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Medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria

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People in Katsina State, Nigeria have been using medicinal plants to cure several ailments associated with liver since time immemorial; however the use of such plants was never documented. In this study, an ethnobotanical survey was conducted to document the medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria. A semi-structured questionnaire method was adopted to interview 150 respondents (50 respondents from 1 Local Government Area of each of the three Senatorial Zones of the State) comprising herbalist, farmers, house wives, and others. A total of 62 plant species belonging to 57 genera distributed among 34 families were documented. Most of the reported plants belong to the Fabaceae (24.19%), Moraceae (6.45%), followed by Anacardiaceae, Euphorbiaceae and Asteraceae (each with 4.84%). *Senna occidentalis* L., *Ficus thonningii* Bl., and *Moringa oleifera* Lam. had the highest relative frequency of citation (RFC) of 0.75, 0.64, and 0.53 respectively. Majority (38.71%) of the reported plants were trees and about 79.03% of the surveyed plants are sourced from wild. Leaves were the most frequently used (45.16%) plants part. Most of the herbal medicines (80.65%) were prepared in form of decoction and all the medicines were administered orally. This is the first ethnobotanical study on hepatic ailments in the study area. Results of the study could serve as baseline data based on which further ethnopharmacological investigations would be carried out. Further researches aimed at conserving as well as validating the folkloric use of the surveyed plants would be ideal.

Key words: Ethnobotany, hepatic ailments, Katsina State, medicinal plants, Nigeria.

INTRODUCTION

Liver, the second-largest organ in the human body, plays a key role in the metabolism of various substances. Besides that, liver also performs vascular, immunological, secretory as well as excretory functions in the human body system (Mitra and Metcalf, 2009). Liver is involved in almost all the biochemical pathways to growth, fight against disease, nutrient supply, energy provision and reproduction (Ward and Daly, 1999). Unfortunately

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however, liver is being affected by both infectious and non-infectious diseases. Liver diseases pose a serious challenge to international public health (Ahsan et al., 2009). One of the most common causes of liver disease is inflammation, which often results from abuse of alcohol, poor diet or even malnutrition. Nigeria is one of the countries with largest burden of hepatitis B virus (one of the leading causative agents of hepatic ailments) with 10-15% prevalence (Owolabi and Ojo, 2008).

Unfortunately, conventional or synthetic drugs used in the treatment of liver diseases are inadequate and sometimes can have serious side effects (Rao et al., 2006). Moreover, there are still no specific treatments in modern medicine that give protection to the liver against damage or help to regenerate hepatic cells (Chatterjee, 2000; Chattopadhyay, 2003).

The scientific study of the relationship that exists between people and plants is called ethnobotany (Ijaz et al., 2017). Since the beginning of human civilization, medicinal plants have been used by mankind for its therapeutic value. Today about 80% of the world's population rely predominantly on plants and plant extracts for healthcare (Setzer et al., 2006). Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Many of these isolations were based on the uses of the agents in traditional medicine. In Nigeria, many rural communities have been using medicinal plants to cure various forms of ailments (Sani and Aliyu, 2011).

Recently, the use of medicinal plants to cure various forms of liver diseases and dysfunctions is becoming increasingly popular and has received wide acceptance (Oyagbemi and Odetola, 2010). Moreover, a large number of medicinal plants and compounds derived from them have been found to have some hepatoprotective ability (Kalaskar and Surana, 2014; Mishra et al., 2014; Arka et al., 2015; Xu et al., 2018).

The use of medicinal plants as traditional medicine is well known in rural areas of many developing countries. Traditional healers claim that their medicine is cheaper and more effective than modern medicine. Indigenous knowledge on the use of medicinal plants is transmitted orally in various communities of the world. This lead to fast disappearing of the knowledge due to the advent of modern technology and transformation of traditional culture and the younger generations are not interested in carrying on this tradition.

There is therefore, a great danger that this knowledge of traditional medicine could be lost. Katsina is one of the poor states of Nigeria. Most people in the area depend on medicinal plants for their healthcare because of poverty as well as affordability and accessibility of the medicinal plants (Kankara et al., 2015). Despite the intense use of the plants, no attempt was made to document their usage for hepatic ailments. It is against this background this research was designed with the aim of documenting medicinal plants used for the management of hepatic ailments in the study area.

MATERIALS AND METHODS

Study area

This research work was conducted in Katsina State, one of the northern states of Nigeria. Katsina State has a land area which covers 23,938 sq km, the state is located between latitudes of 11°08'N and 13°22'N and longitudes 6°52'E and 9°20'E with elevation of 465 m above sea level. The state is bounded by Niger Republic to the north, to the east by Jigawa and Kano States, Kaduna State to the south and Zamfara State to the west. The state has 34 local government areas which are categorized into three Senatorial Zones, namely the Katsina South, Katsina North, and the Katsina Central Senatorial Zones. From each Senatorial Zones, one local government was selected for the purpose of this research.

Data collection

This research work was conducted during the period of August 2016 to October 2016 in three Senatorial Zones of Katsina State, Nigeria. One local government area was randomly selected from each Senatorial Zone; the Local Government Areas were Batagarawa, Kankia, and Malumfashi. The ethnomedicinal plants data were gathered using a semi-structured questionnaire by interviewing 150 respondents (50 respondents from 1 Local Government Area of each of the Senatorial Zones of the State). The questionnaire was validated using Cronbach's alpha with $0.5 < \alpha \geq 0.8$ degree of consistency. During the interview, questions asked according to the questionnaire were divided into two parts, A and B. In part A, socio-demographic information of the respondents was recorded, and information of the plants used for the management of hepatic ailments was recorded in B part.

Collection and identification of plants specimens

Six field trips were carried out to collect the specimens of the reported plants from their natural habitat and cultivated lands with the help of some medicinal plants collectors, traditional healers and farmers. Flora collection permit was obtained from Local Authorities before embarking on the trips. Photographs of the plants were taken using a Sony (14.0) digital camera to aid in the botanical authentication of the plants. Identification of the reported plants was achieved by the aid of herbarium specimens deposited at Umaru Musa Yar'adua University Herbarium and literature on medicinal plants found in Nigeria. Further identifications of the surveyed plants were obtained using catalogue of life (2016) plants databases available online. Herbarium specimens were prepared and deposited in the Herbarium of Umaru Musa Yar'adua University, Katsina State.

Data analysis

A descriptive statistical method using percentages and frequencies was used to analyze the socio-demographic data of the respondents, and the results of this study were analyzed using the Relative Frequency of Citation (RFC). RFC is used to determine the relative importance of a particular species. It is determined using the relation: $RFC = Fc/N$, where Fc is the number of respondents

Table 1. Socio-demographic information of the respondents of ethnobanical survey of medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria.

Biodata	Frequency	Percentage (%)
Gender		
Male	57	38
Female	93	62
Age		
25-35	7	4.67
36-45	16	10.67
46-55	23	15.33
56-65	78	52
> 65	26	17.33
Educational status		
None	117	78
Primary	22	14.67
Secondary	9	6
Tertiary	2	1.33
Occupation		
Herbalists	69	46
Farmers	37	24.67
House wives	28	18.67
Others	16	10.67

who cited a particular species and N is the total number of the respondents (Tardio and Pardo-de-Santayana, 2008).

RESULTS AND DISCUSSION

Socio-demographic information

Table 1 shows the socio-demographic information of the respondents. As shown in the table, 57 respondents were males (38%) and 93 respondents were females (62%)among the total number of 150 respondents interviewed during the survey. Majority of the respondents (52%) are 56 to 65 years of age among the different age groups interviewed. Most of the respondents (78%) had no formal education, and 46% were herbalists. The research revealed that most of the respondents to the indigenous knowledge with regard to their age show that majority were of old age (Figure 1). This reveals that, the passage of ethnomedicinal knowledge is probably more from the elders to the younger ones as similarly reported by Adekunle (1992), and also knowledge transferred to the younger generation was very poor; they seem to keep the knowledge with them either for the sake of secrecy or due to apathy of the younger generation to traditional knowledge. This, however, poses a serious threat to the indigenous knowledge because it may eventually be lost forever following the demise of the older generation (Kankara et al., 2015).

Plant species used for liver diseases

Information on the medicinal plants used for the management of liver diseases in the study area is presented in Table 2. The table contains all the surveyed plants, their common names, scientific names, family names, parts of the plant used, growth habit, domestications, frequency of citation as well as modes of preparation and the routes of administration. A total of 62 plant species belonging to 57 genera, distributed among 34 families are used to treat various liver diseases in Katsina State, Nigeria. Senna occidentalis appeared to be the most popular specie in this study. Phytochemicals present in this plant (including but not limited to flavonoids, alkaloids, lignins, tannins and phenols) may be responsible for its curative power (Manikandaselvi et al., 2016). Several biological activities of S. occidentalis (formerly known as Cassia occidentalis) such as antimicrobial (Hussaini and Deeni, 1991), antimalarial

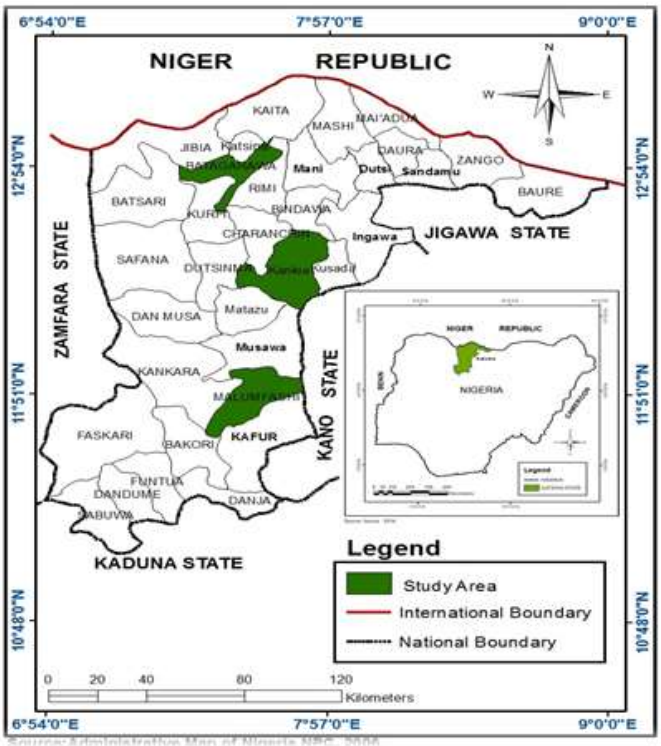

Figure 1. Map of Katsina State, Nigeria showing the study area.

(Tona et al., 2001), anti-inflammatory (Sadique et al., 1987) and anticarcinogenic (sharma et al., 1999) are reported. It is also interesting to note that hepatorotective effect of S. occidentalis has been proven scientifically (Jafri et al., 1991; Usha et al., 2007). It is also worth noting that some of the species reported in this study such as Hibiscus sabdariffa, Moringa oleifera and Zingiber officinale are also used for the same purpose elsewhere (Panday, 2011). The highest recorded family is Fabaceae with 15 species, followed by Moraceae with 4 species, and Anacardiaceae, Asteraceae, and Euphorbiaceae with 3 species each. Connaraceae, Convolvulaceae, Malvaceae, Meliaceae, and Myrtaceae are represented by 2 species each, whereas 24 families contributed 1 species each (Figure 2). The high occurrence of the family Fabaceae could be explained by the fact that most species belonging to the family Fabaceae are mostly found throughout the seasons because they are adapted to withstand the adverse effects of Sahel regions as reported by Kankara et al. (2015). This is however, contrary to the findings of Kalaskar and Surana (2004) who reported that majority of plants used against liver diseases by different tribes of India belong to the Malvaceae family. While majority of plants used to treat liver problems in Maritime region of Togo belong to Caesalpiniaceae (Kpodar et al., 2015).

Majority of the plants used to treat liver diseases in the study area (38.71%) were reported as trees (Figure 3), followed by shrubs (37.10%), and herbs (24.19%). This may be due to the fact that this growth form is available in almost all seasons and in addition are not affected by seasonal variations as reported by Albuquerque (2006). Majority (79.03%) of the plants reported in this study are sourced from the wild (Figure 4). This may not be unconnected to the belief that wild plants have more healing power than their cultivated counterparts. Similar findings were also reported from Togo and India (Haile and Delenasaw, 2007; Kpodar et al., 2015). This has a negative consequence on the plants' diversity of the area as the area is already being faced by other ecological problems. Leaves are the main used plant part in this study (45.16%), followed by the bark (35.48%), and the whole plant (24.19%), whereas the fruit, flower, rhizome, root, stem, and seed account only for 16.11% all together. This corresponds with the findings of other ethnomedicine studies in Africa like Uganda, Ethiopia and Mali where it was reported that most of the plant parts used in different preparations for remedy were the leaves (Tagola, and Diallo 2005). Most of the medications (80.65%) are prepared as decoction (Figure 5), then powder (16.13%), and maceration (3.23%). This also agrees with the findings of Kpodar et al. (2016) who found that medicinal plants used for liver diseases in the Maritime Region of Togo are mostly prepared as decoctions.

White potassium is added in most cases to the

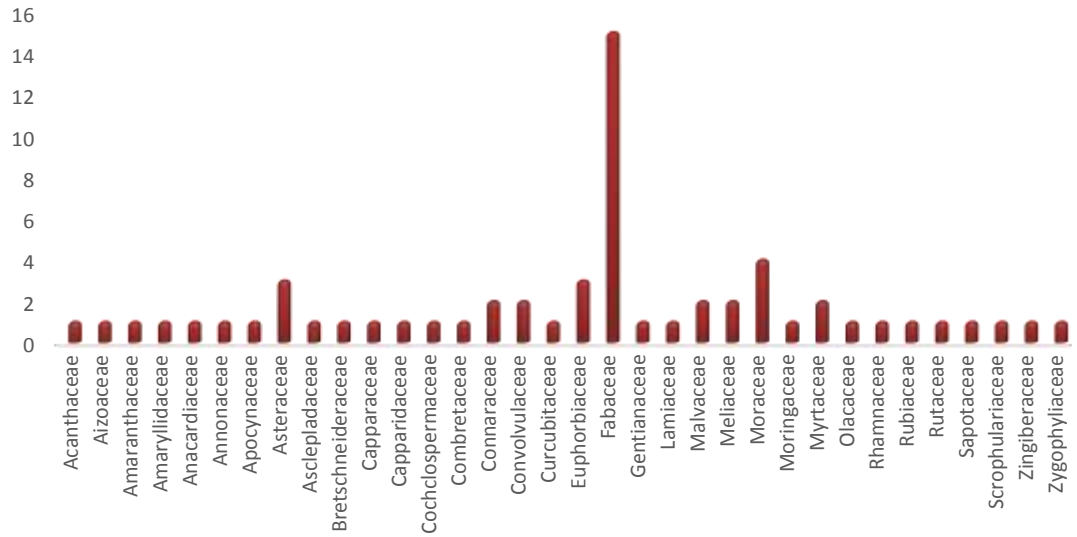

Figure 2. Distribution of plant families used for the management of hepatic ailments in Katsina State, Nigeria.

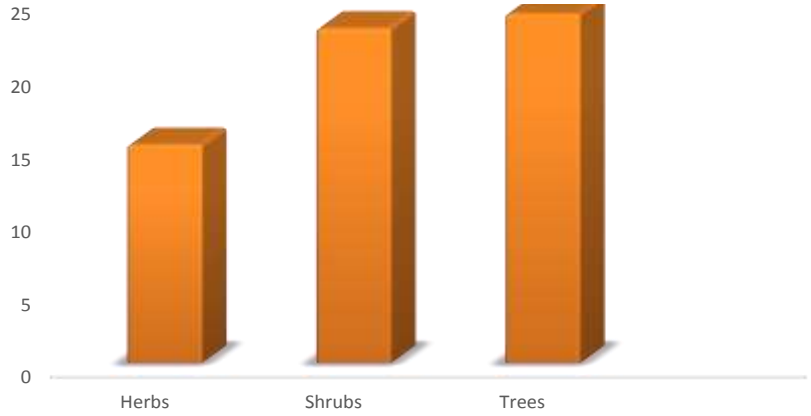

Figure 3. Habit status of medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria.

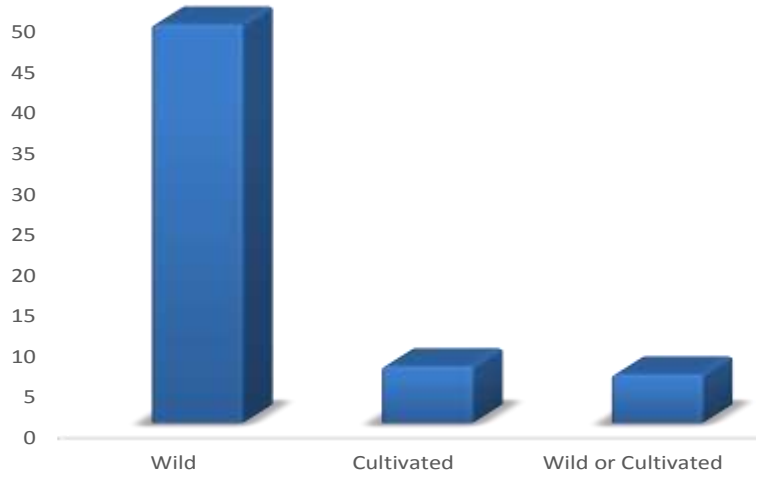

Figure 4. Habitat status of the medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria.

Table 2. Medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria.

Botanical name (Family)	Local name	Common name (Voucher No.)	Part used	Habit/Habitat	RFC	Mode of preparation	Route of administration
Acacia nilotica (L.) Delile (Fabaceae)	Bagaruwa	Black piquant (SSK156)	B, Sd	T/W	0.28	Decoction	Oral
Acanthospernum hispidum DC. (Asteracaae)	Yawo	Bristle star bur (SSK181)	WP	H/W	0.22	Decoction	Oral
Adansonia digitata L. (Malvaceae)	Kuka	Baobab (SSK184)	B	T/W	0.15	Decoction	Oral
Allium sativum L. (Amaryllidaceae)	Tafarnuwa	Garlic	Rh	H/C	0.19	Decoction	Oral
Amaranthus spinosus L. (Amaranthaceae)	Alayyahu	Spiny pigweed (SSK161)	WP	H/C	0.13	Decoction	Oral
Anogeissus leiocarpa DC. (Guill. And Perr.) (Combretaceae)	Marke	African birch (SSK121)	B, L	T/W	0.08	Decoction	Oral
Annona senegalensis Pers. (Annonaceae)	Gwandar daji	African custard apple	L	S/WorC	0.16	Decoction	Oral
Anthocleista djanlonensis A. Chavalier. (Gentianaceae)	Kandare	(SSK148)	B, L	T/W	0.14	Decoction	Oral
Artemesia annua L. (Asteraceae)	Tazargade	Sweet annie	L	S/C	0.10	Decoction	Oral
Azadirachta indica A.Juss (Meliaceae)	Bedi	Neem tree (SSK125)	L	T/WorC	0.19	Decoction	Oral
Balanites aegyptiaca (L.) Delile (Zygophyliaceae)	Aduwa	Desert date (SSK167)	B	T/W	0.11	Decoction	Oral
Bauhinia rufescens Lam. (Fabaceae)	Tsattsagi	Silver Butterfly tree (SSK168)	L, B	T/W	0.11	Decoction	Oral
Bauhinia reticulata DC. (Fabaceae)	Kalgo	Mountain ebony (SSK114)	B	T/W	0.13	Decoction	Oral
Boscia salicifolia Oliv. (Capparidaceae).	Zure	Willow-leaved Shepherds tree (SSK171)	L	S/W	0.01	Powder	Oral
Boswellia dalzielii Hutchinson	Hano	Frankincense tree	B	T/W	0.11	Decoction	Oral

Table 1. Contd.

(Connaraceae)		*(SSK115)*					
Byrsocarpus coccineus Schum and Thonn (Connaraceae)	Tsamiyar kasa	Tamarind of the valley	WP	H/W	0.03	Decoction	Oral
Cassia nigricans Vahl. (Fabaceae)	Gewaya tsamiya	Chamaecrista nigricans (SSK170)	L	H/W	0.11	Maceration	Oral
Cassia arereh Delile (Fabaceae)	Malga	(SSK137)	R	S/W	0.10	Decoction	Oral
Cassia mimosoides L. (Fabaceae)	Bagaruwar kasa	Fishbone cassia (SSK180)	WP	H/W	0.11	Decoction	Oral
Calotropis procera (Ait.) P.T Li (Apocynaceae)	Tumfafiya	Sodom apple (SSK182)	L, St	S/W	0.10	Decoction	Oral
Carica papaya L. (Bretschneideraceae)	Gwanda	Papaya	L	S/C	0.07	Decoction	Oral
Citrus aurentifolia (Christm.) Swingle (Rutaceae)	Lemun tsami	Lime (SSK113)	L, Fr	S/C	0.19	Decoction	Oral
Cochlospermum tinctorium Perr. A. Rich. (Cochlospermaceae)	Rawaya		Rh	S/W	0.17	Powder	Oral
Crateva adansonii DC. (Capparaceae)	Ungududu	Three-leaved caper (SSK185)	L	T/W	0.10	Decoction	Oral
Dichrostachys cinerea (L.) Wight and Arn. (Fabaceae)	Dundu	Kalahari christmas tree (SSK134)	L	S/W	0.03	Powder	Oral
Eucalyptus camaldulensis Dehnh (Myrtaceae)	Turare	River red gum (SSK174)	L	T/W	0.35	Decoction	Oral
Euphorbia convolvuloides Hochst.ex Benth (Euphorbiaceae)	Nonon kurciya	Athsma herb (SSK189)	WP	H/W	0.14	Decoction	Oral
Euphorbia balsamifera Aiton,Hort. (Euphorbiaceae)	Aliyara	Balsam spurge (SSK183)	L, St	S/W	0.08	Decoction	Oral

Table 1. Contd.

Evolvulus alsinoides L. (Convolvulaceae)	Kafi malam	Dwarf morning glory (SSK190)	WP	H/W	0.09	Decoction	Oral
Faidherbia albida (Delile) A.Chev. (Fabaceae)	Gawo	Winter thorn	B	T/W	0.09	Decoction	Oral
Ficus congensis Engl. (Moraceae)	Baure	Fig (SSK154)	B	S/W	0.12	Decoction	Oral
Ficus polita Var. Persicicarpa Hutch. (Moraceae)	Durumi	Heart-leaved fig	L, B	T/W	0.08	Powder	Oral
Ficus platyphylla Del. (Moraceae)	Gamji (SSK155)	Guttapercha tree	L, B	T/W	0.13	Powder	Oral
Ficus thonningii Bl. (Moraceae)	Cediya	Strangler fig (SSK150)	L	T/W	0.64	Decoction	Oral
Hibiscus sabdariffa L. (Malvaceae)	Soborodo	Roselle (SSK188)	L, F	S/C	0.13	Decoction	Oral
Indigofera astragalina DC. (Fabaceae)	Kaikai koma kan mashekiya	Silky indigo (SSK173)	WP	H/W	0.09	Decoction	Oral
Ipomea asarifolia (Desr.) Roem. And Schult. (Convolvulaceae)	Duman kada	Morning glory	WP	H/W	0.12	Decoction	Oral
Jatropha curcas L. (Euphorbiaceae)	Cin da zugu	Barbados nut (SSK118)	L	S/WorC	0.42	Decoction	Oral
Khaya senegalensis (Desv.) A. Juss (Meliaceae)	Madaci	African mahogany (SSK177)	B	T/W	0.09	Decoction	Oral
Lannea acida A.Rich (Anacardiaceae)	Faru	Grape (SSK172)	B	T/W	0.14	Decoction	Oral
Leptadenia hastata (Pers.) Decne (Asclepladaceae)	Yadiya	(SSK165)	WP	H/W	0.13	Decoction	Oral

Table 1. Contd.

Mangifera indica L. (Anacardiaceae)	Mangwaro	Mango (SSK142)	L, B	T/WorC	0.12	Decoction	Oral
Mitragyna inermis (Willd.) Kuntze (Rubiaceae)	Giyayya	False abura	B	S/W	0.08	Decoction	Oral
Momordica balsamina L. (Curcubitaceae)	Garahuni	Balsam apple (SSK126)	WP	S/W	0.10	Decoction	Oral
Moringa oleifera Lam. (Moringaceae)	Zogala	Drumstick tree (SSK122)	L, R	S/WorC	0.53	Decoction	Oral
Ocimum basilicum L. (Lamiaceae)	Doddoya	Sweet basil (SSK164)	WP	H/W	0.09	Decoction	Oral
Parkia biglobosa (Jacq.) G. Don (Fabaceae)	Dorowa	African locust bean tree (SSK128)	B	T/W	0.12	Decoction	Oral
Peristrophe bicalyculata (Retz) Nees (Acanthaceae)	Tubanin dawaki	Horse flower (SSK179)	WP	H/W	0.07	Decoction	Oral
Prosopis africana (Guill. And Perr.) Taub. (Fabaceae)	Kirya	African mesquite (SSK133)	B	T/W	0.13	Decoction	Oral
Psidium guajava L. (Myrtaceae)	Gwaba	Guava (SSK158)	L	S/WorC	0.11	Decoction	Oral
Senna obtusifolia (L.) H.S. Irwin and Barneby (Fabaceae)	Tafasa	Sickle pod (SSK162)	L	S/W	0.11	Powder	Oral
Senna occidentalis L. (Fabaceae)	Tafasar masar	Coffee senna (SSK176)	WP	S/W	0.75	Decoction	Oral
Senna singueana (Delile) Lock (Fabaceae)	Runhu	Wild cassia (SSK127)	L	S/W	0.15	Decoction	Oral
Sclerocarya birrea (A.Rich.) Hochst. (Anacardiaceae)	Danya	Marula (SSK157)	B	T/W	0.01	Maceration	Oral
Striga hermonthica (Delile) Benth (Scrophulariaceae)	Gaugai	Purple witchweed (SSK178)	WP	H/W	0.10	Decoction	Oral
Tamarindus indica L. (Fabaceaea)	Tsamiya	Indian date (SSK169)	B, L	T/W	0.11	Decoction	Oral

Table 1. Contd.

Vernonia amygdalina Delile (Asteraceae)	Shuwaka	Bitter leaf (SSK186)	L	S/W	0.03	Powder	Oral
Vitellaria paradoxa C.F.Gaertn (Sapotaceae)	Kadanya	Shea butter tree (SSK187)	B	T/W	0.08	Powder	Oral
Ximenia americana L. (Olacaceae)	Tsada	Tallow wood (SSK131)	B	T/W	0.11	Powder	Oral
Zaleya pentandra (L.) C. Jeffrey (Aizoaceae)	Gadon maciji		WP	H/W	0.14	Decoction	Oral
Ziziphus mauritiana Lam. (Rhamnaceae)	Magarya	Indian jujube (SSK130)	L	S/W	0.17	Powder	Oral
Zingiber officinale Roscoe (Zingiberaceae)	Citta	Ginger	Rh	S/C	0.17	Decoction	Oral

RFC = Relative Frequency of Citation, H = Herbs, S = Shrubs, T = Tree, W = Wild, C = Cultivated, WorC = Wild or Cultivation, B = Bark, L = Leaves, F = Flower, R = Root, Fr = Fruit, Rh = Rhizome, Sd = Seed, St = Stem, WP = Whole plant.

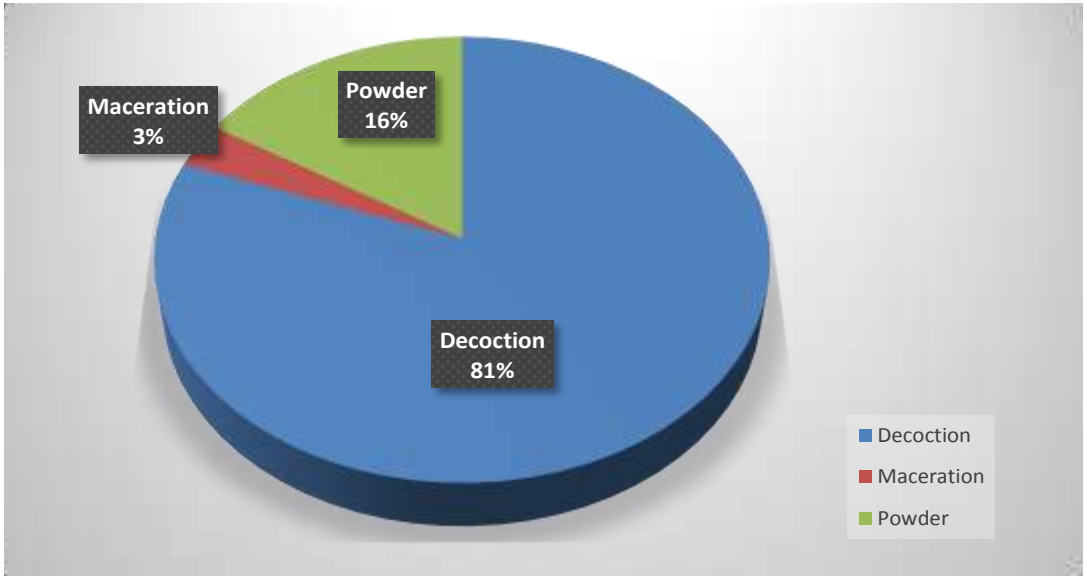

Figure 5. Mode of preparation of medicinal plants used for the management of hepatic ailments in Katsina State, Nigeria.

decoctions to inactivate the bitter taste of the medications. Various additives such as, cow milk, porridge, honey, etc were mixed with the powdered medicines in remedy preparations. More than one plant species have been reported to be used by the people in remedy preparation for hepatic ailments. This could be attributed to additives or synergistic effect that they could have during treatment (Haile and Delenasaw, 2007), while some plants are prepared singly and this agrees with other findings in Bolivia (Macia, 2005).

Following the interview with traditional healers it has been reported that majority were found to have poor knowledge of dosage and antidote while giving prescription of remedy to the patients, and most of the preparations were said to have no side effect except vomiting and in rare cases watery stool and this may be attributed to the low toxicity of medicinal plant species used by the local herbalist (Haile and Delenasaw, 2007).

The major threat to the availability of medicinal plants in the study area was deforestation. This could be attributed to the additional values of the majority of ethnomedicinal plants in the study area as well as current high demand for fuel wood as an energy source. Therefore effort should be made to conserve the diversity of these vital resources.

Conclusion

This study provides the first ethnobotanical data on the use of plants to manage hepatic ailments in the study area. From the study, it is evident that people in the study area still rely on medicinal plants for their primary healthcare. There is no doubt that this study will greatly help in preventing the erosion of indigenous knowledge. Considering the fact that most of the plants reported in this study appeared to be rare, there is an urgent need for strategies towards conserving such vital resources. Further researches aimed at validating the folkloric use of the surveyed plants is also ideal.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Adekunle MF (1992). "Traditional Medicines and wild plant conservation." A case study of Ogun State Nigeria B. for theise University of Agric. Abeokuta, Nigeria

Ahsan R, Islam M, Bulbul JI, Musaddik A, Haque E (2009). Hepatoprotective activity of Methanol extract of some Medicinal plants against carbon tetrachloride - induced hepatotoxicity in rats. European Journal of Scientific Research 37(2):302-310.

Albuquerque UP (2006). Re-examining Hypothesis Concerning the Use and Knowledge of Medicinal Plants: A Study in the Caatinga Vegetation of NE Brazil. Journal of Ethnobiology and Ethnomedicine 2(1):30.

Arka G, Anindita K, Ankit S, Kumar SA, Kumar MS (2015). Preliminary evaluation of hepatoprotective potential of the polyherbal formulation. Journal of Intercultural Ethnopharmacology 4(2):118.

Chatterjee TK (2000). Medicinal Plants with Hepatoprotective Properties. Herbal Options 3:135-7.

Chattopadhyay RR (2003). Possible Mechanism of Hepatoprotective Activity of Azadirachta indica Leaf Extract; Part II. Journal of Ethnopharmacology 89(2-3):217- 219.

Haile Y, Delenasaw Y (2007). Traditional Medicinal Plants Knowledge and Uses by Local Healers in Sekoru District Jimma Zone Ethiopia. Journal of Ethnobiology and Ethnomedicine 3(1):24.

Hussaini HSN, Deeni YY (1991). Plants in Kano Ethnomedicine: Screening for antimicrobial activity and alkaloids. International Journal of Pharmacognosy 29(1):51-56

Ijaz F, Iqbal Z, Ur Rahman I, Ali N, Afzal M (2017). People-Plants Interaction and Its Uses: A Science of Four Words “Ethnobotany”. Alternative Integrated Medicine 6(235):2

Jafri MA, Subhani MJ, Javed K, Singh S (1999). Hepatoprotective activity of leaves of Cassia occidentalis against paracetamol and ethyl alcohol intoxication in rats. Journal of Ethnopharmacology 66(3):355-361.

Kalaskar MG, Surana SJ (2014). Ethnomedicinal plants used against liver diseases among the tribes of India. Journal of Biological Science 14(3):154-68.

Kpodar MS, Karou SD, Katawa G, Anani K, Gbekley HE, Adjrah Y, Simpore J (2016). An Ethnobotanical Study of Plants Used to treat Liver Diseases in the Maritime Region of Togo. Journal of Ethnopharmacology 181:263-273.

Kankara SS, Ibrahim M., Mustafa M, Go R (2015). Ethnobotanical survey of medicinal plants used for traditional maternal healthcare in Katsina state, Nigeria. South African Journal of Botany 97:165-175.

Macia MJ (2005). An Ethnobotanical Survey of Medicinal Plants Commercialized in the Markets La Paz and El Alto, Bolivia. Journal of Ethnopharmacology 97(2):337-350.

Manikandaselvi S, Vadivel V, Brindha P (2016). Studies on physicochemical and nutritional properties of aerial parts of Cassia occidentalis L. Journal of Food and Drug Analysis 24(3): 508-515.

Mishra S, Pani SR, Rout KK, Nayak SK, Sahoo S (2014). Bioassay Guided Fractionation and Hepatoprotective Activity of Oleanolic Acid Acetate Isolated from Vitex negundo Linn. Journal of Biologically Active Products from Nature 4(2):89-100.

Mitra V, Metcalf V (2009). Metaboloic function of liver. Anaesthesia and Intensive Care Medicine 10(7):334-335.

Owolabi HA, Ojo AS (2008). Hepatitis B virus and chronic liver disease in Nigeria: a brief review of literature. Journal of the Obafemi Awolowo University Medical Student's Association (IFEMED), 14(1):6-10.

Oyagbemi AA, Odetola AA (2010). Hepatoprotective Effects of Ethanolic Extract of Cnidoscolus aconitifolius on Paracetamol

Induced Hepatic Damage in Rats. Pakistan Journal of Biological Sciences 13(4):164-169.

Panday G (2011). Medicinal plants against liver disease. International Research Journal of Pharmacy 2:115-121.

Rao GMM, Rao CV, Pushpangadan P, Shirwaikar A (2006). Hepatoprotective Effects of Rubiadin, A Major Constituent of Rubia cordifolia Linn. Journal of Ethnopharmacology 103(3):483-490.

Sadique J, Chandra T, Thenmozhi V, Elango V (1987). Biochemical modes of action of Cassia occidentalis and Cardiospermum halicacabum in inflammation. Journal of Ethnopharmacology 19(2)201-212.

Sani H, Aliyu BS (2011). A Survey of Major Ethnomedicinal Plants of Kano North, Nigeria, their Knowledge and Uses by Traditional Healers. Bayero Journal of Pure and Applied Sciences 4(2):28-34.

Setzer MC, Werka JS, Irvine AK, Jackes BR, Setzer WN (2006). Biological activity of rainforest plant extracts from far north Queensland, Australia. In biologically active natural products for the 21st century (pp. 21-46). Research Signpost.

Sharma N, Trikha P, Athar M, Raisuddin S (1999). Protective Effect of Cassia occidentals Extract on Chemical-Induced Chromosomal Aberrations in Mice. Drug and chemical toxicology 22(4):643-653.

Tardio J, Pardo-de Santayana M (2008). Cultural importance indices: a

comparative analysis based on the useful wild plants of southern Cantabria (Northern Spain). Economic Botany. 62(1):24–39

Tagola A, Diallo D (2005). Ethnopharmacological Survey of Different Uses of Seven Medicinal Plants from Mali (West Africa) in the Region of Doila, Kolokaini, and Siby. Jounal of Ethnobiology and Ethnomedicine 1(1):7.

Tona L, Mesia K, Ngimbi NP, Chrimwami B, Okond'Ahoka, Cimanga K, Pieters L (2001). In-vivo antimalarial activity of Cassia occidentalism Morinda morindoides and Phyllanthus niruri. Annals of Tropical Medicine & Parasitology 95(1):47-57.

Ward FM, Daly MJ (1999). Hepatic disease. In: Clinical pharmacy and therapeutics (Walker R. And C. Edwards Eds.). Churchill Livingstone, New York.

Xu GB, Xiao YH, Zhang QY, Zhou M, Liao SG (2018). Hepatoprotective natural triterpenoids. European Journal of Medicinal Chemistry 145:691-716.