



Nigerian antimalarial ethnomedicine 2: Ethnobotanical surveys of herbal remedies used in the treatment of febrile illnesses in the middle belt of Nigeria

E.O. Ajaiyeoba^{1*}, O.S. Osowole², O.O. Oduola³, J.S. Ashidi⁴, D.O. Akinboye⁴, C.O. Gbotosho³, C.O. Falade³, O.A.T. Ogundahunsi³, O.I. Fawole⁵, O.M. Bolaji⁶, M.O. Falade⁴, O.O. Oladepo², O.A. Itiola⁷ and A.M.J. Oduola⁶

1. Department of Pharmacognosy,
 2. Department of Public Health and Health Education,
 3. Department of Pharmacology & Therapeutics,
 4. Department of Zoology,
 5. Department of Epidemiology, Medical Statistics and Environmental Health,
 6. Postgraduate Institute of Medical research and Training,
 7. Department of Pharmaceutics and Industrial Pharmacy,
- University of Ibadan, Ibadan, Nigeria.

Abstract

An ethnobotanical survey was conducted among residents of Gboko (urban) and Katsina Ala (rural) local government areas in Benue state located in the middle belt of Nigeria. The Katsina-Ala and Gboko communities belong to the Tiv ethnic group. Documentation of the use of herbs as alternative in the treatment of fevers and identification of potential phytomedicines against malaria was done. Semi-structured questionnaires and focus group discussion guides were used to obtain information on description of febrile illness and utilization of herbal remedies for prevention and treatment. A total of 499 respondents comprising of mothers, fathers, community leaders/elders, herbs sellers and traditional healers were interviewed in the study. In the study, 9 types of febrile illnesses were proffered. The five most common type of febrile illnesses described were malaria (37.3%), yellow (28.8%), typhoid (27.3%), high fever (3.4%) and ordinary fever (0.5%). Perceived causes of febrile illness included mosquito bites, contamination of water and food, among others. Headache, general weakness, yellow coloration of eyes/urine, elevated body temperature and diarrhoea, were the most common symptoms associated with febrile illnesses outlined by the respondents. Furthermore, malaria (81.5%) and high fever (57%) were reported to be common during the rainy season while typhoid (52%) is common during the dry season. Yellow fever was said to be non-dependent on season. Respondents believed children were more at risk of malaria compared with the other types of febrile illnesses mentioned. The respondents indicated that herbal recipes were effective treatment for

* Correspondence:

Febrile illness. From the 105 recipes compiled, *Azadirachta indica*, *Ficus thonningii*, *Annona senegalensis* and *Cymbopogon citratus* were the most frequent herbs mentioned. Leaf (60.4%), was the most common part of plants used while boiling (92.5%), was frequently mentioned as method of herbal remedy preparation. The main route of administration of remedies mentioned was oral administration (97.9%). The study confirms the potential contribution of Phytomedicine to management of febrile illnesses, including malaria in the Tiv ethnomedicine.

Keywords: *Fever, malaria, Tiv ethnomedicine, Middle belt, Nigeria.*

Introduction

Tropical rainforest plants are known to have higher concentrations of and a great diversity of chemical defenses than plants from any other biome and are also a potential source of new medicines (1). Ethnobotanical survey is an important step in the identification, selection and development of therapeutic agents for medicinal plants. The approach of retrieval of information on the folk use of plants often yield more potentially useful compounds than empirical approach (2,3). Unfortunately, plant drug discovery has not been very successful, despite the historical importance (4). This has been due to the fact that in ethnobotany and natural products chemistry, the modes of preparation and administration of herbal preparations are often crucial variables in determining efficacy in pharmacological evaluations (5-7).

In rural populations in Africa with limited access to western health care facilities, the people often utilize ethnobotanical and ethnomedical alternatives for the management of health problem including malaria. Such alternative remedies have provided leads for the development of drugs useful in therapeutics as practiced in western medicine (8).

The documentation of the indigenous remedies for febrile illness in non-western communities, the identification and subsequent isolation of antimalarial compounds from plants like *Cinchona sp* and *Artemisia annua* continues to stimulate the search for lead compounds that could be developed from plants (9). Malaria remains a major public health problem in most tropical countries, particularly sub-Saharan Africa. Annually, between 300 and 500 million individuals are infected with over 2 million malaria related deaths (10). The high burden of malaria among communities in tropical Africa partly informs the high priority assigned to global effort to control the disease. The therapeutic potential of plants used traditionally as antimalarial cannot be over-emphasized (11) and the effective utilization of existing tools and development of new strategies are critical in the attainment of significant reduction in global malaria mortality by the end of the 1st decade of the 21st century. The decline in utility of these drugs because of emergence to resistance to readily available drugs constitutes a major challenge to

effective management and control of the disease. Efforts to meet this challenge have resulted in the development of new antimalarial drugs and promotion of Combination therapy. Unfortunately, these alternatives are often very expensive and priced beyond the resources of the population at most risk. In addition, resistance invariably develops to these drugs with prolonged use (12,13)

Further to our study in Southwest Nigeria (14), a systematic approach to understanding the utilization of phytomedicine for prevention and treatment of fevers by the indigenous Tiv population of middle-belt of Nigeria as part of the process of developing antimalarial drugs from Nigerian ethno-botany is presented. This study was designed to obtain information on febrile illnesses and the use of herbs for the treatment of febrile illnesses with the objective of identifying potential antimalarial drugs. The study revealed that fever is a general term for describing illnesses associated with elevated body temperature. The indigenous population has a categorization of fever based on symptoms and causes.

Methods

Study areas

The study was conducted in the middle belt of Nigeria. The study areas consisted of urban and rural communities, Gboko and Katsina Ala Local Government Areas (LGAs) respectively.

The purpose of the study was explained to the local traditional healers association, community and opinion leaders in the two local government areas. Consent to conduct the study was given by the traditional healers and community leaders. An informed consent was obtained from each participant in the study.

Study instruments

The study instruments were pre tested in the two communities and modified for improvement. Subsequently, eight Focus Group Discussions (FGD) guide were held in this study. This comprised of one male and female less than 45 years and one woman and man above 45 years from each of the two in LGAs and 2 in Katsina Ala LGA respectively, targeted at the general populace. The discussions were recorded on audiotapes for ease of reference.

Semi-structured questionnaires were also administered to mothers, leaders, traditional healers, herbalists, herb sellers and adults in the community. A total of 499 respondents were interviewed. In addition to demographic characteristics of the respondents, the issues addressed by the questionnaires included:

(i) Types of fever (ii) Causes of fever (iii) People at risk (iv) Treatment of fevers (v) Herbal preparations (vi) Methods of administration.

Results and discussion

Focus Group Discussion (FGD) on cultural indigenous categorization of febrile illnesses

From the analysis FGD that were conducted in each local government areas (Gboko and Katsina-Ala LGAs), malaria fever, cough, typhoid fever, yellow fever, Convulsion, pneumonia, stomach pain and hemorrhagic pile were common childhood illnesses indicated in the communities. For pregnant women, the most commonly mentioned illnesses were; fever, headache, cough, pile, waist pain, malaria fever, oedema and yellow fever. Illnesses commonly reported among adults were body pains, weakness of the body, typhoid fever and yellow fever were commonly reported among adults.

The participants categorized febrile illnesses as yellow fever, typhoid fever and malaria fever and attributed illnesses to mosquito bite, contaminated water and food, malnutrition, stress, poor ventilation and over exposure to sun.

The members of the community employed orthodox and traditional methods for treatment of febrile illnesses. Orthodox drugs specified by participants were antimalarial drugs such as chloroquine, Sulphadoxine/Pyrimenthamin, antipyretics, analgesics, antibiotics and anti-histamines (chlorpheniramine).

Herbs mentioned included *Azadirachta indica*, *Ficus thonningii*, *Trema occidentalis*, *Erythrina senegalensis*, *Imperata cylindrica*, *Haematostaphis barteria*, *Occimum basilicum*, *O. gratissimum*, *Cissus sp* and *Carica papaya*.

The respondents indicated preference for traditional medicine because of its low cost and some considered it more effective than orthodox drugs. Respondents suggested ways of improving the presentation and profile of traditional medicine. The most common suggestions were packaging of herbs in powdered form for better storage and preservation, dose standardization and conservation of medicinal plants/forest reserve.

Respondent's demographic details

Four hundred and ninety-nine respondents randomly selected from the two communities were interviewed. The detailed demographic characteristics of respondents are enumerated in Table 1. Majority (72.0%) of them were aged between 20-57 years and respondents were mainly males (71.0%). Participants were also mainly Christians (78.8%) and married (74.8%). Respondents consisted of traditional healers 128 (26.6%), community leaders/elders 118(24.5%), mothers 106(22.0%), fathers 91(18.9%) and herbs sellers 38 (7.9%).

Types of febrile illnesses, perception of causes and people at risk

Ninety percent (90%) of respondents were aware of febrile illnesses and described

nine different types. The nine febrile illnesses described are listed in decreasing frequency in Table 2. Malaria fever was the highest febrile illness mentioned (37.7%). Others that were frequently mentioned were yellow fever (29%) and typhoid (27.5%).

Respondents proffered four main causes of fevers. As outlined in Table 3, mosquito bite was the singular significant cause of malaria fever (94.7%) and was the main cause of high fever (60.0%). The perceived cause of yellow fever was mainly malnutrition (47.9%) and for typhoid fever, contaminated food accounted for 60% of the causes. Other causes mentioned in the interview were hunger, alcohol, cold, headache, rain, witchcraft and over exposure to sun.

Seasonality of fevers

Participants were interviewed on the effect of seasonal variation and the occurrence of febrile illnesses. The responses varied and are presented in Fig. 1. Respondents categorized season into 3 (dry season, rainy season and all season). In the multiple response analysis, malaria (81.5%) and high fever (57%) were reported to be common during the rainy season while typhoid (47%) was said to be common during the dry season. The occurrence of yellow fever (59.2%) was said to be non-dependent on season.

People at risk of fevers

The opinion of the respondents on people at risk of fevers differed (Fig. 2). Respondents categorized people at risk of fevers into 3 classes (children, adult and all age group). Fifty-one percent (189) of the respondents claimed that children are at the risk of malaria fever than adults and all age groups. On the other hand respondents believed that adults are prone to yellow fever 128 (53.6%), typhoid 120 (51.04%) and high fever 19 (54.29%) than other categories of people.

Fevers and associated symptoms

Symptoms most frequently associated with the fevers are enumerated in Table 4. Headache (34.4%) and high body temperature (19.5%) were the most perceived symptoms of malaria fever. Symptoms of yellow fever mentioned were headache (38.0%) and body pains (27.1%). Other symptoms discussed were vomiting; mouth sore, diarrhea, weight loss, restlessness and breathlessness

Methods of preventing different types of fevers

The preventive measures used by the communities for different types of fever varied (Table 5). The preventive measures most frequently used for malaria fever by respondents were the prevention of mosquito bites through the use of mosquito nets 104 (34%), insecticides 46 (15.2%) and clearing of bush 97 (32%). Sterilization of drinking water by either boiling 75 (39%) or filtering 30 (15.6%) was indicated as the main preventive measures against typhoid fever. The use of aqueous or alcoholic extract of herbs 9 (45.0%) was frequently mentioned as

preventive measures for high fever. Improper feeding 123 (60.23%) were indicated for prevention of yellow fever. Other preventive measures mentioned include religious ceremonies, use of orthodox drugs, cleanliness and reduction in physical exertion. Avoiding over exposure to sun, taking proper care of self and having adequate rest were also mentioned.

Treatment of fevers using herbal recipes

Most respondents affirmed that traditional herbs were effective in treating the different types of fever mentioned. Different herbal recipes were mentioned in the

treatment of the different types of fevers (Table 6). In a multiple response system, Dongoyaro (*Azadirachta indica*, 20.1%), *Ficus thonningii*, (10%) were the most commonly mentioned herbs for malaria fever. Others were *Imperata cylindrica*, *Cymbopogon citratus*, *Ocimum sp*, *Erythrina senegalensis*. For high fever, *Haematostaphis barteria* (12.5%) and *Pericopsis eleta*, (4.7%) were among the commonly mentioned herbs. *Ocimum brasiliicum*, *Citrus medica* were commonly mentioned for typhoid fever and for ordinary fever, *Ocimum brasiliicum* and *Ficus thonningii* were indicated.

Herbal recipes, preparation and method of administration

Respondents affirmed that the traditional herbs were effective in treating the different types of fevers mentioned. The list of the most 20 frequently mentioned plants were also compiled (Table 7).

Respondents were interviewed on the part of herbs used, method of collection, storing and processing. The various part of herbs used for preparing herbal recipes are presented in Fig. 3. The most frequently used part is the leaf 877 (60.4%). Boiling 1293 (92.5%) was the most common form of preparation while oral administration 969 (97.9%) was the popular method of administration as presented in Table 8.

Malaria fever was the most frequently mentioned fever (37.3%), this is followed by Yellow fever (28.8%), Typhoid fever (27.3%) and High fever (3.4%). In Southwestern Nigeria (14), the frequently febrile illnesses were Yellow fever (39.1%), Typhoid (34.8%), Ordinary (28.8%), rain (20.8%) and headache (10.5%) fevers respectively. While malaria fever was not significant in the SW ethnobotany, it was the most commonly proffered febrile illness in Middle Belt. Furthermore, Typhoid and Yellow fevers were common febrile illnesses mentioned in both ethnobotany, since epidemics have been recorded in Senegal (15), and South east Asia (16) there is need to note the results of this study, to prevent morbidity and mortality due to these 2 febrile illnesses in the study regions in Nigeria.

Views and opinions of participants about causes of malaria, typhoid and yellow

fever were documented. Majority of participants (95%) mentioned mosquito bite as the cause of malaria fever. Participants associated typhoid fever with contaminated water and food (64.4 & 17.05% respectively). Twenty percent of the participants attributed the cause to mosquito bites while others mentioned malnutrition (47.9%), contaminated food and water (15.8 & 4.9%). The symptoms mentioned (Table 3) for the different types of fever appear to be adequate except in the case of yellow fever; one would have expected that a substantial number of respondents would mention yellow eyes/urine as an important symptom of yellow fever. Similarly, herbal remedies are used along side with orthodox medicines.

The management of fever in the community is mainly through the use of herbal remedies. Over one hundred different herbal recipes used for the treatment of febrile illnesses were compiled. Plant ingredients ranged from 2-7 in the recipes proffered. While a few of the plants (*Azadirachta indica*, *Cymbopogon citratus*, *Mangifera indica*) in the Middle Belt ethnobotany were also significantly mentioned in the Southwest Nigeria (14), majority of the plants were not mentioned in the former. These include: *Ficus thonningii*, *Erythrina senegalensis*, *Annona senegalensis*, *Terminalia sp*, *Imperata cylindrica* and *Jatropha curcas*. The disparity recorded in plants employed in the herbal recipes, could be due to the differing vegetation in moving from the Southwest (an evergreen rainforest region) to the middle belt of Nigeria with decreasing vegetation and approaching the Savannah area. In another study in the Benue ethnomedicine, *Bridelia sp*, *Imperata cylindrica*, and *Terminalia catappa* were mentioned for malaria and of the screened for secondary metabolites (17).

From the results of the ethnobotanical surveys in this study, one can conclude that, in Middle Belt of Nigeria, herbal preparations are significantly used for the prevention and treatment of the febrile illnesses proffered and respondents were knowledgeable about the causes of mentioned febrile illnesses. The categorization of one of the fever as high fever may be repetitive. In the absence of laboratory confirmation of *Plasmodium falciparum* infection, there is a need for study of the categorization of the fevers and correlation with *P. falciparum* infection.

The systematic therapeutic potential of plants used in the traditional treatment of febrile illnesses from the Tiv ethnobotany has been exhaustively investigated and documented. In an aim to develop antimalarial compounds from this zone, we have been able to determine through ethnographic research, plants used as medicines in preventing and treating febrile illnesses, including malaria. In addition, ethnomedical values of the febrile illnesses in Tivland have been recorded.

Conclusion

Though Etkin (18), studied antimalarial plants used by the Hausas in Northern Nigeria, from the Asian ethnomedicine, various studies have been done using herbal remedies (19-21) and in the African ethnomedicines, many plants have also

been recorded as having antimalarial properties (22-26). However, this is the first report of the categorization of febrile illnesses in the Nigerian Middle belt ethnobotany. Correlation of the illnesses to the various herbal remedies proffered for treatment has also been studied in the region. A lot of useful data has been obtained and this is being used as a guide in the pharmacological studies on the mentioned plants in order to isolate and characterize useful active components thereof. The determination of efficacy and safety of these plants in relation to one another and other known antimalarial drugs will be done in an attempt to contribute to antimalarial drug development from the Nigerian Middle belt Phytomedicine compendium.

Acknowledgements

This research received financial support from WHO/TDR/MIM Africa Research Capability Strengthening Grant ID 980046. We are grateful to all the respondents and the Primary Health Co-coordinators in Gboko and Kastina-Ala Local Government Areas in Benue State of Nigeria, for assisting in the study.

References

- Balick M.J., Elisabetsky, E., and Laird S.A. (1996) *Medicinal Resources of the Tropical Forest*, p. 40. Columbia University Press, New York.
- Carvalho L.H., Brandao M.G and Santos Filho H. (1991) Antimalarial activity of crude extracts from Brazilian plants studied *in vivo* in *Plasmodium berghei* infected mice & *in vitro* against *Plasmodium falciparum* in culture. *Braz. J. Med. Biol. Res.* 24, 1113-23.
- Berlin, B, Berlin, E.A., Ugalde, J.C.F, Barrios, L.G, Puett, D., Nash, R. and Gonzalez-Espinoza, R. (1994) The Maya ICGB: Drug discovery, medical ethnobiology, and alternative forms of economic development in the Highland Maya Region of Chiapas, Mexico. *Pharmaceut. Biol.* 37, 127- 144
- Craig, G.M., Newman, L.G and Snader K.M. (1997) Natural products drug Discovery and Development. *J. Nat. Prod.* 60, 52-60.
- Levine, A. (1981) The Mexican Plant zoapatle (*Montanoa tomentosa*) in Reproductive medicine. Past, Present and Future. *J. Reprod. Med.* 26, 524- 528.
- Lewis W., Mutchler, D., Castro N., Elvin-Lewis, M. and Farnsworth, N. (1998) *Ethnomedicine, Chemistry and Biological Activity of South American Plants*, Chapman and Hull, London.
- Albers-Schonerg, G, Antoun, M., Gupta, A., Burely, J. and Sobrevila, C. (1997) Report of a special panel of experts on International Cooperation Biodiversity Groups (ICGB). Unpublished paper (http://www.nih.gov/fic/opportunities/final_report.html)
- Phillipson, J.D. (1994) Natural Products as Drugs. *Trans. R. Soc. Trop. Med. Hyg.* 88, 17-19.
- Guido, F., Passreiter, C.M. and Herman J. (1996) Antiplasmodial activities and cytotoxic effects of aqueous extract & sesquiterpene lactones from *Neurolaena lobata*. *Planta Medica* 62, 128-129.
- Butler D. (1997) Time to put malaria control on the global agenda. *Nature* 386, 535-536.
- Bodeker, G., Willcox, M., Flohr, C. and Chi-Keonig, O. (1999) *The therapeutic potential of plants used traditionally as antimalarials: New directions for research*, p 287-289. Traditional and Complimentary Health Systems in Health in the Commonwealth.
- Ringwald P., Bicki, J. and Basco, L K. (1998) Amodiaquine as first-line treatment of malaria in Younde. Presumptive evidence from in-vitro and cross-resistance pattern. *Trans. Roy. Soc. Trop. Med. Hyg.* 42, 199-203.
- World Health Organization (1996) *Assessment of therapeutic efficacy of antimalarial drugs*,

- WHO/MAL/96.1077.
14. Ajaiyeoba, E.O., Oladepo, O., Fawole, O.I., Bolaji, O.M., Akinboye, D.O., Ogundahunsi, O.A.T., Falade, C.O., Gbotosho, G.O., Itiola, O.A., Happi, T.C., Ebong, O.O., Ononiwu, I.M., Osowole, O.S., Oduola, O.O., Ashidi, J.S., and Oduola A.M.J. (2003) Cultural categorization of febrile illnesses in Correlation with Herbal remedies for treatment in Southwestern Nigeria. *J. Ethnopharmacol.* 85, 179-185
 15. Reiter, P., Cordellier R. and Ouma J.O. (1998) First recorded outbreak of yellow fever in Kenya, 1992-1993. II. Entomologic investigations. *Am. J. Trop. Med. & Hyg.* 59, 650-656.
 16. Sinna A., Sazawal S., Kumal R. (1999) Typhoid fever in children aged less than 5 years. *Lancet* 354, 734-737.
 17. Ekpendu, T.O.E., Obande, O.D., Anyogo, P.U. and Attah, A.D. (1998) Nigerian Ethnomedicine and Medicinal Plant Flora The Benue Experience. *J. Pharmaceut. Res. & Dev.* 3, 37-46.
 18. Etkin, N.L. (1997) Antimalarial plants used by the Hausas in Northern Nigeria. *Trop. Doctor* 27, 12-16.
 19. Sharma, K.D., Kapoor, M.L., Vaidya, S.P. and Sharma, L.K. (1991) A Clinical Trial of 'Ayush 64' (A coded Antimalarial Medicine) in Cases of Malaria. *J. Res. Ay. Sid.* 2, 309-326.
 20. Vedavanthy, S. and Rao, D.N. (1995) Herbal Folk Medicine of Tirumala and Tirupati Region of Chittoor District, Andhra Pradesh. *Fitoterapia* 66, 167-171.
 21. Sharma, P. and Sharma, J.D. (1999) Evaluation of in-vitro schizontocidal activity of plant parts of *Calostropis procera*- an Ethnobotanical approach. *J. Ethnopharmacol.* 68, 83-95.
 22. Burkhill, H.M. (1985). *The Useful Plants of West Tropical Africa*, Royal Botanical Gardens, Kew.
 23. Bep-Oliver (1986) *Medicinal Plants in Tropical West Africa*. Cambridge University Press, pp 1-375
 24. Iwu, M.M. (1993) *A Handbook of African Medicinal Plants*, CRC Press, Boca Raton. p 226
 25. Gill, L.S. 1993). *Ethnomedical Uses of Plants in Nigeria*, p 1-275. Uniben Press, Benin-City.
 26. Benoit, A., Valentin, A., Pelissier, Y., Diafonka, F., Marion, C., Bamba, D., Kone, M., Mallie, M. and Bastide, J.M. (1996). In-vitro antimalarial activity of Vegetal extracts used in West African Traditional Medicine. *Am. J. Trop. Med & Hyg.* 54,, 67-71.

TABLE 1: Demographic Characteristics Of Respondents

	Number	Percentage
Age		
10-20	22	4.7
21-31	103	22.0
32-42	135	28.8
43-53	99	21.2
54-64	60	12.8
65-91	49	10.5
Sex		
Male	351	72.8
Female	131	27.2
Religion		
Christianity	378	78.8
Islam	16	3.3
Traditional	86	17.9
Education		
None	158	34.1
Primary	88	19.0
Secondary	133	28.7
Tertiary	53	11.4
Arabic education	4	0.9
Adult education	28	6.0
Occupation		
Unskilled	403	78.1
Skilled	78	15.1
Apprentice/student	32	6.2
Unemployed	3	0.6
Marital Status		
Never married	74	15.9
Married	348	74.8
Separated	22	4.7
Divorced	4	0.9
Widow	17	3.7

TABLE 2: The types of fever indicated by the respondents

Types of Fever	Percentages
Malaria fever	37.7
Yellow fever	29.0
Typhoid fever	27.5
High fever	3.4
White fever	0.9
Ordinary Fever	0.6
Lassa fever	0.4
Fever due to chicken pox/measles	0.3
Dengue fever	0.3

TABLE 3: Types of febrile illness and perceived causes

Types of Fever	*Percentages				
	Mosquito bites	Contaminated water	Contaminated food	Malnutrition work	Too much
Malaria fever	94.7	1.4	---	0.8	---
Yellow fever	20.4	4.6	15.8	47.9	1.7
Typhoid fever	5.4	64.4	17.1	7.0	0.4
High fever	60.0	4.0	4.0	8.0	12.0

*Multiple responses

TABLE 4: Types of febrile illness and perceived symptoms

Types of fever	*Percentages						
	Headache	High body Temperature	Body pain	Cold & chills	Yellow eyes / urine	Weakness	Loss of appetite
Malaria	34.4	19.5	11.3	11.7	---	12.70	4.1
Yellow fever	30.0	5.5	27.1	5.1	0.9	12.76	3.3
Typhoid fever	37.1	5.3	26.4	5.0	1.2	12.46	2.1
High fever	23.3	18.6	16.3	18.6	2.3	2.33	2.3

*Multiple responses

TABLE 5: Methods of fever prevention

Types of Fever	*Percentages					
	Prevention of mosquito bites	Herb	Orthodox drug	Sterilization of water	Proper feeding	Vaccination
Malaria fever	81.8	5.0	5.3	---	2.7	---
Yellow fever	13.2	8.3	8.3	5.4	60.3	8.3
Typhoid fever	13.5	6.3	10.9	54.7	12.0	0.5
High fever	25.0	45.0	10.0	---	5.0	---

*Multiple responses

TABLE 6: Recipes used for the treatment of febrile illnesses

Fever	Recipes
*Malaria	<ol style="list-style-type: none"> 1. <i>Azadirachta indica</i> (b) & <i>Erythrina senegalensis</i> (l) 2. <i>Mangifera indica</i> (l), <i>Ficus thonningii</i> (l) & <i>Cymbopogon citratus</i> (l) 3. <i>Azadirachta indica</i> (l), <i>Imperata cylindrica</i> (l) & Guinea corn (l) 4. <i>Cymbopogon citratus</i> (l), <i>Azadirachta indica</i> (l), <i>Erythrina senegalensis</i> (l) & <i>Ocimum basilicum</i> (l) 5. <i>Gossypium sp.</i>(l), <i>Azadirachta indica</i> (b), <i>Ficus thonningii</i>(l) & <i>Cymbopogon citratus</i> (l)
*Yellow	<ol style="list-style-type: none"> 1. <i>Erythrina senegalensis</i> (l), <i>Anarcadium occidentale</i> (l), <i>Cymbopogon medica</i>(f) & <i>Azadirachta indica</i> (l) 2. <i>Carica papaya</i> (wl), <i>Cymbopogon citratus</i> (l), <i>Allium sativa</i> (b), <i>Jatropha curcas</i> & <i>Psidium gaujava</i> (l) 3. <i>Mangifera indica</i> (b,l), <i>Azadirachta indica</i> (l) & <i>Newbouldia laevis</i> (l) 4. <i>Cymbopogon citratus</i> (l), <i>Ficus thonningii</i> (l) & <i>Scleocarya burea</i> (l) 5. <i>Ficus thonningii</i> (l), <i>Terminalia catappa</i> (l) & <i>Annona senegalensis</i> (l)
*Typhoid	<ol style="list-style-type: none"> 1. <i>Bridelia marant</i> (l), <i>Terminalia catappa</i> (l), <i>Piliostigma thonningii</i> & <i>Occimum basilicum</i> (l) 2. <i>Azadirachta indica</i> (l), <i>Ficus thonningii</i> (l), <i>Trema orientalis</i>, <i>Annona senegalensis</i>(l) & <i>Cissus sp.</i> 3. <i>Acacia sp.</i> (l), <i>Erythrina senegalensis</i> (l) & <i>Cassia alata</i> (l). 4. <i>Ficus thonningii</i> (l), <i>Ocimum gratissimum</i> (l) & <i>Haematostaphis barteria</i> 5. <i>Azadirachta indica</i> (l), <i>Annona senegalensis</i> (l) & <i>Cassia alata</i>(b,l)
	b-bark j-juice *Boiling recipes in water.
	l-leaves wl-withered leaves

TABLE 7: List of the most frequently mentioned plants used for the treatment of febrile illnesses in middle belt of Nigeria

S/No	Local names	Botanical names
1	<i>Dongoyaro</i>	<i>Azadirachta indica</i> (Meliaceae)
2	<i>Akinde</i>	<i>Ficus thonningii</i> (Moraceae)
3	<i>Ahuu</i>	<i>Annona senegalensis</i> (Annonaceae)
4	<i>Tea leaves</i>	<i>Cymbopogon citratus</i> (Graminae)
5	<i>Ishoho</i>	<i>Erythrina senegalensis</i> (Rutaceae)
6	<i>Kuegh</i>	<i>Terminalia catappa</i> (Combretaceae)
7	<i>Ukwegh</i>	<i>Terminalia laxiflora</i> (Combretaceae)
8	<i>Hira</i>	<i>Imperata cylindrical</i> (Graminae)
9	<i>Gydam</i>	<i>Jatropha curcas</i> (Euphorbiaceae)
10	<i>Kuhwa</i>	<i>Cassia alata</i> (Caesalpinaceae)
11	<i>Kuhwa-indyar</i>	<i>Cassia occidentalis</i> (Caesalpinaceae)
12	<i>Ikurakase</i>	<i>Nauclea latifolia</i> (Rubiaceae)
13	<i>Kungraku utane</i>	<i>Occimum basilicum</i> (Labiatae)
14	<i>Tsada</i>	<i>Haematostaphis barteria</i> (
15	<i>Umunatumba</i>	<i>Sterospermum sunthiamum</i> (Bignonacca)
16	<i>Gbabogom</i>	<i>Burkea africana</i> (Caesalpinaceae)
17	<i>Ikpine</i>	<i>Bridelia micrantha</i> (Euphorbiaceae)
18	<i>Yankpade</i>	<i>Piliostigma thonningii</i> (Caesalpinaceae)
19	<i>Ikuranomso</i>	<i>Lophira alata</i> (Ochnaceae)
20	<i>Mango</i>	<i>Mangifera indica</i> (Anarcadiaceae)

TABLE 8: Method of preparation and route of administration of herbal remedies

Method of Preparation	Percentages (%)
Boiling (water)	92.5
Steeping (alcohol)	4.3
Powdering	1.9
Total	99.7
Route of Administration	
Oral	98.0
Topical	1.0
Inhalation	0.9
Scarification	0.1
Total	100.0

