

**Medicinal Plants used for Complementary and Alternative Cancer Therapy in Katsina State, Northwestern Nigeria**

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ABSTRACT

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In Katsina State, Nigeria, medicinal plants are widely used for the management of cancer. The usage is however, poorly documented. In this study an ethnobotanical survey of medicinal plants used for the management of cancer in Katsina State, using semi-structured questionnaire. Descriptive statistics were used to present the data on demographic information of the respondents. Relative Frequency of Citation (RFC) and Use Consensus Value (UCV) were used to analyze the popularity of the cited species. Among the 180 respondents, 159 (88%) were males and 21 (12%) females. The majority of the respondents (32.7%) were between 61-75 years of age. Most of the respondents (85%) were married. Majority (68%) of the respondents had no formal education, while 123 (68.88%) of the respondents were herbalists. Fifty six (56) medicinal plants distributed in 22 families were documented. Most of the species belong to Fabaceae family with 21 representatives and *Diospyros mespiliformis* had the highest RFC and UCV of 0.15 and 0.30, respectively, while the least RFC and UCV were seen in *Tamarindus indica* with 0.09 and 0.18, respectively. Of the 57 species, 46 (81%) were trees and 11 (19%) shrubs. Most of the medications (63%) are prepared as decoction and powder. Some of the cited species are utilized for the same purpose in different parts of the world and potent anticancer potentials of some of the cited species have since been unravelled. Further studies aimed at scientifically authenticating and isolating compound with anticancer potentials from the documented species would be highly valuable.

Keywords: Cancer; Ethnobotany, Medicinal plants; Katsina State, Nigeria.

Introduction

Cancer, uncontrolled cells' growth, is the leading cause of death worldwide.¹ It was estimated that cancer causes more deaths than all coronary diseases or all strokes.² Almost 8.2 million people die as a result of cancer each year, accounting for about 13% of all deaths. Annually, about 6 million new incidences of cancer are reported.³ More than 100 types of cancer exist and each requires unique diagnosis and treatment and it is predicted that by the year 2020 new cases of cancer in the world will increase to more than 15 million, while deaths from various types of cancer will rise to about 12 million.¹

Due to population aging and growth, as well as the adoption of cancer-associated lifestyles such as smoking, physical inactivity and "westernized" diets, the burden of cancer is increasing in developing countries.⁴ Although developed countries have put in place various measures to prevent certain types of cancer, the incidence of such cancers is relatively higher in developing countries. This disparity is attributed partly, to early detection and access to advanced diagnostic modalities and cancer therapies.⁵ Nigeria has the highest cancer deaths in Africa with 10,000 people dying every year.¹ Although many observers believed that there could be as high as 500,000 new cancer cases annually in Nigeria, the World Health Organisation report that 100,000 new cases are being reported annually.⁶ It is projected that by

the year 2020 the incidence of cancer in Nigerian males and females will be 90.7/100,000 and 100.9/100,000, respectively.⁷

Chemotherapy remains the most popular option for cancer treatment. In the last five decades useful chemotherapeutic agents such as 5-fluorouracil, doxorubicin, bleomycin and cyclophosphamide, to mention but a few, have been developed, courtesy of systematic drug discovery and development. However, these chemotherapeutic agents are associated with various abnormal health conditions including but not limited to cardiotoxicity, renal toxicity, myelotoxicity, bladder toxicity, immunosuppression, alopecia and haemorrhagic cystitis.⁸ Because of their less toxic side effects compared to chemotherapeutic agents, as well as availability, naturally derived compounds from plants are gaining popularity in cancer treatment. Since time immemorial, herbal medicine has been in use, especially in developing countries, where the majority of the population had no or limited access to state-of-the-art healthcare facilities, to treat various ailments including cancer.⁹ Several studies have been conducted in different parts of the world to document the usage of medicinal plants in the management of cancer.¹⁰⁻¹⁴ Many scientific pieces of research aimed at validating the anticancer properties of various plant species, especially those used for the folkloric treatment of cancers in developing countries have been conducted.¹⁵⁻²⁰

Katsina is one of the most populous states in Nigeria. Economically, the state is among the poorer states of the country. Healthcare facilities are very scanty in the state, a reason why majority of the population depends on plants for the management of various health conditions including cancer. However, plant diversity is facing both human and natural threats including unsustainable exploitation, deforestation, desert encroachment, flooding, etc. Despite the intense use of herbal medicine in Katsina State, very few studies have documented their usage as information on herbal medicine is in most cases, passed orally from one generation to another.²¹ Despite several attempts to document medicinal plants used in the management of cancer around the globe, to date, to the best of our knowledge, there is little or no ethnobotanical studies on cancer in the study area. This study is,

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therefore, an attempt to document medicinal plants used for the management of cancer in Katsina State, Nigeria.

Materials and Methods

Study area

This study was conducted in Katsina State, northwestern Nigeria. The state is located between latitudes 11°08'N and 13°22'N and longitudes 6°52'E and 9°20'E. It covers an area of 23,938 Sq. km. The State has 34 Local Government Areas and for the purpose of this study, it is divided into three senatorial zones namely Katsina South, Katsina North and Katsina Central. Three local government areas from each of the senatorial zone were randomly selected for the study.

Data collection

This study was conducted from April to October 2018. Ethnobotanical data were obtained using semi-structured questionnaire. The target respondents for this study were herbalists, petty traders, farmers, civil servants and other people with the knowledge of medicinal plants usage. The questionnaire was divided into two sections (A and B). In section A, socio-demographic information of the respondents was recorded, while information on the plants used for the management of cancer was recorded in section B. Twenty (20) respondents were selected from each LGA. Before the interviews, consent approvals were secured from local authorities. Potential respondents were briefed on how rapidly the knowledge of medicinal plants' usage is diminishing in the area and the importance of preserving and conserving both the indigenous knowledge and plant biodiversity before they are completely lost. Interviews were conducted in Hausa Language and each respondent was interviewed alone to ensure confidentiality. Report of the interview was later transcribed to English Language. Interview was facilitated by "key herbalist" in each sampled area. Only plants cited to cure cancer by at least three respondents were documented and only plants that were used to cure external cancers (breast cancer and different sarcomas), locally referred to as "*ciwon daji*" were considered in this study.

Collection and identification of plants specimen

With the help of some of the respondents, series of field trips were conducted in order to collect cited plants from natural vegetation and/or home gardens. Sampled plants were identified by the use of herbarium specimen and literature on Nigerian medicinal plants by the help of renowned taxonomist in person of Dr. Abubakar Bello of Biology Department, Umaru Musa Yar'adua University, Katsina. Online database of plant biodiversity such as Catalogue of Life, CITES, FishBase and IUCN Red List were used to confirm the identity of the cited plants. Voucher specimens were prepared and deposited at the Herbarium of Biology Department, Umaru Musa Yar'adua University, Katsina, Nigeria.

Data analysis

Descriptive statistics using frequency and percentage were used to analyze the socio-demographic data of the respondents, while the results of the ethnobotanical survey were analyzed using Relative Frequency of Citation (RFC) and Use Consensus Value (UCs).

Relative Frequency of Citation (RFC)

This was calculated to determine the relative importance of a particular species. It was determined using the relation $RFC = Fc/N$. Where Fc is the number of respondents who cited a particular species and N is the total number of the respondents.²¹

Use Consensus Value (UCV)

This measures how large the degree of accordance is between informants concerning whether they regard a species as useful or not.²² It was used to identify plants of particular inter cultural relevance and to agree on their use. $UCV = 2ns/n-1$, where ns = number of people

using a species, n = total number of informants and its value ranges between 0 to +1.

Results and Discussion

Socio-demographic information of the respondents

Table 1 shows the socio-demographic information of the respondents. It can be seen that most of the respondents were males (88%). This is similar to the earlier reported findings that men have more knowledge of herbal cancer therapy than their female counterparts in neighboring Kebbi and Sokoto states in northern Nigeria,^{23,24} Iwo and Ibadan; Ilorin and Lagos in southwestern Nigeria^{25,26} and Greater Casablanca, Morocco.²⁷ This is however contrary to another report that 67% of respondents for ethnobotanical study on cancer in Bali, Gashaka and Sardauna Local Government Areas of Taraba State in Nigeria were females.²⁸ Another ethnobotanical study on cancer in Morocco revealed that 75% of the respondents were females.²⁹ The difference in their findings may not be unconnected with the fact that the latter used cancer patients admitted at various hospitals, majority of whom were women. Voeks however, reported that women are more familiar with field identities and medicinal values of local flora in northeastern Brazil.³⁰ The fact is that women mainly treat children and typical child diseases, while men treat both children and adults. Many of the respondents (59%) range between 61-75 years of age. This poses great threat to the indigenous knowledge, as it may eventually be lost following the death of the older generation. Aliyu and Abubakar also reported that people with older age are more knowledgeable in treating cancer with medicinal plants in Northeastern Nigeria.³¹ However, in Maknes-Taflate Region of Morocco, most people that reported the use of medicinal plants to cure cancer were between 16 and 30 years old.³² Majority of the respondents in this study had no formal education. Previous ethnobotanical studies on cancer also revealed that majority of stakeholders are people with no formal education.^{28,29,31} In West Bank region of Palestine, however, majority of respondents (76%) who participated in an ethnobotanical study on cancer had formal education.³³ Majority of the respondents in this study (68.33%) were herbalists. This indicates that herbalists in the study area play a very important role in the provision of healthcare needs of the community. It also further reiterates the impression that ethnobotanical knowledge can best be obtained from the indigenous people who trade plants as a means of survival.^{34,35}

Medicinal plants used in the management of cancer

Table 2 shows the medicinal plants used for the management of cancer, in Katsina State, Nigeria. Scientific, vernacular and common names of the cited species were provided in the table. Habit, habitat, part used, mode of preparation and route of administration were also indicated in the table. A total of fifty six (56) medicinal plants belonging to twenty two (22) families are used for the management of various types of cancer in the study area. *Diospyros mespiliformis*, *Piliostigma reticulatum*, *Tamarindus indica*, *Detarium senegalensis*, *Ficus congensis*, *Ximenia americana*, *Azadirachta indica* and *Acacia nilotica* had the highest relative frequency of citation (RFC) of 0.15, 0.11, 0.09, 0.07, 0.07, 0.06, 0.06 and 0.06, respectively. It can also be observed that the RFC of the cited species is generally low. This indicated that herbal medicine practitioners in the study area used different species to cure cancer related ailments. It is interesting to note that some of the species cited in this study are equally used to manage cancer in different parts of the world. *D. mespiliformis*, *T. indica*, *A. nilotica* and *A. indica* for example, were also reported to be the most widely used species in managing cancer in Northeastern Nigeria.³¹ *Afromamum melegueta*, *Annona senegalensis*, *Mitragyana inermis* and *Securidaca longipedunculata* were also reported to be used in treating various types of cancers in Southwestern Nigeria.³⁶ *Securidaca longipedunculata* was reported to be the most popular plant used by the *Ijebus* for managing cancer in Southwestern Nigeria.³⁷ *Lawsonia inermis*, *Ziziphus mauritania* and *Z. spina-christi* are also used for the same purpose in Southern Region of Ilam, West Iran.³⁸ Reports from Algeria and Morocco further informed that leaves

and flowers of *L. inermis* are widely used in treating breast, skin, ovary and prostate cancers.²⁹ In Brazil, leaves, seeds and roots of *Senna occidentalis* were reported to be used in managing cancer.³⁹ Fruits, leaves and roots of *Z. mauritania* and *Z. spina-christi* are also widely used to cure breast cancer, general cancer and tumors in Ethiopia.⁴⁰

It is noteworthy that some of the species cited in this study contain chemicals that have anticancer potentials. *L. inermis* for example, contains lawsone which is used as a starting material in the synthesis of isoplumbogin, apigenin, apigenin glycoside and luteolin, all of which were reported to have cytotoxic and chemopreventive activities against different types of cancer cells.⁴¹ Ethanol crude extract of *S. occidentalis* was also found to have cytotoxic activities against breast cancer (MCF-7), lung cancer (H-460) and Central Nervous System (SF-268) cell lines.⁴² In another study, both *in vitro* cytotoxic activity against HL-60, Molt-4, HeLa and *in vivo* activity against Ehrlich ascites carcinoma in Swiss albino rats were attributed to the seed extracts of *Z. Mauritania*.⁴³ Ethanol extracts of aerial parts of *A. nilotica* also lowered Dalton's ascetic lymphoma (DAL)-induced solid and ascetic tumors in BALB/c mice.⁴⁴ In another study, *in vitro* antiproliferative activity of the petroleum ether extract of *A. senegalensis* against throat cancer cell line (HEp-2) was also reported.⁴⁵

Most of the cited species (21) belong to the family Fabaceae (Figure 2). High occurrence of Fabaceae may not be unconnected with the fact that members of the family constitute major part of the indigenous flora of the study area, as they have adaptive features to withstand adverse weather conditions common to Sahel regions.

Previous ethnobotanical studies in the study area revealed that most of the species reported to be used locally in managing other ailments were also members of Fabaceae family.^{21,46} Most of the species reported to be used for managing cancer in Taraba State and Northeastern Nigeria also belong to the Fabaceae family.^{28,31} Most of the medicinal plants used for the management of cancer by *Ijebus* in southwestern Nigeria also belong to Fabaceae family.³⁷ Members of Fabaceae family were widely used in the management of various types of cancer in Brazil.³⁹ Most of the species used in managing cancer in Ethiopia also belong to the Fabaceae family.⁴⁰ However, Asteraceae is the most popular family reported in an ethnobotanical study on cancer from Sothern Region of Ilam, West Iran.³⁸

Most of the cited species in this study are trees (Figure 3). This may not be unconnected with the fact that most herbalists in the area use trees whose stem barks are processed to produce powdered plant materials that are mixed with either honey, shea butter, or both, to make a paste that is usually applied externally on the cancerous area. This is however, contrary to earlier report that most species used for treating cancer in Greater Casablanca Region of Morocco were shrubs, subshrubs or herbs.²⁷ Unsustainable use of tree species for medicinal purpose is posing great danger to the plants' biodiversity in the study area as trees are also the main source of fuel and are indiscriminately being used for construction purposes. It is also interesting to note that all the cited species are sourced from the wild. This may be because of the belief that wild species are more effective in curing "complicated" ailments like cancer.

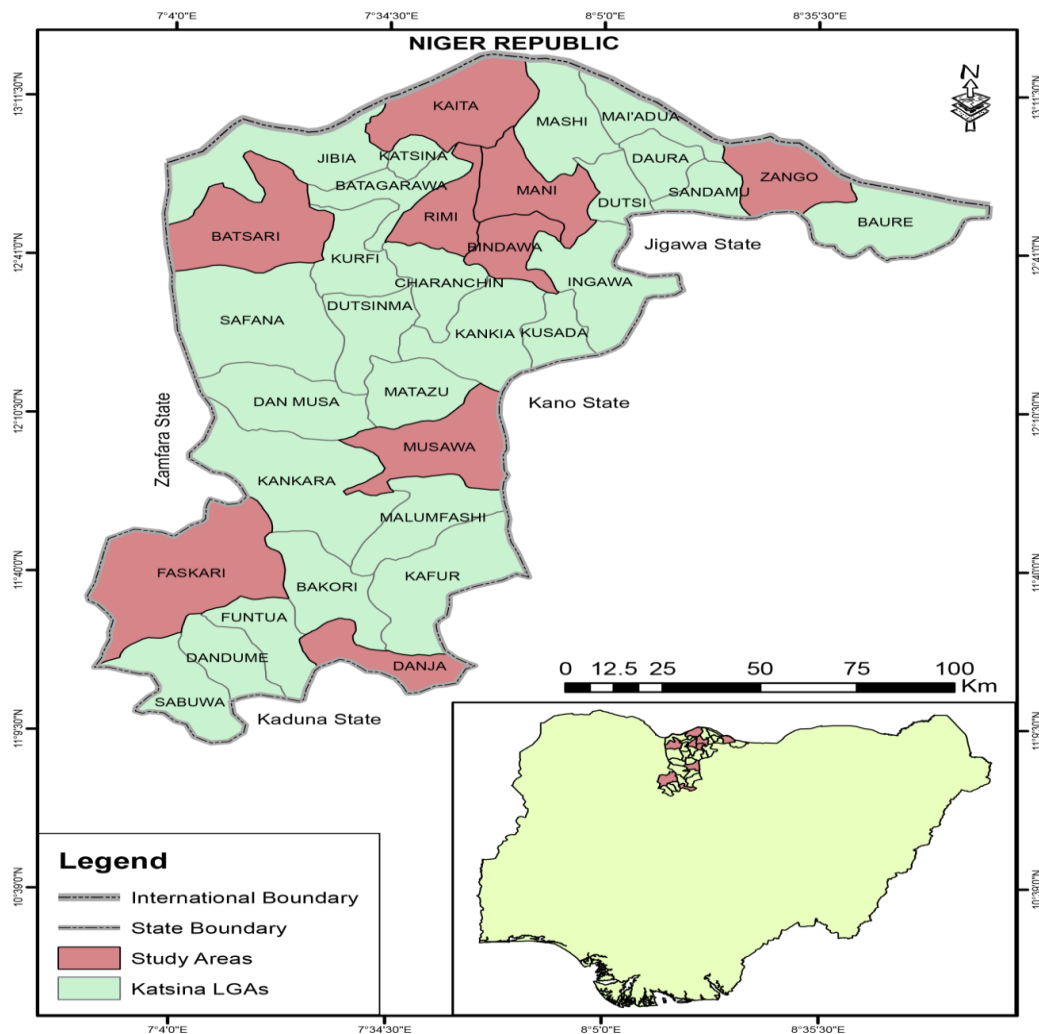


Figure 1: Map of Katsina State showing the study area

Table 1: Socio-demographic information of the respondents on medicinal plants used for the management of cancer in Katsina State, Nigeria

Biodata	Frequency	Percentage (%)
Sex		
Male	159	88
Female	21	12
Age		
15-30	10	5.5
31-45	37	20.5
46-60	45	25
61-75	59	32.7
75 above	29	16.1
Marital status		
Single	11	6.1
Married	153	85
Widow	3	1.66
Widowers	13	7.22
Educational Qualification		
Non formal	124	68
Primary	21	12
Secondary	21	12
Tertiary	14	8
Occupation		
Herbalists	123	68.88
Petty traders	29	16.1
Farmers	17	9.44
Civil servants	7	3.88
Others	4	2.2

Stem barks were the most commonly used plant parts in this study (Figure 4). This has negative consequences on the plants' biodiversity as it leads to unsustainable exploitation of the species. Using stem bark to cure cancer may not be unconnected with the belief people in the study area had that stem bark is "mightier", and therefore, more effective in curing cancer. This result agrees with the findings that stems were the most frequently used plant part for managing cancer in Southern Region of Ilam, West Iran.³⁸ Reports from the neighboring northeastern Nigeria however, revealed that leaves were the most popular plant part in managing cancer.³¹ Report from Iwo and Ibadan of southwestern Nigeria also revealed that leaves were the most frequently used plant part for the treatment of cancer.²⁵ In Greater Casablanca Region of Morocco, leaves were also reported to be the most popular plant part employed in curing cancer.²⁷ Medications are mostly prepared as decoctions (Figure 5). This is because decoctions of most of the species that are applied externally are also taken orally (Figure 6). This, according to the respondents, helps in expelling the "internal cause" of the ailment. Similar findings were also reported from different parts of the world.^{13,24,25,26,32,33,40}

Conclusion

This study demonstrates that medicinal plants are very useful in managing deadly diseases like cancer in the study area. The study also revealed that the medicinal plants reported are facing some conservation challenges. This study, if properly harnessed, would go a long way in preserving indigenous knowledge on medicinal plants utilization in the study area. Further studies aimed at ascertaining scientifically, the acclaimed anticancer effect of the cited species as well as unravelling the conservation status of the documented species would be highly valuable.

Conflict of interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

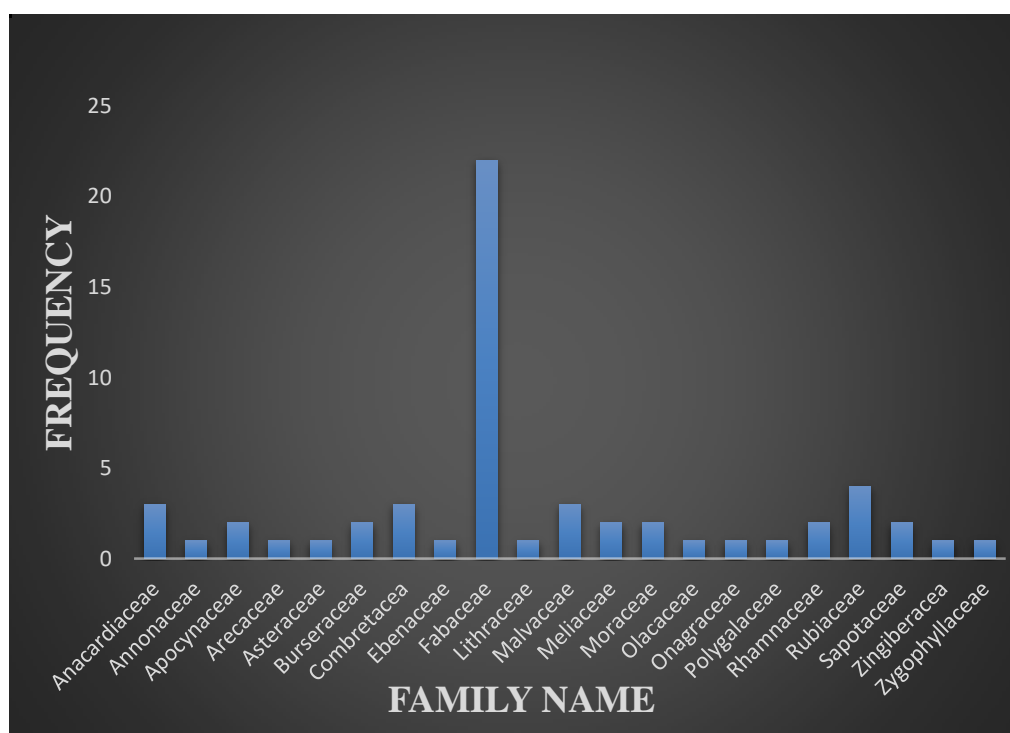
**Figure 2:** Family distribution of medicinal plants used in the management of cancer in Katsina State, Nigeria

Table 2: Medicinal plants used for the management of cancer in Katsina State, Nigeria

Family	Botanical Name	Local Name	Common Name	Voucher Specimen No.	RFC	UCV	Habit/Domestication	PU	MOP	ROA
Anacardiaceae	<i>Lannea acida</i> L.	Faru	African grape	KT19	0.03	0.06	Tree/Wild	SB	Dec./Pow	O/D
Anacardiaceae	<i>Mangifera indica</i> L.	Mangwaro	Mango	KT04	0.01	0.03	Tree/Wild	SB	Mac.	O
Anacardiaceae	<i>Sclerocarya birrea</i> (A.Rich) Hochst.	Danya	Marula	KT32	0.02	0.05	Tree/Wild	SB	Dec/Pow	O/D
Annonaceae	<i>Annona senegalensis</i> Pers.	Gwandar-daji	Custard apple	KT20	0.03	0.07	Shrub/Wild	L	Pow	D
Apocynaceae	<i>Calotropis procera</i> (Ait.) Fill	Tunfafiya	Sodom apple	KT07	0.05	0.11	Shrub/Wild	Lt.	Inf.	D
Apocynaceae	<i>Carissa edulis</i> Vahl.	Gizaki	Egyptian carissa	KT47	0.01	0.03	Tree/Wild	R	Dec/Pow	O/D
Arecaceae	<i>Borassusa ethiopum</i> Mart	Giginya	African fan palm	KT31	0.01	0.03	Tree/Wild	SB	Dec.	O
Asteraceae	<i>Centaurea acarnanica</i> (Matthias) Greuter	Dayi	Thistle	KT16	0.02	0.04	Shrub/Wild	W.P	Dec/Pow	O/D
Burseraceae	<i>Boswellia dalzielii</i> Hutch.	Hano	Frankincense tree	KT15	0.03	0.07	Tree/Wild	SB	Dec./Pow	O/D
Burseraceae	<i>Commiphora hildebrandtii</i> Engl.	Dashi	Gold Coast	KT27	0.03	0.07	Tree/Wild	SB	Pow.	D
Combretaceae	<i>Anogeissus leiocarpus</i> DC. Guill and Perr.	Marke	Chew stick	KT29	0.02	0.04	Tree/Wild	SB	Dec.	O
Family	Botanical Name	Local Name	Common Name	Voucher Specimen No.	RFC	UCV	Habit/Domestication	PU	MOP	ROA
Combretaceae	<i>Cambretum macrantum</i> G.Don	Geza	Kinkeliba	KT57	0.05	0.11	Shrub/Wild	SB	Dec.	O
Combretaceae	<i>Terminalia</i> sp. L.	Baushe	Indian laurel	KT58	0.02	0.05	Tree/Wild	L/SB	Dec./Pow.	O/D
Ebanaceae	<i>Diospyros mespiliformis</i> Hochst.	Kanya	African ebony	KT09	0.15	0.30	Tree/Wild	SB	Dec.	O
Fabaceae	<i>Acacia ataxacantha</i> (DC.) Kyal & Boatwr	Sarkakiya	Flame thorn	KT03	0.02	0.04	Tree/Wild	L	Mac/Pow	O/D
Fabaceae	<i>Acacia nilotica</i> (L)Delile	Bagaruwa	Thorn mimosa	KT55	0.06	0.12	Tree/Wild	L	Dec./Mac.	O/D
Fabaceae	<i>Acacia senegal</i> (L.)Willd	Dakwara	Gum Arabic tree	KT22	0.01	0.03	Tree/Wild	SB	Dec/Pow	O/D
Fabaceae	<i>Acacia seyal</i> Delile	Dundu	Mimosa	KT02	0.02	0.05	Tree/Wild	R	Dec/Pow	O/D
Fabaceae	<i>Acacia sieberiana</i> DC.	Farar kaya	Paper back thorn	KT37	0.01	0.03	Tree/Wild	SB	Dec.	O
Fabaceae	<i>Albizia chevalieri</i> (Harms.)	Katsari	Flat crown	KT24	0.01	0.03	Tree/Wild	R	Dec./Mac.	O
Fabaceae	<i>Bauhenia rufesence</i> (Lam.)	Tsattsagi	Silver butterfly tree	KT33	0.03	0.06	Tree/Wild	L	Dec.	O
Fabaceae	<i>Cassia arereh</i> Delile	Malga	Cassia	KT05	0.01	0.03	Tree/Wild	SB	Dec.	O
Fabaceae	<i>Detarium microcarpum</i> (Guill. and Perr.)	Taura	Sweet dattock	KT25	0.01	0.03	Tree/Wild	SB	Dec/Pow	O/D

Family	Botanical Name	Local Name	Common Name	Voucher Specimen No.	RFC	UCV	Habit/Domestication	PU	MOP	ROA
Fabaceae	<i>Detarium senegalensis</i> (J.F) Gmel	Runhu	Wild Cassia	KT46	0.07	0.14	Tree/Wild	L	Pow	D
Fabaceae	<i>Entada africana</i> Guill. & Perr.	Tawatsa	Sweet denanthera	KT18	0.04	0.08	Tree/Wild	SB	Dec.	O
Fabaceae	<i>Faidherbia albida</i> (A. Chev.)	Gawo	Apple ring acacia	KT21	0.05	0.11	Tree/Wild	L	Dec.	D
Fabaceae	<i>Parkia biglobosa</i> (Jacq) R. Br.	Dorowa	African locust bean	KT11	0.03	0.07	Tree/Wild	SB	Dec.	O
Fabaceae	<i>Pericopsis laxiflora</i> (Benth.)	Makarho	False dalbergia	KT54	0.01	0.03	Tree/Wild	SB	Dec/Pow	O/D
Fabaceae	<i>Piliostigma reticulatum</i> DC. Hochst.	Kalgo	Camel foot	KT44	0.11	0.22	Tree/Wild	L/SB	Dec.	O
Fabaceae	<i>Prosopis africana</i> (Guill. & Perr.)	Kiryra	Iron tree	KT51	0.02	0.04	Tree/Wild	SB	Dec/Pow	O/D
Fabaceae	<i>Senna occidentalis</i> L.	Raidore	Coffea senna	KT01	0.02	0.04	Shrub/Wild	R/L	Mac/Pow	O/D
Fabaceae	<i>Tamarindus indica</i> L.	Tsamiya	India date	KT12	0.09	0.18	Tree/Wild	SB	Dec/Pow	O/D
Fabaceae	<i>Tephrosia linearis</i> L	Tsintsiyar- maharba	Hoary pea	KT30	0.03	0.06	Shrub/Wild	L	Dec./Pow.	O/D
Fabaceae	<i>Uraria picta</i> Jacq. D.C	Shege ka cira	Dabra	KT38	0.01	0.03	Shrub/Wild	W.P	Dec/Pow	D/O
Lythraceae	<i>Lawsonia inermis</i> L	Lalle	Henna Tree	KT56	0.01	0.03	Tree/Wild	L	Dec./Pow	O/D
Malvaceae	<i>Adansonia digitata</i> L.	Kuka	Baobab	KT14	0.04	0.08	Tree/Wild	SB	Dec.	O
Family	Botanical Name	Local Name	Common Name	Voucher Specimen No.	RFC	UCV	Habit/Domestication	PU	MOP	ROA
Malvaceae	<i>Bombax buonopozense</i> P.Beauv.	Kurya	African bombax	KT17	0.01	0.03	Tree/Wild	L/SB	Pow	D
Malvaceae	<i>Sterculia setigera</i> Delile. L.	Kukkuki	Gum tree	KT52	0.02	0.04	Tree/Wild	SB	Dec.	O
Malvaceae	<i>Waltheria indica</i> L.	Hankufa	Sleepy morning plant	KT13	0.01	0.03	Shrub/Wild	L	Pow	D
Meliaceae	<i>Azadiracta indica</i> A. Juss	Bedi	Neem tree	KT10	0.06	0.13	Tree/Wild	SB	Dec/Pow	O/D
Meliaceae	<i>Khaya senegalensis</i> (Ders.) A. Juss	Madaci	Mahogany	KT53	0.02	0.04	Tree/Wild	SB	Dec/Pow	O/D
Moraceae	<i>Ficus congensis</i> Engl.	Baure	Fig	KT34	0.07	0.14	Tree/Wild	SB	Dec./Pow	O/D
Moraceae	<i>Ficus ingens</i> (Lam.)	Kawari	Red-leaved fig	KT39	0.02	0.04	Tree/Wild	SB	Dec	O
Moraceae	<i>Ficus ovate</i> (Vahl)	Gamji	Gutta-percha tree	KT26	0.03	0.06	Tree/Wild	SB	Mac.	O
Olacaceae	<i>Ximenia americana</i> L.	Tsada	Tallow wood	KT28	0.06	0.12	Tree/Wild	SB/L/ R	Dec/Mac/P ow	D/O
Onograceae	<i>Ludwigia octovalvis</i> Jacq.	Shashatau	Willow primrose	KT35	0.04	0.08	Shrub/Wild	W.P	Pow	D
Polygalaceae	<i>Securidaca longipedunculata</i> Fresen.	Sanya	Violet tree	KT49	0.03	0.07	Tree/Wild	L/R/S	Dec./Pow.	O/D

Family	Botanical Name	Local Name	Common Name	Voucher	RFC	UCV	Habit/Domestication	PU	MOP	ROA
Rhamnaceae	<i>Ziziphus mauritiana</i> (Hochst.)	Magarya	Indian jujube	KT06	0.01	0.03	Tree/Wild	L	Dec.	O
Rhamnaceae	<i>Ziziphus spina-christi</i> L.	Kurna	Christ's thorn	KT36	0.03	0.06	Tree/Wild	L	Inf./Mac.	O
Rubiaceae	<i>Feretia opodanthera</i> Delile	Kurukuru	Feretia	KT50	0.01	0.03	Tree/Wild	L	Mac/Pow	O/D
Rubiaceae	<i>Gardenia aqualla</i> (Staff. & Hutch.)	Gaude	Gardenia	KT40	0.02	0.04	Tree/Wild	SB	Dec.	O
Rubiaceae	<i>Mitracarpus hirtus</i> (Linn). DC.	Gogamasu	Girdle pod	KT43	0.01	0.03	Shrub/Wild	W.P	Lat	D
Rubiaceae	<i>Mitragyna inermis</i> (Willd) Kuntze	Giyayya	False abura	KT45	0.01	0.03	Tree/Wild	SB	Dec.	O
Sapotaceae	<i>Butyrospermum parkii</i> L	Bagai		KT41	0.02	0.04	Tree/Wild	L/SB	Dec/Pow	O/D
Sapotaceae	<i>Vitallaria paradoxa</i> CF. Gaertn.	Kadanya	Shea tree	KT23	0.04	0.08	Tree/Wild	SB	Mac.	O
Zingiberaceae	<i>Aframamum melegueta</i> K. Schum.	Citta mai yaya	Grains of paradise	KT42	0.02	0.04	Shrub/Wild	SD	Dec.	O
Zygophyllaceae	<i>Balanite aegyptiaca</i> L.	Aduwa	Desert date	KT08	0.01	0.03	Tree/Wild	L	Dec.	O

RFC = Relative Frequency of Citation, UCs = Use Consensus Value, PU = Part Used, L = Leaves, SB = Stem bark, R = Root, Lat. = Latex, W.P = Whole Plant, MOP = Mode of Preparation, Dec. = Decoction, Pow = Powder, Mac. = Maceration, Inf. = Infusion, ROA = Route of Administration, O = Oral, D = Dermal.

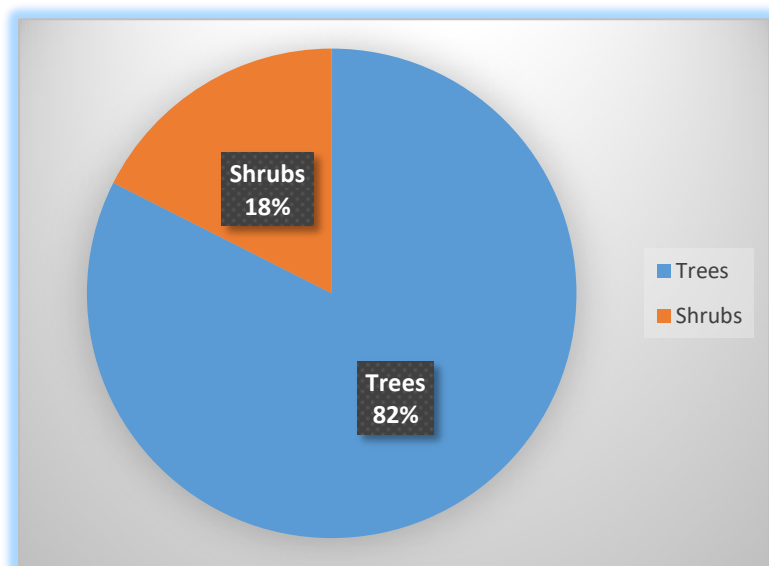


Figure 3: Habit status of medicinal plants used for the management of cancer in Katsina State, Nigeria.

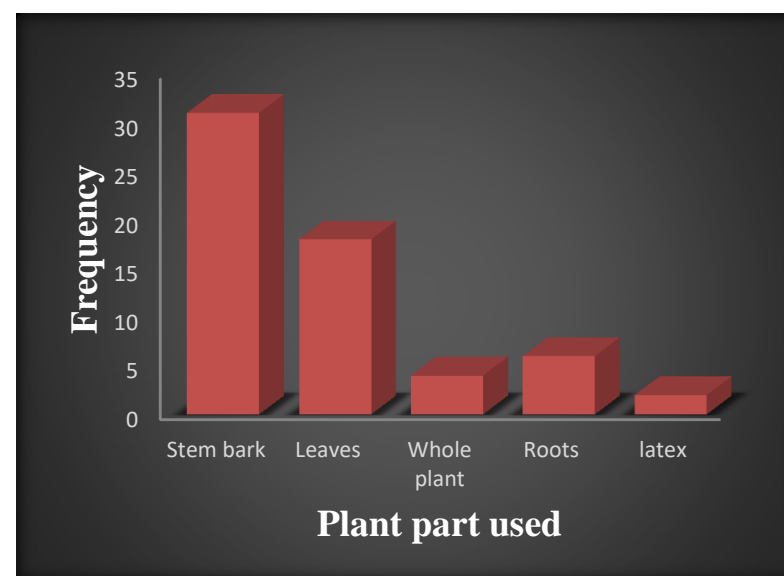


Figure 4: Plant parts used for the management of cancer in Katsina State, Nigeria.

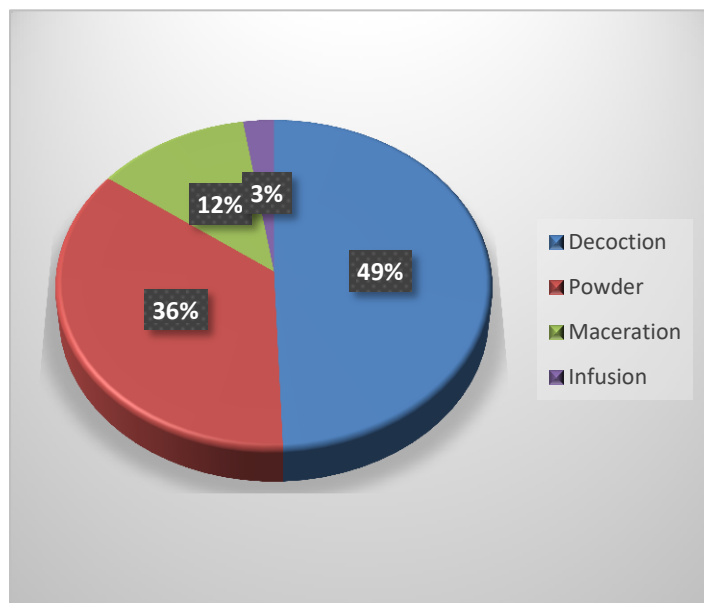


Figure 5: Mode of preparation of medicinal plants used for the management of cancer in Katsina State, Nigeria.

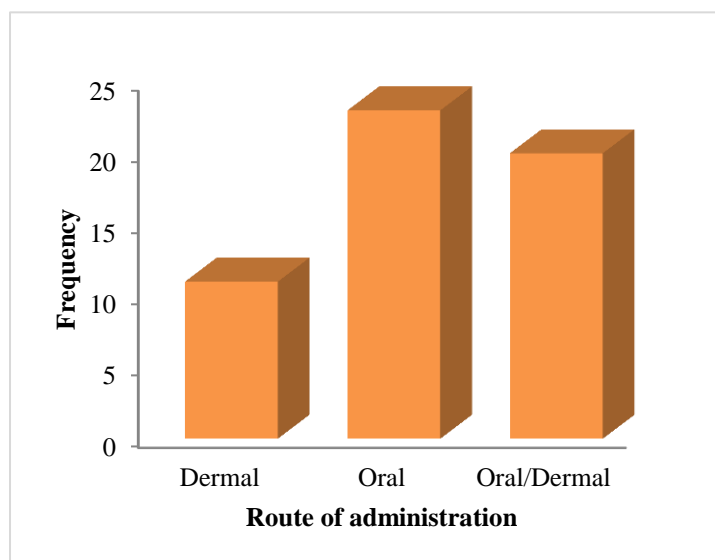


Figure 6: Route of administration of medicinal plants used for the management of cancer in Katsina State, Nigeria.

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