



## Therapeutic plants used for Typhoid Fever treatment in Kaduna State Nigeria

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### 1. Introduction

For years plants are known for their medicinal values, traditionally they are used for the treatments of ailments by people all over the world [1, 2]. The custom for the knowledge utilisation of traditional medicinal plants preoccupied man from the inception moving from generation to generation. Due to the cost of modern medicine and reportage of the side effects; people opt to used medicinal plants (*Guiera senegalensis*, *Magnifera indica*, *Euphorbia unispina*, *Azadirachta indica*, *Ziziphus mauritiana* etc) [3]. The world health organisation (WHO) established more than 70% of the world populations relied on traditional medicinal plants to meet their health care [4]. Globally, especially in African countries

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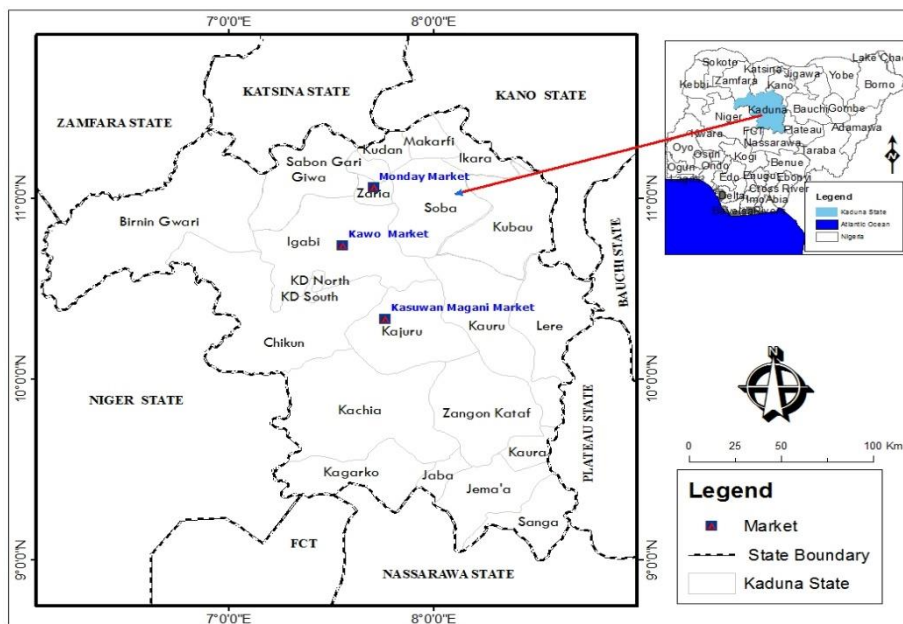
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resistance of drugs presents an enormous health problem results in increased morbidity and mortality [5]. Despite the recent development of modern medicine in the developing countries, Nigeria included people still relied on traditional herbal medicine for the treatment of diseases. The usage of traditional medicinal plants in one form or another is increasing rapidly all over the world. For understanding the cultural utilisation of plants, ethnobotany is important. In order to get information on diseases prevalent in a community [5]. For millennia typhoid fever is a serious disease infection of public health concern. The disease is prevalent in Africa [6]. Typhoid fever is an antiquated ailment as a result of consistent contamination of sources of water. Poor sanitary conditions lead to the disease. After malaria, typhoid fever is the second most endemic infectious disease in Africa. Estimated by World Health Organisation (WHO) (2000) fever from typhoid, annually between 16 to 33 million cases [7]. Annually between 500 and 700 thousand deaths all over the world [8]. Bacteria from the genus *Salmonella* known as *Salmonella typhi* is responsible for the Typhoid fever infection [9]. The period for the incubation of the bacteria if got into the human system is 1 to 3 weeks. Loss of appetite, high fever, headache, and high fever are considered the most common symptoms of Typhoid infection. Sometimes body weakness was reported a sign of Typhoid fever infection caused by *Salmonella typhi* [9]. In Africa lacking in portable water resulted the region more prone to the typhoid fever all over the globe [10]. Nigeria is similarly has the challenge of portable water, especially the rural areas. As of today, medicinal plants are still one of the major source of ailment treatments in Nigeria [11]. As reported by WHO, the traditional medicinal practitioners ratio is 1:110 while that of modern medicine is 1:16, 400 [12]. The above information confirmed majority of the Nigerian populace patronized traditional medical practitioners more often as compared to doctors [12]. Ethnobotanical studies of a particular community is paramount at an interval of time for conservational studies [3]. Documentation of the medicinal plants will lead to the discovery of more potent and nontoxic drugs of antityphoid [13]. Because of the state's cultural diversity and uniformity, Kaduna is known as Nigeria's heartland. Despite the fact that Kaduna State is located in the heart of northern Nigeria. No documentation of ethnomedicinal practices of antityphoid was carried out. As a result, the purpose of the following research is to compile data on the use of plants in the treatment of typhoid fever.

## **2. Materials and Methods**

### **2.1 Study area**

The research was conducted in Kaduna State, Nigeria (10° 35" N, 7° 19" E). The Sudan savannah vegetation of Kaduna state is characterized by scattered tropical trees and grasses. Civil servants, businesspeople, traders, and farmers with international cultures make up the population (Figure 1).



**Figure 1: Map of the Study Area Identifying the Sampling Locations**

## 2.2 Sampling and Interview Sessions

Non-random probability and expert sampling method was adopted. Determination of the sampling size not needed. Six months of research was carried out in Kaduna state's three geopolitical zones (Figure 1). In each zone, a large herbalist market was chosen. The method used was an open-ended interview. Validation of the questionnaire was carried out prior to adoption in the study[3].

## 2.3 Herbarium Deposition and Taxonomic Identification

For therapeutic plant samples obtained from natural environments and home gardens, herbarium specimens were made. A certified taxonomist identified the collected plants in the field and finally deposited at the herbarium of Ahmadu Bello University, Zaria. A voucher number was given (Table 2).

## 2.4 Data Analysis

The study employed a simple descriptive analysis for the obtained ethnobotanical data to determine the frequencies and percentage based on the following information:

- I. Socio-demographic information of the respondents.
- II. Plant taxonomic information, mode of administration, mode of preparation, growth form and parts of the plant utilised.
- III. Quantitative data were computed based on the following indices:
  - I. The Used value index (UV) was used to assess the relative relevance of therapeutic plants [3].
  - II. The relative frequency of citation (RFC) was used to determine the medicinal plant species' popularity [3].

**III.** Fidelity Level III (FL) This measure was used to determine the ability of a plant species to treat a specific ailment. [3].

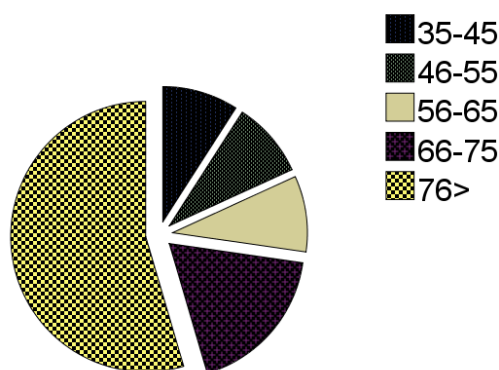
### 3. Results

#### 3.1 Demographics profile of the respondents

The respondents only interview traditional herbalists from the age of 35 and above Figure 2. All the respondents have attended the first stage of the basic level of education Table 1. The respondents are born in the practice because they inherited it from their parents. All the respondents have registration with their association and the government for practicing their profession. The respondents believe there is a need for improvement in their profession and its incorporation into the modern health care system.

**Table 1 Demographic information of the Respondents**

<b>Gender</b>	Frequency	Percentage
Male	22	100
Female	0	0
<b>Age</b>		
35-45	2	9.1
46-55	2	9.1
56-65	2	9.1
66-75	4	18.2
76->	12	54.5
<b>Education</b>		
Basic education	16	72.7
Post basic education	6	23.7
Tertiary	0	0
None	0	0



**Figure 2: Demographic information of the respondents**

### 3.2 Plants identification and diversity

Thirty species of plants are documented during the ethnobotanical survey Table 2. Out of which *Garcinia mangostana*, *Ananas comosus* and *Moringa oleifera* has the highest RFC with 0.9 respectively (Table 3). With family Fabaceae (*Erythrina senegalensis*, *Pterocarpus erinaceus* and *Senna alata*) and Myrtaceae (*Psidium guajava*, *Eucalyptus camaldulensis* and *Eugenia caryophyllus*) has much abundance in Kaduna state Figure 3 . The following species has the highest percentage of occurrence at 9.2 respectively Table 2.

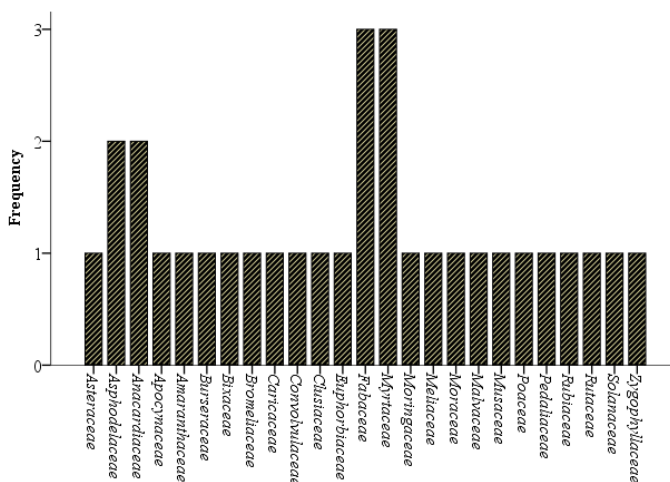


Figure 3: Family occurrence of the plants used for the treatment of typhoid fever in Kaduna state.

### 3.3 Parts of the plants used for the treatment of typhoid fever

Leaves are found the most used part of the plant treat typhoid fever 40.9, followed by whole plant 27.3 and root 13.6 % respectively Figure 4. The respondents reported the usage of a different combinations of plant parts to have effective treatments. The respondents were asked if there is any yardstick, they used in measuring the quantity of the plants before combining different recipes. The respondent believes to be up the head in combining the different recipe.

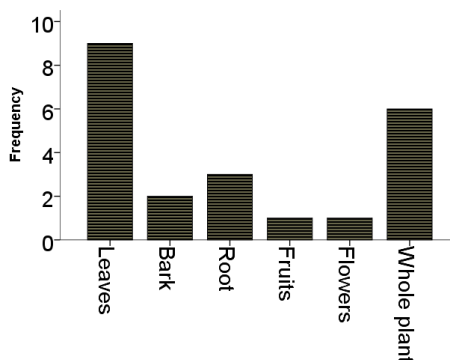


Figure 4: Parts of the Plants used for the Treatment of Typhoid fever

**Table 2: Taxonomic Domestication of Medicinal Plants Used for the Treatment and Management of Typhoid Fever in Kaduna State**

S/N	Family	Scientif Name	Common Name (English Name)	Common Name (Hausa Name)	Parts Utilised	Method Preparation	Method of Administration	Voucher Number
1	Asteraceae	<i>Acanthospermum hispidum</i> D.C.	Bristly starbur	Kayar yawo	Leaves and whole plants	Decoction, Infusion and Maceration	Oral	ABU04523
2	Asphodelaceae	<i>Aloe indica</i> Royle	Aloe vera	Alovera	Whole plants	Decoction and Infusion	Oral	ABU0763
3	Asphodelaceae	<i>Aloe ferox</i> Mill.	Aloe vera	Alovera	Whole plant	Decoction and Infusion	Oral	ABU06523
4	Anacardiaceae	<i>Mangifera indica</i> L.	Mango	Mangora	Leaves and Bark	Decoction and Infusion	Oral	ABU01944
5	Anacardiaceae	<i>Anacardium occidentale</i> L.	Cashew tree	Kashiu	Leaves and fruits	Decoction	Oral	ABU0184
6	Apocynaceae	<i>Carissa carandas</i> L.	Bengal currant	Cizaki	Leaves and Bark	Decoction and Infusion		ABU0900182
7	Amaranthaceae	<i>Amaranthus spinosa</i> L.	Spiny amaranth	Zaranga de	Leaves and Whole plant	Decoction, Infusion, Poultice and Maceration	Oral and Dermal	ABU0585
8	Burseraceae	<i>Boswellia odorata</i> Roxb. ex Colebr	Indian frankincense	Ararabi	Back, Flower and Leaves	Decoction, Infusion	Oral	ABU02448
9	Bixaceae	<i>Cochlospermum religiosum</i> (L.) Alston	Buttercup tree	Rawaya	Leaves, Flower and Bark	Decoction	Oral	ABU02759
10	Bromeliaceae	<i>Ananas comosus</i>	Pineapple	Abarba	Leaves and Fruit Bark	Decoction	Oral	ABU0719

11	Caricaceae	<i>Carica papaya</i> L	Pawpaw	Gwanda	Leaves	Decoction	Oral	ABU0817
12	Convolvulaceae	<i>Ipomoea batatas</i> (L.) Lam.	Sweetpotato	Dankali	Leaves	Decoction	Oral	ABU02806
13	Clusiaceae	<i>Garcinia mangostana</i> L.	Purple mangosteen	gawasa	Leaves and Bark	Decoction and Infusion	Oral	ABU08471
14	Euphorbiaceae	<i>Jatropha curcas</i>	Barbados nut	Mamulu	Leaves, Fruits and Whole plant	Decoction, Infusion, Poulitice and Maceration	Oral	ABU0375
15	Fabaceae	<i>Erythrina senegalensis</i> DC.	Senegal coraltree	Mijinrin ya	Leaves and Bark	Decoction	Oral	ABU07095
16	Fabaceae	<i>Pterocarpus erinaceus</i> Poir.	African kino tree	Madubi ya	Laves and Bark	Decoction	Oral	ABU0751
17	Fabaceae	<i>Senna alata</i> (L.) Roxb.	Emperor's candlesticks		Whole plant	Decoction	Oral	ABU02888
18	Myrtaceae	<i>Psidium guajava</i> . L.	Guava	Gauiba	Leave, Fruits	Decoction, Infusion and Maceration	Oral	ABU03256
19	Myrtaceae	<i>Eucalyptus cameldulensis</i> Dehnh	River red gum	Turare	Leaves and Bark	Decoction	Oral	ABU0322
20	Myrtaceae	<i>Eugenia caryophyllus</i> (L.) Merr. & L.M.Perry	Clove	Kanumfari	Leaves and fruits	Decoction and Infusion	Oral	ABU0772

21	Moringaceae	<i>Moringa oleifera Lam.</i>	Drumstick	Zogale	Leaves and Seeds	Decoction, Infusion	Oral and Dermal	ABU0517
22	Meliaceae	<i>Azadirachta indica A.Juss.</i>	Neem	Dogonyaro	Leaves and Bark	Decoction and Infusion	Oral and Dermal	ABU0900151
23	Moraceae	<i>Ficus glumosa Delile</i>	Mountain fig	Baurenkiyashi	Leaves and Bark	Decoction	Oral	ABU01883
24	Malvaceae	<i>Hibiscus sabdariffa L.</i>	Roselle	Yakuwa	Whole plant	Decoction	Oral and Dermal	ABU01717
25	Musaceae	<i>Musa angolensis</i>	Banana	Ayaba	Leaves, Fruit, and Fruit Peel	Decoction	Oral	ABU01101
26	Poaceae	<i>Cymbopogon citrates</i>	West Indian lemon grass	Ganyenshayi	Whole plant	Decoction	Oral	ABU01648
27	Pedaliaceae	<i>Sesamum indicum</i>	Benne	Ridi	Leaves and whole plant	Decoction, Infusion, Poultice and Maceration	Oral	ABU03451
28	Rubiaceae	<i>Spermacoce villosus Sw.</i>	Tropical girdlepod	karyagarma	Whole plant	Decoction, Infusion, Poultice and Maceration	Oral	ABU0251
29	Rutaceae	<i>Citrus sinensis (L.) Osbeck</i>	Orange	Lemun Zaki	Leaves and Fruits	Decoction, Infusion, Poultice and Maceration	Oral	ABU0990
30	Solanaceae	<i>Schwenkia americana L.</i>	Greece	Dandan	Whole plants	Decoction	Oral	ABU07251
31	Zygophyllaceae	<i>Balanites aegyptiaca (L.) Delile</i>	Egyptian balsam	Aduwa	Leaves, Bark, Fruit and Root	Infusion, Poultice and Maceration	Oral	ABU0900175

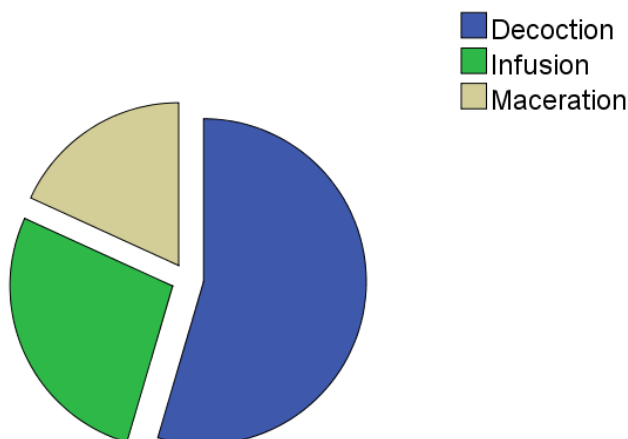


**Table 3: Quantitative Evaluation of the Documented Medicinal Plants**

S/N	Scientific Name	Used Value (UV)	Relative Frequency Citation (RFC)	Fidelity Level (FL)
1	<i>Acanthospermum hispidum D.C.</i>	0.3	0.45	45
2	<i>Aloe indica Royle</i>	0.1	0.45	45
3	<i>Aloe ferox Mill.</i>	0.4	0.45	45
4	<i>Mangifera indica L.</i>	0.5	0.68	68
5	<i>Anacardium occidentale L.</i>	0.4	0.45	45
6	<i>Carissa carandos L.</i>	0.3	0.45	45
7	<i>Amaranthus spinosa. L.</i>	0.3	0.68	68
8	<i>Boswellia odorata Roxb. ex Colebr</i>	0.1	0.45	45
9	<i>Cochlospermum religiosum (L.) Alston</i>	0.4	0.68	68
10	<i>Ananas comosus</i>	0.4	0.9	90
11	<i>Carica papaya L</i>	0.1	0.45	45
12	<i>Ipomoea batatas (L.) Lam.</i>	0.3	0.45	45
13	<i>Garcinia mangostana L.</i>	0.3	0.9	90
14	<i>Jatropha curcas</i>	0.3	0.45	45
15	<i>Erythrina senegalensis DC.</i>	0.3	0.45	45
16	<i>Pterocarpus erinaceus Poir.</i>	0.3	0.8	80
17	<i>Senna alata (L.) Roxb.</i>	0.4	0.9	90
18	<i>Psidium guajava. L.</i>	0.3	0.45	45
19	<i>Eucalyptus cameldulensis Dehnh</i>	0.3	0.8	45
20	<i>Eugenea caryophyllus (L.) Merr. &amp; L.M.Perry</i>	0.1	0.45	45
21	<i>Moringa oleifera Lam.</i>	0.4	0.9	90
22	<i>Azadirachta indica A.Juss.</i>	0.3	0.45	45
23	<i>Ficus glumosa Delile</i>	0.4	0.8	80
24	<i>Hibiscus sabdariffa L.</i>	0.1	0.9	90
25	<i>Musa angolensis</i>	0.1	0.8	80
26	<i>Cymbopogon citrates</i>	0.4	0.45	45
27	<i>Sesamum indicum</i>	0.1	0.45	45
2	<i>Spermacoce villosus Sw.</i>	0.3	0.45	45
8				
2	<i>Citrus sinensis (L.) Osbeck</i>	0.1	0.45	45
9				
3	<i>Schwenkia americana L</i>	0.1	0.45	45
0				
31	<i>Balanites aegyptiaca (L.) Delile</i>	0.1	0.45	45

### 3.4 Mode of Preparation

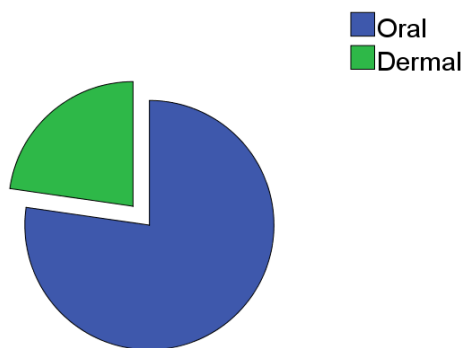
The recipe of traditional medicinal plants are prepared in many ways as mentioned by the respondents during the ethnobotanical survey. Some of the collected plants are used freshly by the traditional herbalist while some are dried and used in powdered form. The most commonly used method in preparation of the recipe is decoction 54.5 followed by infusion 27.3 % Figure 5 respectively. The respondents explained that after raining season all plants are dried and preserve to avoid complete drying of the plant in the forest due to lack of water.



**Figure 5: Mode of Preparation**

### 3.5 Diagnosis, Treatment and Dosage

The traditional herbalist identified patient with typhoid fever if he/she complained of weakness of the body, diarrhea, yellowish eyes and some part of the body, urination color is the major observation with some other symptoms as said by the respondents. The recipe is mostly taken orally 77.3% Figure 6. The recipe is taken three times daily after a meal, sometimes it is mixed with honey, milk or local food called *kohkoh*. The respondents normally asked their patients to drink teacup as the measurement of the recipe. The respondents have no specific time of stoppage of taken the recipe until all symptoms disappear. The respondent was asked if they refer their patient to the hospital for treatment of complicated typhoid fever but they said, they treated all kinds of typhoid fever. They also said they do not know the number of cases they treated per day as mentioned during the survey Figure 7.



**Figure 6: Mode of utilisation of plant material used for the treatment of typhoid fever**



**Figure 7: The researcher with the respondents**

### **3.6 Toxicity**

The respondents interview in the present study reported all the documented species have no site effect after consumption. No case has ever been reported to them by the patient for toxicity or complication. Nevertheless, they all believe there is some plants material that is toxic which is not listed in the present study.

## **4. Discussion**

The utilisation of medicinal plants by man is properly documented. The present knowledge of medicinal plants as sources to cure ailments dated back to the early civilization of man [14]. The chemical contents in plants have a diverse range of medicinal applications. All over the world, approximately 70=80 % rely on traditional medicinal plants for treatments of diseases and health improvement [15]. Presently, an enormous number of plants are being discovered for the treatment of diverse diseases [16]. As a result of the high cost of modern medicine in Africa; traditional medicinal plants are gaining more interest and acceptability to the populace. Focus on the traditional medicinal knowledge is increasing [17]. Over the last decades in Nigeria, there is enormous utilisation of traditional medicinal knowledge [18]. Traditional medicinal plants are used in the form of semi-solid, liquid, solid and vapor [19]. The ethnobotanical study revealed the people of Kaduna state, the Northern part of Nigeria rely on traditional herbal medicine to treat various ailments. The study aged people are the custodian of traditional knowledgeable of utilisation of medicinal plants. Men are the most knowledge of traditional medicinal plants in Northern Nigeria. This is due to the culture and beliefs of the community. The study is in conformity with the previous study of traditional medicinal plants carried out in Northern Nigeria [3, 20]. Also, the effectiveness was due to the presence of secondary metabolites in the plant parts such as alkaloids, phenolic glycosides, volatile oils [3]. The study quantitatively documented 31 traditional medicinal plants that are frequently used in the community of Kaduna state with Fabaceae and Myrtaceae family has highest abundance for the treatment of typhoid fever. Only plant high RFC of at least 0.45 was reported in the following study. The quantitative parameters determine in the following study revealed the popularity of the documented species in the treatment of typhoid fever. Leaves were found to be the used plant parts for the treatment of typhoid fever in Kaduna state. Globally, not Nigeria alone leaves are the most used

part in the treatments of ailments this is due to the fact that production of secondary metabolites take place in the leaves and their synergistic effect results in the efficacy of the plant. Water was found also as the main diluent of the plant material. Both methods of preparation were reported in the following study. The respondent reported the reasons for the utilisation of the methods as to inherit it from their parents. No scientific reason was given. Orally and birthing were the only methods reported for the administration of the plant material for the treatment of typhoid fever. The study did not tally with studies of ethnomedicinal plants used for the treatment of typhoid fever in Kenya. Morning, day, and the night was the time of administration reported by all respondent no specific dosage was also reported. With the increasing sources of polluted water in Nigeria due to the urbanization of automobiles. Utilisation of traditional medicinal plants remains the only sustainable solution to the treatment of typhoid fever in Nigeria. Frequent archiving of the above information will serve as background information in improving the Nigerian health care system, management of forest conservation, ecological monitoring, and research purposes. The study serves as a green light to the government to avoid oversampling of the documented species in Northern Nigeria. Increased in the prevalence of typhoid fever among all ages of the Nigerian population. There is an immediate need for scientific examination of the documented plants, as well as modernisation of traditional medicine to serve as approved alternative medicine.

## 5. Conclusion

The study established the people of Kaduna state Northern part of Nigeria are well knowledgeable of traditional medicine to treat typhoid fever using plant extract. It is also found elderly people are the custodian of the knowledge combined with deforestation for urbanization. Therefore, there is an urgent need to document all information related to traditional medicinal knowledge to treat various ailments. In Nigeria, there are many autonomous communities that are unexplored. The aged people are the custodian of traditional knowledge in Nigeria. Validation of the documented plants is paramount to further scientific investigation on the pharmacological efficacy of the plants. It is expected evaluation of the phytochemical contents from the leaf part will conserve the Northern Nigeria biodiversity. It is hoped the study will serve as an avenue for the development of the Nigerian medicinal plants database.

## 6. Acknowledgements

The author wishes to acknowledge the respondents for sharing their valuable knowledge for the development of our great Nation.

## 7. Conflict of interest

Author do not have any conflict of interests to declare. The author alone are responsible for the content of the paper.

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