy. From this study, it was also observed that the dose of the herbal remedy used is dependent on disappearance of symptoms of malarial fever. Most of the respondents believe that herbal remedies can be consumed as much as possible, even as prophylactics but they are ignorant of the toxic affects of most of these herbs. Studies had however proved that some antimalarial herbs have dose dependent effect, for example high levels of chemosuppression were produced at high doses of the leaf and root-bark extracts of *Vernonia amygdalina* (Abosi and Raseroka, 2003). Studies had also shown that some plants are highly toxic despite their high chemosuppression of parasitaemia. *Morinda lucida* for example, which is top on the list of frequently used plants was observed for its in vitro cytotoxicity and the stem bark was found to be extremely toxic (Ajaiyeoba et al., 2006). The seeds of *Lawsonia inermis* have also been found to be toxic in molluscs (Singh and Singh, 2001). However, our search on published studies on the level of antimalarial activity and toxicity of the 38 plants in this study showed that 80% have been documented to have antimalarial property but suppressive and none clearance, while about 65% have toxic effects. Extract of the stem bark of *Alstonia boonei* could be potentially nephrotoxic especially when dose is high and duration of use extended (Panda, 1999). The toxicity of *S. latifolius* is moderately high while *Cymbopogon citratus* is insignificant respectively (Iwu, 1993).

Conclusion

This study and similar studies shows the need for the enlightenment of traditional medicine practitioners and the public in general on selective use of herbs for the treatment of malaria.

However, study on the effectiveness of aqueous extract from fermented maize (as observed in practice) as solvent of extraction in laboratory test extracts had not been documented.

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