Medicinal plants with folkloric uses in the management of Breast Cancer in Northwestern Nigeria: A Cross-sectional survey

Suleiman Danladi, Umar Idris Ibrahim, Khalid Garba Mohammed, Basira Kankia Lawal, Aisha Mohammed, Idris Aliyu Mas'ud, Nazifi Auwalu Abubakar, Aisha Muhammad Alhassan, Sani Sa'idu Bello

Correspondence

Suleiman Danladi[1*], Umar Idris Ibrahim[2*], Khalid Garba Mohammed[3], Basira Kankia Lawal[4], Aisha Mohammed[5], Idris Aliyu Mas'ud[6], Nazifi Auwalu Abubakar[1], Aisha Muhammad Alhassan[1], Sani Sa'idu Bello[1]

[1]Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Bayero University, Kano, Nigeria.
[2]Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, Universiti Sultan Zainal Abidin, 22200 Besut, Malaysia.
[3]School of Life Sciences, Pharmacy and Chemistry, Faculty of Science, Engineering and Computing, Kingston University, Penrhyn Road, Kingston upon Thames KT1 2EE, United Kingdom.
[4]Department of Clinical Pharmacy and Pharmacy Management, Faculty of Pharmaceutical Sciences, Kaduna State University, Kaduna, Nigeria
[5]Department of Pharmaceutical Microbiology and Biotechnology, Faculty of Pharmaceutical Sciences, Bayero University, Kano, Nigeria.
[6]Department of Pharmacognosy and Herbal Medicine, Faculty of Pharmaceutical Sciences, Bayero University, Kano, Nigeria

*Corresponding Author: umaribrahim@unisza.edu.my, sdanladi.phc@buk.edu.ng

Ethnobotany Research and Applications 31:18 (2025) - http://dx.doi.org/10.32859/era.31.18.1-19
Manuscript received: 18/05/2025 – Revised manuscript received: 12/06/2025 - Published: 13/06/2025

Research

Abstract

Background: The ethnobotanical use of medicinal plants for the treatment of breast cancer is widely practiced in north-western Nigeria. While their pharmaceutical potential is often explored, this study prioritizes the cultural significance and traditional knowledge surrounding plant use by local healers. This study aimed to document and analyse the knowledge, practices, and cultural contexts in which traditional medicinal plants are used for breast cancer management in three states of north-western Nigeria.

Methods: An ethnobotanical survey using structured interviews was conducted among 154 traditional medicine practitioners and herb sellers across Kano, Katsina, and Kebbi. Data were analysed using descriptive statistics and multivariate techniques, including cluster and correspondence analyses, to identify patterns in plant use.

Results: A total of 80 plant species from 34 families were documented, with Fabaceae being the most cited. Key species included *Guiera senegalensis*, *Cassia singueana*, and *Boswellia odorata*. Leaves and bark were the most frequently used parts. Cluster analysis revealed distinct usage patterns by geography and healer type. Though few healers reported ritualistic

practices, these traditions were often embedded in their healing philosophies. Correspondence analysis showed a strong association between plant part and administration route.

Conclusion: The study highlights the rich ethnobotanical knowledge of traditional healers in north-western Nigeria. While biomedical interest may view these plants for drug discovery, their cultural roles and ritual uses highlights the importance of preserving indigenous knowledge systems. Further interdisciplinary research is encouraged to integrate ethnobotany with cultural anthropology and health policy.

Keywords: Medicinal plants; Breast-cancer; Survey; Traditional medicine; Northwest, Nigeri

Background

Cancer is a condition marked by the uncontrolled growth of cells, caused by disruptions in normal cell regulation and interference with the cell cycle, which can lead to the formation of malignant tumors capable of spreading to other parts of the body. Globally, cancer has become the leading cause of death, with a 17% increase in cancer-related deaths reported between 2005 and 2015 (Rawat *et al*. 2021). Female breast cancer is the most commonly diagnosed cancer in Nigeria and the incidence rate is increasing by >5% per year (Sung *et al*. 2021). Many women with breast cancer suffer from pain, postmenopausal symptoms, psychosocial stress, depression, sleep disorders, or fatigue (Feiten *et al*. 2014). Globally, West Africa was ranked the second region in terms of mortality rates with Nigeria having the highest (Sung *et al*. 2021). Various treatment options exist for breast cancer, such as surgery, radiation therapy, and chemotherapy. However, these methods often come with notable drawbacks, highlighting the need to develop alternative therapeutic strategies. Advancing such approaches relies heavily on having dependable experimental models that accurately reflect the origin, development, and treatment responses of tumors. Standard first-line treatments, including surgery and chemotherapy, either alone or combined are typically invasive and commonly linked to serious side effects and high rates of comorbid conditions (Costa *et al*. 2020).

Recurrence and relapse are the most common complications associated with breast cancer surgery. Most of the commonly used chemotherapeutic agents used in the treatment of breast cancer are tamoxifen, doxorubicin, paclitaxel and 5-fluorouracil. However, these agents are accompanied with adverse effects such as cardiotoxicity, pulmonary embolism, deep vein thrombosis, endometrial cancer, peripheral neuropathy and hair loss (Shapiro & Recht 2001, Shah *et al*. 2014). Radiation therapy for breast cancer has the potential to negatively impact long term cosmetic outcome of the treated breast. Reports indicate that medicinal plants such as *Solanum americanum* Mill. (Solanaceae), *Omphalocarpum procerum* P.Beauv. (Sapotaceae), *Tieghemella africana* Pierre (Sapotaceae) and *Morinda lucida* Benth. (Rubiaceae) have been in use over the years for the management of different types of cancers in developing countries (Ngoua-Meye-Misso 2019). Additionally, there have been some folkloric claims on the use of medicinal plants such as *Acacia nilotica* (Leguminosae), *Mangifera indica* L. (Anacadiaceae), *Moringa oleifera* Lam. (Moringaceae), *Hibiscus cannabinus* L. (Malvaceae) and *Ximenia americana* L. (Malvaceae) in traditional management of breast cancer in Sokoto State, Nigeria (Malami *et al*. 2020).

Conventional cancer treatments often involve pharmaceutical agents that are associated with significant toxicity, prompting interest in alternative therapies. Medicinal plants, which are generally affordable and widely accessible, have shown promising anticancer properties and may offer a safer, more tolerable treatment option. Numerous clinical and phytochemical studies have confirmed the antitumor potential of herbal remedies across various cancer types (Hosseini *et al.* 2015). Notably, several effective chemotherapeutic agents such as camptothecin from *Camptotheca acuminata* Decne., vincristine and vinblastine from *Catharanthus roseus* (L.) G.Don and paclitaxel from *Taxus brevifolia* (L.) G.Don were originally derived from plants (Moncrief & Lipscomb 1965, Suffness 1993, Wall *et al.* 1966). Given this precedent, exploring and cataloging traditional medicinal plants used for breast cancer treatment could lead to the discovery of novel, less toxic therapeutic alternatives. This study, therefore, aimed to investigate and document the medicinal plants traditionally employed in the management of breast cancer in Northwestern Nigeria.

Materials and Methods

Study area

The study was conducted in the northwestern part of Nigeria. Northwest is one of the six geopolitical zones in Nigeria, having seven states: Kano, Jigawa, Kaduna, Kebbi, Katsina, Zamfara and Sokoto. Northwest is the most populous geopolitical zone in Nigeria. Three states; Kano, Katsina and Kebbi were selected based on convenience sampling. Kano State is the most populous state in the region in particular, and Nigeria at large. In 2022, it has been projected that Kano, Katsina and Kebbi States have population 15,462,200, 10,368,500 and 5,563,900 respectively. See figure 1 for the map of Nigeria.

Figure 1. The Map of Nigeria Indicating the Northwest Region (Danibrahim et al. 2022)

Survey sampling technique and interview

A non-random, purposive sampling method involving expert selection was utilized in this study (Anas and Abdulrahman 2021). The respondents who are either traditional medicine practitioners, herbalists, and or herb sellers, and involved in the traditional treatment of breast cancer were interviewed verbally in the Hausa language. The ethical approval for the study was obtained from the Health Research Ethics Committee, Kano State Ministry of Health (NHREC/17/03/2018). The informed consent of each respondent was obtained before the interview. Respondents were fully informed about the purpose and importance of the study, and they were made to understand, participation in the study is voluntary. The study was conducted in line with the Code of Ethics of the International Society of Ethnobiology (International Society of Ethnobiology 2006). All information relevant to the study were recorded in the questionnaire.

Sample Size Determination

The sample size for this study was determined using a purposive sampling strategy commonly employed in ethnobotanical and qualitative health studies where traditional knowledge is held by specific community members. Based on prior studies (e.g., Malami et al., 2020), and considering the need to ensure regional representation across the three selected states; Kano, Katsina, and Kebbi, a target of 150 respondents was established. The final number of respondents interviewed was 154, ensuring an even broader data scope than initially planned. This sample provided adequate representation to capture the diversity of medicinal plant use across the study areas.

Questionnaire Description

Data were collected using a structured questionnaire that was adapted and modified from validated tools used in similar ethnobotanical surveys (Malami *et al.* 2020). The questionnaire was designed to elicit both qualitative and quantitative data and was divided into the following sections:

1. Demographics: Age, gender, ethnicity, religion, profession (TMP, herbalist, herb seller), years of practice.
2. Clinical Practice: Methods of diagnosis (e.g., physical, biological, spiritual), patient admission, referral practices.
3. Medicinal Plant Use: Local/common name and scientific name of plant, plant part(s) used (e.g., leaf, root, bark), method of preparation (e.g., maceration, decoction, powder), route of administration (oral, topical, infusion), frequency of use
4.

The questionnaire was translated into Hausa (the predominant local language) and was pilot-tested for clarity and appropriateness among five TMPs in Kano State before usage in the actual study.

Data Collection Procedure

Data collection was carried out over a 10-month period (June 2024 – April 2025) through face-to-face interviews conducted by trained research assistants fluent in both English and Hausa. Interviews were conducted in community settings convenient to the respondents, such as herbal markets, traditional healing centers, and TMP homes.

Participation was voluntary, and informed consent was obtained prior to the interview. Respondents were assured of confidentiality, and no identifying personal information was collected. Each interview lasted approximately 30 to 45 minutes, during which responses were recorded on paper forms and later transcribed into an electronic database for analysis.
The team ensured geographical and ethnic diversity in the sample by including participants from urban, peri-urban, and rural areas in each of the three states. Plant specimens mentioned by respondents were collected when possible, and photographed or tagged for proper identification. Voucher specimens were submitted to the Herbarium Unit, Department of Plant Science, Bayero University Kano, for identification and authentication.

Data Analysis

Data were entered into IBM SPSS Statistics version 20. Descriptive statistics (frequencies and percentages) were used to summarize responses. To uncover underlying usage patterns among plant species and healer groups, hierarchical cluster analysis and correspondence analysis were performed based on frequency of citation, plant part used, and preparation method. Chi-square tests were also conducted to assess significant associations between categorical variables

Results

Demographic Data

A total of One hundred and fifty-four (154) respondents were interviewed; 78 from Kano State (50.6%), 45 from Katsina State (29.2%), and 31 from Kebbi State (20.1%) (Figure 2).

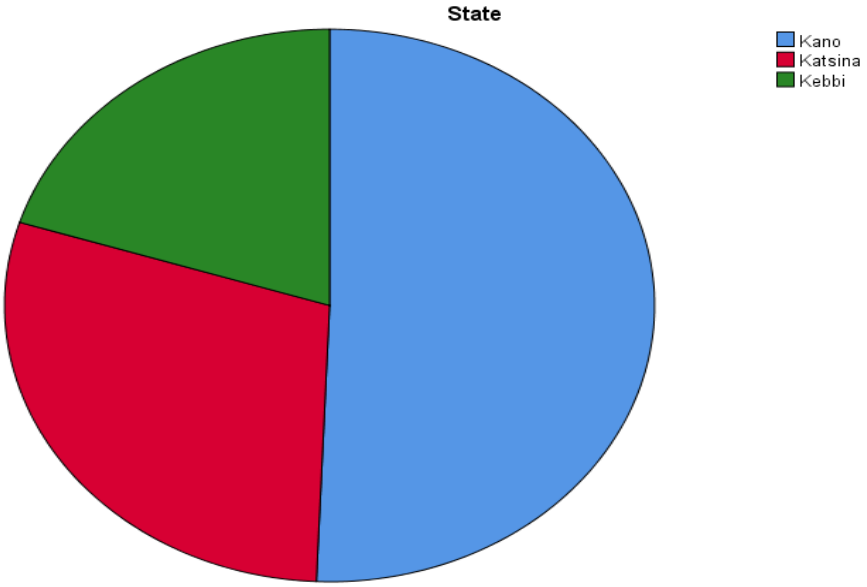

Figure 2. Distribution of respondents across study area

The respondents comprising traditional medicine practitioners (TMPs), herbalists, and herb sellers across Kano, Katsina, and Kebbi States. The majority of respondents (more than 70%) were aged above 40 years, with the largest age group being 41–50 years (27.9%), followed by those aged 51–60 years (21.4%) and above 60 years (21.4%). Younger respondents aged 20–30 years constituted only 9.7% of the sample. Most participants were male (87.7%), and the predominant ethnic group was Hausa (81.2%), followed by Fulani (9.7%), with other tribes accounting for 9.1%. Regarding religion, the vast majority were Muslims (98.1%), with only 1.9% identifying as Christians. In terms of professional specialty, herbalists (46.1%) and TMPs (44.2%) made up nearly 90% of the respondents, while herb sellers (7.1%) and dual practitioners (2.6%) constituted a smaller proportion.

Concerning the duration of practice, approximately 58.5% had been practicing traditional medicine for more than 20 years. Specifically, 29.9% had practiced for over 31 years, while 28.6% had between 21–30 years of experience. Most respondents (72.1%) diagnosed breast cancer primarily through physical examination (PE), while a small proportion used biological methods (1.3%), psychological assessments (3.2%), or spiritual means (3.2%). About 23% used combination assessment methods.

Regarding patient admission, only 12.3% reported admitting patients for breast cancer treatment, while the majority (87.7%) did not. In terms of referral practices, 38.3% referred patients directly to hospitals, 32.5% referred to more experienced traditional practitioners (senior colleagues), and 22.7% made referrals to both hospitals and senior colleagues depending on the situation. Only a small fraction (6.5%) of respondents indicated that they do not refer patients elsewhere, believing in their ability to manage all cases.

Table 1. Socio-Demographic Characteristics of Respondents by State (N = 154)

Variable	Kano (n)	Katsina (n)	Kebbi (n)	Total (n)	Percentage (%)
Age (years)					
20–30	12	2	1	15	9.7
31–40	12	10	8	30	19.5
41–50	20	11	12	43	27.9
51–60	18	8	7	33	21.4
Above 60	16	14	3	33	21.4
Gender					
Male	71	36	28	135	87.7
Female	7	9	3	19	12.3
Ethnicity					
Hausa	63	38	24	125	81.2
Fulani	11	4	0	15	9.7
Others	4	3	7	14	9.1
Religion					
Islam	76	45	30	151	98.1
Christianity	2	0	1	3	1.9
Specialty					
TMP	31	19	18	68	44.2
Herbalist	39	20	12	71	46.1
Herb seller	4	6	1	11	7.1
TMP and Herbalist	4	0	0	4	2.6
Practice Duration (Years)					
1–10	7	8	11	26	16.9
11–20	15	12	11	38	24.7
21–30	25	12	7	44	28.6
Above 30	31	13	2	46	29.9
Method of Diagnosis					
Physical Examination	47	39	25	111	72.1
Biological Examination	1	1	0	2	1.3
Psychological Examination	2	0	3	5	3.2
Combination of the above	28	5	3	36	23.2
Admission					
Yes	13	4	2	19	12.3
No	65	41	29	135	87.7
Referral					
to Senior	25	12	13	50	32.5
to Hospital	23	20	16	59	38.3
Referral to Both	28	6	1	35	22.7
No Referral	2	7	1	10	6.5

Plant information and taxonomic biodiversity

Table 2 presents a comprehensive list of 80 medicinal plant species used traditionally in North-western Nigeria for the management of breast cancer as reported by the participants. Each entry includes the local and common names, scientific classification, family name, herbarium identification number, plant parts used, methods of preparation, routes of administration, across three states: KN, KT, and KB.

Most of the plant species were trees (87.7%), followed by shrubs (5.5%), climbers (4.1%), and herbs (2.7%). Forty-eight (79.5%) species were discovered in the forest, 7 (9.6%) in the farmlands, and 8 (11%) in both the forest and the farmlands. In terms of the number of species, Moraceae was the most dominant botanical family with 13 species, followed by Phylantaceae and Fagaceae (8 species each), Clusiaceae (4 species), and Anacardiaceae, Malvaceae, Melastomataceae, Meliaceae, and Myrtaceae represented by 3 species each. The remaining 17 families are represented by one to two species.

Table 2. Medicinal plants used in the traditional management of breast cancer in Northwester Nigeria

Scientific Name	Family Name	Identification Number	Local Name	Common Name	Part of Plant Used	Method of Prep	Rout of Ad
Boswellia odorata Hutch.	Burseraceae	BUKHAN0381	Ararrabi	Frankincense	Leaves, Bark	Maceration Decoction, Powder	Oral, Topical
Guiera senegalensis J.F.Gmel.	Combretaceae	BUKHAN0032	Sabara	Senegal quiera	Leaves, Bark, Root	Maceration Decoction, Powder	Oral, Topical
*Piliostigma reticulatum (*DC.) Hochst.	Fabaceae	BUKHAN0072	Kalgo	Camel's foot	Leaves, Bark, Root	Maceration Decoction, Powder	Oral, Topical
Vachellia nilotica (L.) P.J.H. Hurter & Mabb.	Fabaceae	BUKHAN0186	Bagaruwa	Egyptian thorn	Leaves, Bark, Root, Stem	Decoction, Powder	Oral, Topical
Sclerocarya birrea (A. Rich.) Hochst.	Anacardiaceae	BUKHAN0435	Danya	Marula	Leaves, Bark	Maceration Decoction, Powder	Oral, Topical
Crinum latifolium L.	Amaryllidaceae	BUKHAN0292	Gadali	Pink striped Trumpelily	Stem	Decoction	Topical
Stereospermum kunthianum Cham.	Bignoniaceae	BUKHAN0159	Sansami	Pink Jacarander	Leaves, Bark, Root	Maceration, Powder	Oral, Topical,
Senegalia ataxacantha (DC.) Kyal. & Boatwr.	Fabaceae	BUKHAN0189	Sarkakiya/Duhuwa	Flame thorn	Leaves, Bark	Maceration Decoction, Powder	Oral, Topical
Boswellia dalzielii Hutch.	Burseraceae	BUKHAN0362	Hanu	Frankiincense	Leaves	Maceration	Oral
Ficus sycomorus L.	Moraceae	BUKHAN0109	Baure	Sycomore fig	Leaves, Bark	Maceration Decoction, Powder	Oral, Topical
Tamarindus indica L.	Fabaceae	BUKHAN0074	Tsamiya	Tamarind	Leaves, Bark, Root, Fruit	Maceration Decoction, Powder	Oral, Topical
Prosopis africana (Guill. & Perr.) Taub.	Mimosoideae	BUKHAN0193	Kirya	Iron tree	Leaves, Bark, Root	Maceration Decoction, Powder	Oral, Topical

Cassia singueana Delile	Fabaceae	BUKHAN0316	Runhu	Winter Cassia	Leaves, Bark, Root, Stem	Maceration Decoction, Powder	Oral, Topical
Khaya senegalensis (Desv.) A.Juss.	Maliaceae	BUKHAN0116	Madaci	Mahogany	Leaves, Bark	Maceration Decoction, Powder	Oral, Topical
Lannea microcarpa Engl. & K.Krause	Anacardiaceae	BUKHAN0280	Faru	African grape	Leaves, Bark	Maceration Decoction	Oral
Syzygium guineense (Willd.) DC.	Myrtaceae	BUKHAN0406	Malmo	Water berry	Bark	Maceration	Oral
Ximenia americana L.	Olacaceae	BUKHAN0302	Tsada	Sea lemon	Leaves, Bark, Root	Maceration Decoction, Powder	Oral, Topical
Maerua angolensis DC.	Capparaceae	BUKHAN0335	Nagelbali (Cucuwa)/Mandiwa	Bed Bean Tree	Leaves, Root	Maceration Decoction, Powder	Oral, Topical
Cadaba farinose Forssk.	Capparaceae	BHKHAN0491	Bagayi	Cadaba	Leaves, Root, Whole Plant	Decoction, Powder	Oral, Topical
Anogeissus leiocarpa (DC.) Guill. & Perr.	Combretaceae	BUKHAN0029	Marke	African birch	Leaves, Bark, Root	Maceration Powder	Oral
Annona senegalensis Pers.	Annonaceae	BUKHAN0003	Gwandar Daji	Wild Soursop	Leaves	Maceration	Oral
Carica papaya L.	Caricaceae	BUKHAN0012	Gwanda	Pawpaw	Leaves, Fruit	Maceration Decoction, Powder	Oral, Topical
Ficus platyphylla Delile	Moraceae	BUKHAN0106	Gamji	Gutta percha	Leaves	Decoction	Topical
Ricinus communis L.	Euphorbiaceae	BUKHAN0062	Zurman	Castor oil plant seed	Seed	Maceration, Infusion	Topical
Combretum micranthum G.Don	Combrataceae	BUKHAN0272	Geza	Kinkeliba	Leaves	Maceration, Powder	Oral, Topical
Urelytrum giganteum Pilg.	Poaceae	BUKHAN0365	Jema	Giant grass	Root	Maceration, Infusion	Oral

Lamium purpureum L.	Lamiaceae	BUKHAN0257	Bunsurun fage	Purple deadnettle	Leaves	Powder	Oral
Leucas martinicensis (Jacq.) R.Br.	Lamiaceae	BUKHAN0176	Kan Barawo	White wort	Stem	Maceration, Infusion	Oral
Momordica charantia L.	Curcubitaceae	BUKHAN0562	Garafuni	Bittrer melon	Leaves, Whole Plant	Maceration, Powder	Oral, Topical
Diospyros mespiliformis Hochst. ex A.DC.	Ebenaceae	BUKHAN0121	Kanya	Ebony tree	Leaves, Barks	Maceration, Powder	Oral
Albizia lebbeck (L.) Benth.	Fabaceae	BUKHAN0187	Madobiya fara	Flea tree	Leaves, Bark, Stem	Maceration Powder	Oral, Topical
Albizia chevalieri Harms.	Fabaceae	BUKHAN0378	Katsari	Flea	Leaves	Maceration Decoction, Powder	Oral. Topical
Waltheria indica L.	Malvaceae	BUKHAN0035	Hankufa	India waltheria	Leaves, Root	Maceration Decoction, Powder	Oral, Topical
Celtis integrifolia Lam.	Ulmaceae	BUKHAN0102	Zuwo	Nettle tree	Leaves	Decoction, Powder	Oral, Topical
Allium sativum L.	Amaryllidaceae	BUKHAN0297	Tafarnuwa	Garlic	Leaves, Stem	Decoction, Powder	Oral, Topical
Vitellaria paradoxa C.F.Gaertn.	Sapotaceae	BUKHAN0489	Kadanya	Shear butter	Leaves	Powder	Oral, Topical
Jatropha curcas L.	Euphorbiaceae	BUKHAN0060	Bini da zugu	Physic nut	Bark, Root, Leaves	Maceration Decoction, Powder	Oral, Topical
Moringa oleifera Lam.	Moringaceae	BUKHAN0011	Zogale	Drumstick tree	Leaves, Root	Maceration Decoction, Powder	Oral, Topical
Echinochloa stagnina (Retz.) P.Beauv.	Poaceae	BUKHAN0482	Buruku	Burgu Millet	Root	Decoction, Powder	Oral, Topical
Ipomoea asarifolia (Desr.) Roem. & Schult.	Convulvulaceae	BUKHAN0152	Dumar Rafi	Ginger-leaf Morning Glory	Leaves	Powder	Oral, Topical
Allium cepa L.	Amaryllidaceae	BUKHAN0370	Albasa	Onion	Stem	Decoction, Powder	Oral, Topical
Calotropis procera (Aiton) Dryand.	Asclepiadaceae	BUKHAN0132	Tunfafiya	Sodon Apple	Leaves, Barks, Stem	Maceration	Oral, Topical

						Decoction, Powder	
Azadirachta indica A.Juss.	Maliaceae	BUKHAN0312	Darbejiya	Neem tree	Leaves	Powder	Topical
Zingiber officinale Roscoe	Zingiberaceae	BUKHAN0296	Citta	Ginger	Stem	Decoction, Powder	Oral, Topical
Mentha piperita L.	Lamiaceae	BIKHAN0337	Na'a-Na'a	Peppermint	Leaves	Powder	Topical
Detarium microcarpum Guill. & Perr.	Fabaceae	BUKHAN0071	Taura	Sweet detar	Bark, Root	Decoction, Powder	Oral, Topical
Daniellia oliveri (Rolfe) Hutch. & Dalziel	Fabaceae	BUKHAN0268	Maje	African copaiba balsam	Bark	Powder	Oral
Catunaregam nilotica (Stapf) Tirveng.	Rubiaceae	BUKHAN0287	Kwanarya	African catunaregam	Leaves, Bark, Root	Maceration, Powder	Oral, Topical
Parkia biglobosa (Jacq.) G.Don	Fabaceae	BUKHAN0262	Dorawa	African locustbean	Leaves, Pod	Maceration Decoction, Powder	Oral, Topical
Psidium guajava L.	Myrtaceae	BUKHAN0336	Goba	Guava	Leaves	Maceration Decoction,	Oral
Ziziphus spina-christi (Mill.) Georgi	Rhammaceae	BUKHAN0269	Kurna	Christ's thorn Jujube	Leaves	Maceration Decoction, Powder	Oral, Topical
Commiphora Africana (A.Rich.) Endl.	Burseraceae	BUKHAN0114	Dashi	African myrr	Leaves	Maceration Decoction, Infusion	Oral, Topical
Launaea taraxacifolia (Willd.) Amin ex C.Jeffrey	Astraceae	BUKHAN0473	Dayi	Wild lettuce	Leaves	Maceration, Powder	Oral, Topical
Dichrostachys cinerea (L.) Wight & Arn.	Fabaceae	BUKHAN0383	Dundu	Sickle Bush	Leaves	Powder	Oral, Topical
Balanites aegyptiaca (L.) Delile	Zygophyllaceae	BUKHAN0359	Aduwa	Desert Date	Stem	Powder	Topical
Mitracarpus hirtus (L.) DC.	Rubiaceae	BUKHAN0284	Gogamasu	Tropical girlepod	Leaves	Maceration	Oral, Topical

Ficus thonningii Blume	Moraceae	BUKHAN0110	Cediya	Strangler fig	Leaves	Maceration	Oral, Topical
Typha latifolia L.	Thyphaceae	BUKHAN0358	Geranya	Broadleaf cattail	Leaves	Maceration	Oral, Topical
Mitragyna inermis (Willd.) Kuntze	Rubiaceae	BUKHA0100	GIyayya		Leaves Root	Maceration	Oral, Topical
Vernonia kotschyana Sch.Bip. ex Wal	Asteraceae	BUKHAN0441	Daumashi	kotschy's ironweed or kotschy's vernonia	Root	Powder	Oral, Topical
Mangifera indica L.	Anacardiaceae	BUKHAN0348	Mangwaro	mango	Leaves	Decoction	Oral
Senna occidentalis (L.) Link	Fabaceae	BUKHAN0073	Sanga-Sanga/ Rai dore/Rai Rai	Coffee senna	Whole plant	Decoction	Oral
Hibiscus cannabinus L.	Malvaceae	BUKHAN0251	Rama	Kenaf	Seed	Maceration	Oral
Senna tora (L.) Roxb.	Fabaceae	BUKHAN0307	Tafasa	Sickle wild	Leaves	Maceration	Oral
Cissampelos owariensis P.Beauv. ex DC.	Menispermaceae	BUKHAN0513	Judar Kasa	Velvet tree	Leaves	Powder	Oral, Topical
Pseudocedrela kotschyi (Schweinf.) Harms	Proteaceae	BUKHAN0547	Tunas	Dry zone cedar	Bark	Powder	Oral, Topical
Vigna subterranea (L.) Verdc.	Fabaceae	BUKHAN0509	Kan Makwarwa	Bambara nut	Leaves	Powder	Oral, Topical
Combretum molle R.Br. ex G.Don	Combretaceae	BUKHAN0334	Gogen damo/Wuyan damo	Valvet bushwillow	Root	Maceration	Oral
Securidaca longipedunculata Fresen.	Polygalaceae	BUKHAN0013	Sanya/ Uwar Magunguna	Violet tree	Leaves, Bark, Root	Maceration, Powder	Oral
Tephrosia bracteolate Guill. & Perr.	Fabaceae	BUKHAN0373	Shege katsinka	Tephrosia	Leaves	Maceration	Oral
Acacia sieberiana DC.	Fabaceae	BUKHAN0067	Farar Kaya	Red acacia	Root	Powder	Oral, Topical

Acacia albida Delile	Fabaceae	BUKHAN0346	Gawo	Winter thorn	Root	Powder	Oral
Ficus polita Vahl	Moraceae	BUKHAN0001	Durumi	Polish fish	Leaves	Decoction	Oral
Nauclea diderrichii (De Wild.) Merr.	Rubiaceae	BUKHAN0434	Tafashiya	Opepe plant	Bark	Powder	Oral
Bridelia ferruginea Benth.	Euphorbiaceae	BUKHAN0049	Kisni/Kirni	Rusted brideia	Bark	Powder	Oral, Topical
Sterculia setigera Delile	Starculiaceae	BUKHAN0208	Kukkuke	Tropical chestnut	Bark	Powder	Oral
Strychnoss spinosa Lam.	Loganiaceae	BUKHAN0127	Kokiya	Monkey ball	Bark	Decoction	Topical
Adansonia digitata L.	Malvaceae	BUKHAN0036	Kuka	Baobab	Seed, Root	Decoction	Oral, Topical
Borassus aethiopum Mart.	Arecaceae	BUKHAN0276	Giginya	African Fan Palm	Bark	Powder	Oral
Xylopia aethiopica (Dunal) A.Rich.	Annonaceae	BUKHAN0510	Kimba	Ethiopian pepper	Bark	Decoction	Topical

Rout of Ad: Route of administration

Family Distribution

Figure 3 shows family distribution of medicinal plants that are used in the treatment of breast cancer in the Northwestern region. The Fabaceae family had the highest (17) distribution of plant species such as *Vachellia nilotica* (L.), *Piliostigma reticulatum (*DC.) Hochst., and *Cassia singueana* Delile with reported anti-breast cancer activity.

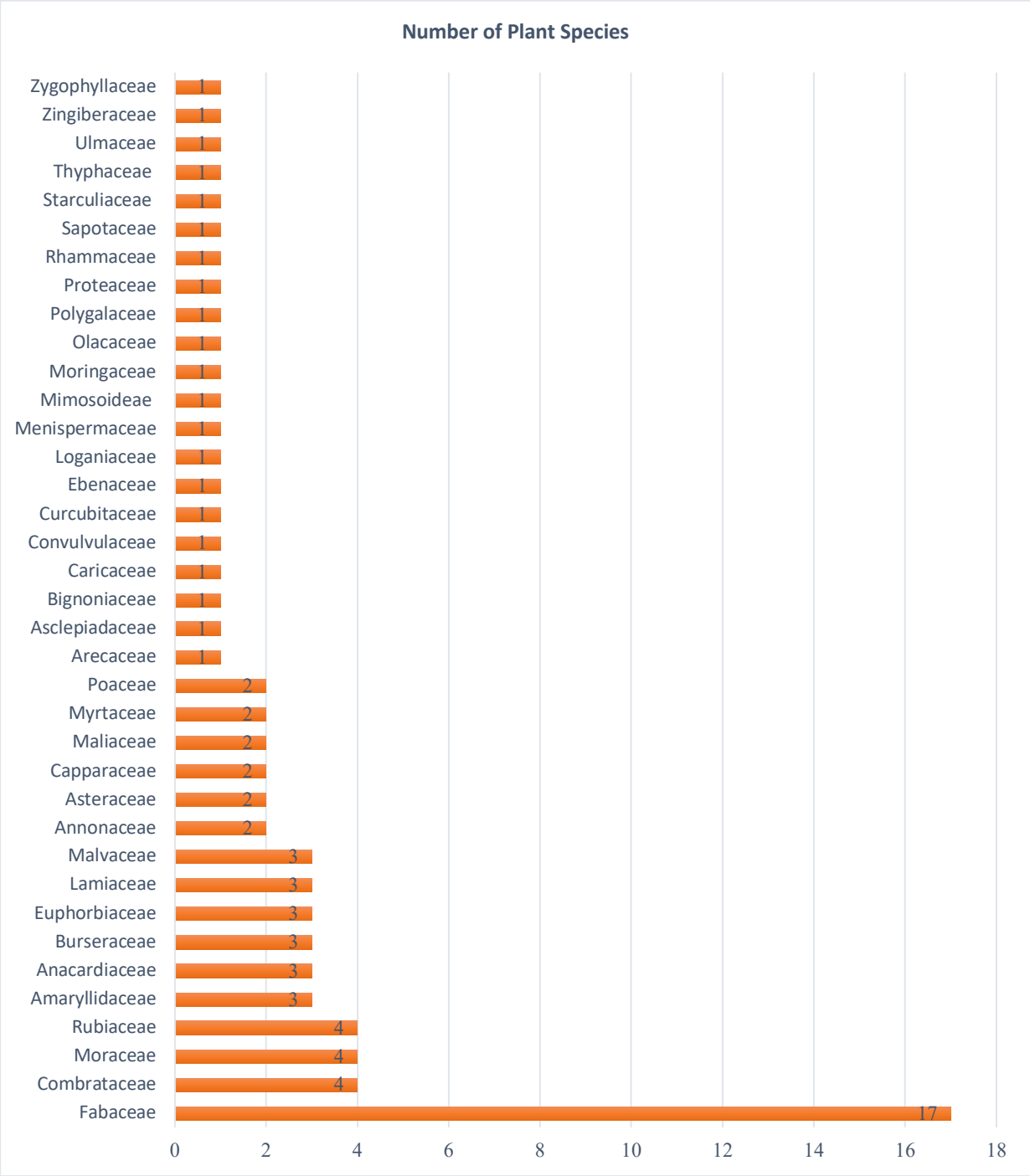

Figure 3. Family of Plants Used in the treatment of breast cancer

The plants**,** *Guiera senegalensis* J.F.Gmel., *Cassia singueana* Delile and *Boswellia odorata* Hutch demonstrated highest frequency of citations in northwestern region indicating their prominence and trust among traditional practitioners. Other plants with moderate to high FC values included *Tamarindus indica*, *Vachellia nilotica* (L.) and *Ximenia americana* L. Similarly, *Guiera senegalensis* J.F.Gmel was the most cited medicinal plant in Kano State. However, in Katsina State, *Cassia singueana* Delile was found to be the most cited medicinal plant. In Kebbi State, *Prosopis Africana* (Guill. & Perr.) Taub, *Khaya senegalensis* (Desv.) A.Juss, *Ximenia America* L and *Acacia sieberiana* DC are the most cited medicinal plants (Table 3)

Table 3. Frequency of citation and Relative Frequency of Citation of Medicinal Plants Used in the Treatment of Breast Cancer

Scientific Name	Family Name	FC /State	FC in Northwest	RFC
Boswellia odorata Hutch.	Burseraceae	KN= 17	17	11.04
Guiera senegalensis J.F.Gmel.	Combretaceae	KN = 23 KT = 6 KB = 2	31	20.13
*Piliostigma reticulatum (*DC.) Hochst.	Fabaceae	KN = 6 KB = 2	8	5.19
Vachellia nilotica (L.) P.J.H. Hurter & Mabb.	Fabaceae	KN =5 KT = 3	8	5.19
Sclerocarya birrea (A. Rich.) Hochst.	Anacardiaceae	KN = 5 KB = 1	6	3.90
Crinum latifolium L.	Amaryllidaceae	KN = 1	1	0.65
Stereospermum kunthianum Cham.	Bignoniaceae	KN = 4 KB = 1	5	3.25
Senegalia ataxacantha (DC.) Kyal. & Boatwr.	Fabaceae	KN = 8	8	5.19
Boswellia dalzielii Hutch.	Burseraceae	KB = 1	1	0.65
Ficus sycomorus L.	Moraceae	KN = 2 KB = 2	4	2.60
Tamarindus indica L.	Fabaceae	KN = 8 KT = 3 KB = 1	12	7.14
Prosopis africana (Guill. & Perr.) Taub.	Mimosoideae	KN = 4 KB = 3	7	4.55
Cassia singueana Delile	Fabaceae	KN =12 KT = 7	19	12.34
Khaya senegalensis (Desv.) A.Juss.	Maliaceae	KN = 1 KT = 1 KB = 3	5	3.25
Lannea microcarpa Engl. & K.Krause	Anacardiaceae	KN = 1	1	0.65
Syzygium guineense (Willd.) DC.	Myrtaceae	KN = 1	1	0.65
Ximenia americana L.	Olacaceae	KN = 5 KT = 5 KB = 3	13	6.49
Maerua angolensis DC.	Capparaceae	KN = 9	9	8.44
Cadaba farinose Forssk.	Capparaceae	KN = 9 KT =3	12	7.79
Anogeissus leiocarpa (DC.) Guill. & Perr.	Combretaceae	KN = 2 KT = 4 KB = 2	8	5.19
Annona senegalensis Pers.	Annonaceae	KN = 2	2	1.30
Carica papaya L.	Caricaceae	KN = 2	2	1.30
Ficus platyphylla Delile	Moraceae	KN = 1 KB = 1	2	1.30
Ricinus communis L.	Euphorbiaceae	KN = 1 KT = 1	2	1.30
Combretum micranthum G.Don	Combrataceae	KN = 2	2	1.30
Urelytrum giganteum Pilg.	Poaceae	KN = 1	1	0.65
Lamium purpureum L.	Lamiaceae	KN = 1	1	0.65

Leucas martinicensis (Jacq.) R.Br.	Lamiaceae	KN = 1	1	0.65
Momordica charantia L.	Curcubitaceae	KN = 4	4	2.60
Diospyros mespiliformis Hochst. ex A.DC.	Ebenaceae	KN = 1 KB = 2	3	1.95
Albizia lebbeck (L.) Benth.	Fabaceae	KN = 3 KB = 2	5	3.25
Albizia chevalieri Harms.	Fabaceae	KN = 5 KT = 1	6	3.90
Waltheria indica L.	Malvaceae	KN = 3 KT = 2	5	3.25
Celtis integrifolia Lam.	Ulmaceae	KN = 1	1	0.65
Allium sativum L.	Amaryllidaceae	KN = 8	8	5.19
Vitellaria paradoxa C.F.Gaertn.	Sapotaceae	KN = 3	3	1.95
Jatropha curcas L.	Euphorbiaceae	KN = 1 KT = 1	2	1.30
Moringa oleifera Lam.	Moringaceae	KN = 2 KT = 4	6	3.90
Echinochloa stagnina (Retz.) P.Beauv.	Poaceae	KN = 1	1	0.65
Ipomoea asarifolia (Desr.) Roem. & Schult.	Convulvulaceae	KN = 1	1	0.65
Allium cepa L.	Amaryllidaceae	KN = 2	2	1.30
Calotropis procera (Aiton) Dryand.	Asclepiadaceae	KN = 11 KT = 1	12	7.79
Azadirachta indica A.Juss.	Maliaceae	KN = 1	1	0.65
Zingiber officinale Roscoe	Zingiberaceae	KN = 1 KT = 1 KB = 1	3	1.95
Mentha piperita L.	Lamiaceae	KN = 1	1	0.65
Detarium microcarpum Guill. & Perr.	Fabaceae	KN = 1 KT = 1 KB = 2	4	2.60
Daniellia oliveri (Rolfe) Hutch. & Dalziel	Fabaceae	KN = 1	1	0.65
Catunaregam nilotica (Stapf) Tirveng.	Rubiaceae	KN = 3	3	1.95
Parkia biglobosa (Jacq.) G.Don	Fabaceae	KN = 3 KT = 1 KB = 1	5	3.25
Psidium guajava L.	Myrtaceae	KN = 1 KT =1 KB =2	4	2.60
Ziziphus spina-christi (Mill.) Georgi	Rhammaceae	KN = 3	3	1.95
Commiphora Africana (A.Rich.) Endl.	Burseraceae	KN = 3	3	1.95
Launaea taraxacifolia (Willd.) Amin ex C.Jeffrey	Astraceae	KN = 1	1	0.65
Dichrostachys cinerea (L.) Wight & Arn.	Fabaceae	KN = 1	1	0.65
Balanites aegyptiaca (L.) Delile	Zygophyllaceae	KN = 1 KT = 1	2	1.30
Mitracarpus hirtus (L.) DC.	Rubiaceae	KN = 1	1	0.65
Ficus thonningii Blume	Moraceae	KN = 1	1	0.65
Typha latifolia L.	Thyphaceae	KN = 1	1	0.65
Mitragyna inermis (Willd.) Kuntze	Rubiaceae	KN = 1 KT =1 KB = 1	3	1.95
Vernonia kotschyana Sch.Bip. ex Wal	Asteraceae	KN = 1	1	0.65

Mangifera indica L.	Anacardiaceae	KT = 1 KB = 2	3	1.95
Senna occidentalis (L.) Link	Fabaceae	KT =2	2	1.30
Hibiscus cannabinus L.	Malvaceae	KT = 1	1	0.65
Senna tora (L.) Roxb.	Fabaceae	KT = 1	1	0.65
Cissampelos owariensis P.Beauv. ex DC.	Menispermaceae	KT = 1	1	0.65
Pseudocedrela kotschyi (Schweinf.) Harms	Proteaceae	KT = 1 KB = 1	2	1.30
Vigna subterranea (L.) Verdc.	Fabaceae	KT = 1	1	0.65
Combretum molle R.Br. ex G.Don	Combretaceae	KT = 1	1	0.65
Securidaca longipedunculata Fresen.	Polygalaceae	KT = 1 KB = 3	4	2.60
Tephrosia bracteolate Guill. & Perr.	Fabaceae	KT =1	1	0.65
Acacia sieberiana DC.	Fabaceae	KB = 3	3	1.95
Acacia albida Delile	Fabaceae	KB = 1	1	0.65
Ficus polita Vahl	Moraceae	KB = 1	1	0.65
Nauclea diderrichii (De Wild.) Merr.	Rubiaceae	KB = 1	1	0.65
Bridelia ferruginea Benth.	Euphorbiaceae	KB = 2	2	1.30
Sterculia setigera Delile	Starculiaceae	KB = 1	1	0.65
Strychnoss spinosa Lam.	Loganiaceae	KB = 1	1	0.65
Adansonia digitata L.	Malvaceae	KB = 1	1	0.65
Borassus aethiopum Mart.	Arecaceae	KB = 1	1	0.65
Xylopia aethiopica (Dunal) A.Rich.	Annonaceae	KB = 1	1	0.65

Cluster analysis revealed distinct groupings among plant use practices. One cluster included treatments using leaves prepared by maceration and administered orally, while another grouped bark and root-based preparations, typically used topically in powdered form. These patterns suggest consistent cultural preferences in remedy formulation and application (Figure 4).

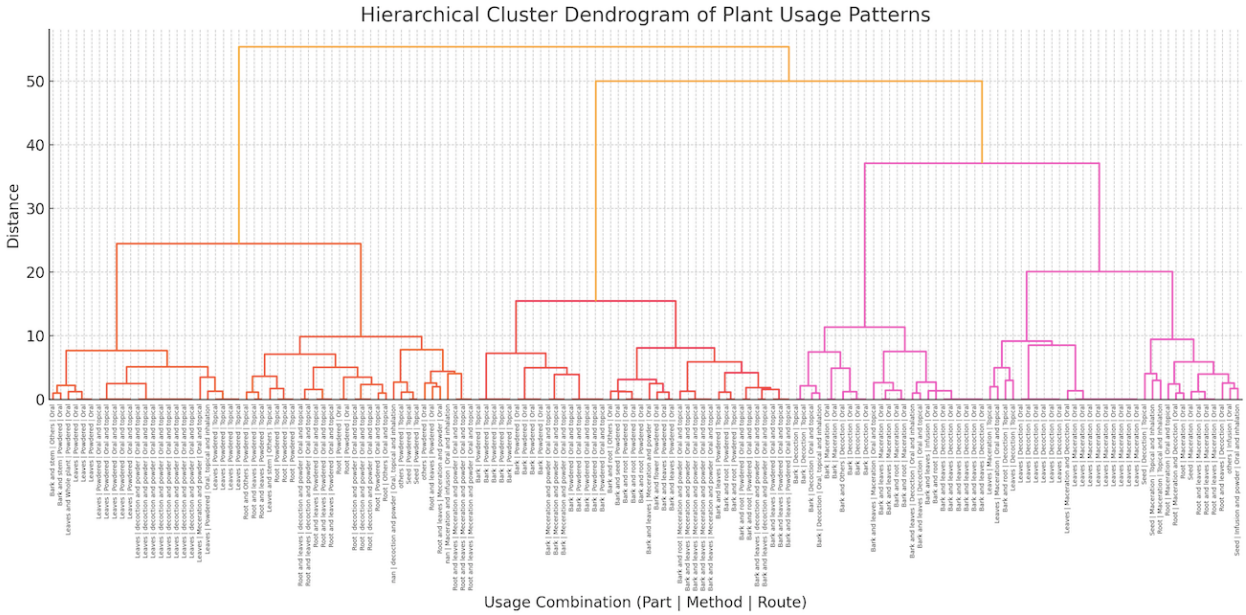

Figure 4. Dendrogram of clustered plant usage patterns by part used, preparation method, and administration route.

Correspondence analysis was conducted to examine the association between different plant parts and their routes of administration in traditional breast cancer management (Figure 5). The resulting biplot revealed distinct groupings. Plant parts such as leaves and seeds were closely associated with oral administration, while bark and roots were more frequently linked to topical applications. This spatial distribution of categories suggests that practitioners may select specific plant parts

not only based on availability or tradition but also due to perceived effectiveness through particular routes. The association between whole plant use and mixed routes also indicated variability in treatment approaches among respondents.

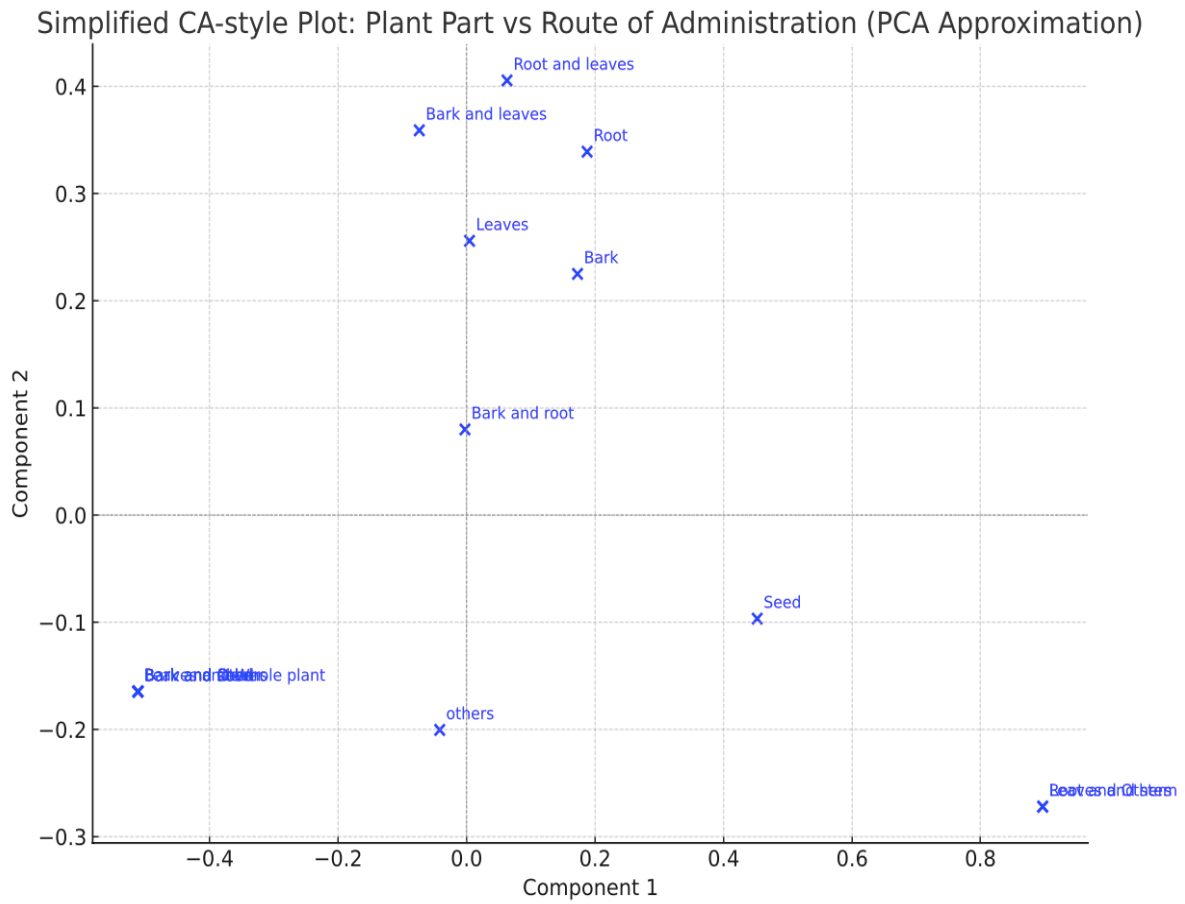

Figure 5. Correspondence plot showing associations between plant parts and administration routes.

Chi-square tests further supported these findings. A significant association between plant part and state ($\chi^2 = 46.61$, df = 28, p = 0.015) indicated regional variation in usage. A highly significant association between route of administration and method of preparation ($\chi^2 = 198.18$, df = 45, $p < 0.001$) reinforced the cultural logic in formulation (Table 4)

Table 4. Summary of chi-square results for ethnobotanical usage relationships

Chi-Square Comparison	χ^2	df	p-value
Part Used vs State	46.61	28	0.015

Discussion

The study highlights several critical insights into the traditional management of breast cancer in Northwestern Nigeria. The lack of systematic cancer screening in underdeveloped areas contributes significantly to late diagnosis and higher mortality rates. This issue is compounded by the toxicity and resistance often associated with current chemotherapeutic drugs. Natural products, particularly those derived from plants, continue to play a vital role in cancer management (Newman and Cragg 2007).

The Hausa-Fulani tribes, predominant in the study region, have a rich heritage of traditional medicine (Shinkafi *et al*. 2015). Most respondents were male, Muslim, and aged above 40 years, with fewer women represented due to cultural roles that limit female involvement in public and professional spheres (Abba & Abdulrahman 2021). Younger people are also less engaged in traditional practices, a trend observed across various Nigerian studies (Anas & Abdulrahman 2021, Dafam *et al*. 2016, Labaran *et al*. 2021).

Diagnosis by TMPs relies largely on visible symptoms such as breast swelling and pain, similar to practices in Uganda and Ghana (Lutoti *et al*. 2023, O'Brien *et al*. 2012). However, this method is insufficient and may result in misdiagnoses. TMPs should be trained to recognize early cancer symptoms and encouraged to refer patients to medical facilities (Casey *et al.* 2008, Mwaka *et al*. 2021). The low hospital referral rate (only 38.3%) suggests a significant gap in diagnostic accuracy and treatment outcomes. Furthermore, misconceptions about cancer, such as identifying it with abscesses or high cholesterol, underline the need for educational outreach (Al Naggar *et al*. 2012, Co *et al*. 2020).

Ethnobotanical findings reveal 80 plant species used in breast cancer management, dominated by the Fabaceae family, which has also been reported in other regions of Nigeria and internationally (De Melo *et al*. 2011, Kankara *et al*. 2020, Mohammed *et al*. 2014). This prevalence may stem from its wide availability and adaptability to the harsh climatic conditions of the Sahel, as well as its deep cultural significance in traditional healing practices.

Preparation methods were mostly decoctions, macerations, and powders, with oral and topical applications being predominant (97%), consistent with findings from other Nigerian and Moroccan studies (Bourhia 2019, Mohammed *et al*. 2014, Omogbadegun, 2013). Leaves were the most frequently used plant part, although regional variations exist. For instance, stem bark was more prominent in reports from Kankara *et al*. 2020, while leaves were dominant in studies from southwestern Nigeria (Afolayan *et al*. 2020).

Key species consistently cited for breast cancer treatment include *Guiera senegalensis* J.F.Gmel., *Cassia singueana* Delile, *Boswellia odorata* Hutch, and *Prosopis africana* (Guill. & Perr.) Taub, though their prominence varied across Kano, Katsina, and Kebbi states. These discrepancies may be influenced by ecological, cultural, and socio-economic factors affecting ethnomedicinal preferences (Eshete & Molla 2021, Menendez-Baceta *et al*. 2015). During our discussion with respondents, it was noticed that the majority used only medicinal plants in the management of breast cancer. However, few respondents combine the use of medicinal plants with other forms of traditional medicine, such as incantation, due to the popular belief among the community that cancer occurs as a result of contact of the patient with evil spirits. Despite diversity in the preparation and use of medicinal plants, they play a crucial role in the management of different types of cancers in northwestern Nigeria (Malami *et al*. 2020, Abubakar *et al.* 2007).

The inclusion of multivariate statistical techniques provides additional robustness to the findings. Cluster analysis highlighted internal consistency in plant use practices, and correspondence analysis supported the culturally meaningful links between plant part selection and how remedies are administered. These findings add quantitative support to the ethnobotanical understanding that traditional healing systems are not random, but rather patterned and culturally coherent. The correspondence analysis plot revealed distinct associations between plant parts and routes of administration among traditional healers in Northwestern Nigeria. For example, leaves and seeds were closely aligned with oral administration, suggesting a cultural or practical preference for ingestible parts when treating breast cancer. Conversely, bark and roots clustered near topical administration, indicating their external application in poultices or decoctions. These relationships highlight not only the pharmacological beliefs but also the embedded cultural practices in traditional medicine. Such insights reflect a nuanced human–plant interaction that goes beyond the listing of remedies, supporting the need for ethnobotanical documentation grounded in sociocultural contexts (Martin 2010, Albuquerque *et al.* 2014).

Conclusion

This study has brought to light the deep-rooted knowledge and cultural heritage of traditional healers in Northwestern Nigeria who have relied on medicinal plants for generations in managing breast cancer. By documenting 80 species used in this practice, we not only honor this indigenous wisdom but also open the door for scientific exploration of these plant-based remedies. The plants identified, especially those frequently cited like *Guiera senegalensis* J.F.Gmel., *Cassia singueana* Delile, and *Boswellia odorata* Hutch represent more than therapeutic agents; they symbolize hope for safer, locally accessible, and culturally acceptable cancer treatments. While modern medicine offers powerful interventions, its limitations call for a complementary approach that bridges traditional and contemporary healthcare.

Declarations

List of abbreviations: Bayero University Kano Herbarium Accession Number **(**BUKHAN), Relative Frequency of Citation (RFC), Kano (KN), Katsina (KT), Kebbi (KB

Ethics approval and consent to participate: The authors confirm that the study was reviewed and approved by Health Research Ethics Committee, Kano State Ministry of Health. The informed consent of each respondent was obtained before the interview
Consent for publication: Oral permission. All authors agreed for submission
Availability of data and materials: Data is available on demand
Competing interests: Authors have no conflict of interest.
Funding: This research is sponsored by the National Research Fund (NRF) under the Tertiary Education Trust Fund (TETFund), Nigeria. Grant Number: TETF/ES/DR&D-CE/NRF2023/CC/STI/00104/VOL.I
Author contributions: SD, UII, KGM, BLK: Conceptualization, study design, compiled and analyzed the data, NAA, IAM, SSB conducted the survey. AMA, AM: Draft manuscript: manuscript writing. All authors have read, approved the final version of the manuscript

Acknowledgements

The authors would like to thank all respondents that participated in this research and provide valuable information. Furthermore, the authors acknowledge the research grant (TETF/ES/DR&D-CE/NRF2023/CC/STI/00104/VOL.I**)** received from Tertiary Education Trust Fund (TETFund), Nigeria for the conduct of this research.

Literature cited

Abba A, Abdulrahman MD. 2021. Ethnomedicinal survey of plants used for management of inflammatory diseases in Ringim local government, Jigawa state, Nigeria. Ethnobotany Research and Applications 22(47):1-27.

Abubakar MS, Musa AM, Ahmed A, Hussaini IM. 2007. The perception and practice of traditional medicine in the treatment of cancers and inflammations by the Hausa and Fulani tribes of Northern Nigeria. J Ethnopharmacol 111(3):625-629.

Afolayan FI, Sulaiman KA, Okunade WT, Garrido G. 2020. Ethnobotanical survey of plants used in cancer therapy in Iwo and Ibadan, South-Western of Nigeria. J Pharm Pharmacogn Res 8(5):346-367.

Al-Naggar RA, Bobryshev YV, Abdulghani MAMM, Rammohan S, Al-Jashamy K. 2012. Knowledge and perceptions of cancer and cancer prevention among Malaysian traditional healers: a qualitative study. Asian Pacific Journal of Cancer Prevention 13(8):3841-3850.

Albuquerque UP, De Lucena RFP, da Cunha LVFC, Alves RRN (Eds.) 2019. Methods and techniques in ethnobiology and ethnoecology. Springer, New York: Humana Press.

Bourhia M, Abdelaziz Shahat A, Mohammed Almarfadi O, Ali Naser F, Mostafa AW, Ait HS A, Khlil N. 2019. Ethnopharmacological Survey of Herbal Remedies Used for the Treatment of Cancer in the Greater Casablanca-Morocco. Evidence-Based Complementary and Alternative Medicine (1):1613457.

Casey M, Adams J, Sibbritt D. 2008. An examination of the clinical practices and perceptions of professional herbalists providing patient care concurrently with conventional medical practice in Australia. Complementary Therapies in Medicine, 16(4):228-232.

Co M, Lee A, Kwong A. 2020. Delayed presentation, diagnosis, and psychosocial aspects of male breast cancer. Cancer Medicine 9(10):3305-3309.

Costa E, Ferreira-Gonçalves T, Cardoso M, Coelho JM, Gaspar MM, Faísca P, ... Figueiredo IV. 2020. A step forward in breast cancer research: From a natural-like experimental model to a preliminary photothermal approach. International journal of molecular sciences 21(24):9681.

Dafam DG, Agunu A, Ibrahim H, Ajima U, Ohemu TL, Okwori VA, ... Ilyas N. 2016. A preliminary ethno-medical survey of plants used in the traditional management of cancer and related diseases amongst Tarok people of Plateau State, North-Central Nigeria. European Journal of Medicinal Plants,16(4):1-10.

Danibrahim NT, Kohar UHA, Indiran L. 2022. Influence of entrepreneurial competencies on the performance of SMEs in Northwest Nigeria. International Journal of Academic Research in Business and Social Sciences 12(5):858-872.

De Melo JG, Santos AG, de Amorim ELC, Nascimento SCD, de Albuquerque UP. 2011. Medicinal plants used as antitumor agents in Brazil: an ethnobotanical approach. Evidence-Based Complementary and Alternative Medicine 1:1-14.

Eshete MA, Molla EL. 2021. Cultural significance of medicinal plants in healing human ailments among Guji semi-pastoralist people, Suro Barguda District, Ethiopia. Journal of Ethnobiology and Ethnomedicine 17:1-18.

Feiten S, Dünnebacke J, Heymanns J, Köppler H, Thomalla J, van Roye C, ... Weide R. 2014. Breast cancer morbidity: questionnaire survey of patients on the long term effects of disease and adjuvant therapy. Deutsches Ärzteblatt International 111(31-32):537.

Hosseini A, Ghorbani A. 2015. Cancer therapy with phytochemicals: evidence from clinical studies. Avicenna Journal of Phytomedicine 5(2):84.

International Society of Ethnobiology 2006. ISE Code of Ethics (with 2008 additions). Online: http://ethnobiology.net/code-of-ethics/

Kankara SS, Ibrahim MH, 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.

Labaran I, Abdulrahman MD, Hamad SW, Lema ABA, Jakada BH. 2021. Traditional medicinal plants used for the treatment of cancer in Mubi, Adamawa State, Nigeria. Al-Qadisiyah Journal of Pure Science, 26(4):258-268.

Lutoti S, Kaggwa B, Kamba PF, Mukonzo J, Sesaazi CD, Katuura E. 2023. Ethnobotanical survey of medicinal plants used in breast cancer treatment by traditional health practitioners in Central Uganda. Journal of Multidisciplinary Healthcare 635-651.

Malami I, Jagaba NM, Abubakar IB, Muhammad A, Alhassan AM, Waziri PM, ... Mathias SN. 2020. Integration of medicinal plants into the traditional system of medicine for the treatment of cancer in Sokoto State, Nigeria. Heliyon, 6(9):e04830.

Martin GJ. 2010. Ethnobotany: a methods manual. Routledge.

Menendez-Baceta G, Aceituno-Mata L, Reyes-García V, Tardío J, Salpeteur M, Pardo-de-Santayana M. 2015. The importance of cultural factors in the distribution of medicinal plant knowledge: a case study in four Basque regions. Journal of Ethnopharmacology 161:116-127.

Mohammed ZK, Daja A, Hamzxa HG, Gidado A, Hussaini IM. 2014. Ethnomedicinal survey of folkloric plants used in managing breast cancers by the traditional medical practitioners of North-East Nigeria. Journal of Medicinal and Applied Bioscience 6(1): 29-43.

Moncrief JW, Lipscomb WN. 1965. Structures of Leurocristine (Vincristine) and Vincaleukoblastine. 1 X-Ray Analysis of Leurocristine Methiodide. Journal of the American Chemical Society 87(21):4963-4964.

Mwaka AD, Achan J, Adoch W, Wabinga H. 2021. From their own perspectives: a qualitative study exploring the perceptions of traditional health practitioners in northern Uganda regarding cancers, their causes and treatments. BMC Family Practice 22:1-14.

Newman DJ, Cragg GM. 2007. Natural products as sources of new drugs over the last 25 years. Journal of natural products, 70(3):461-477.

Ngoua-Meye-Misso RL, Sima-Obiang C, Ndong JDLC, Ndong-Atome GR, Ondo JP, Abessolo FO, Obame-Engonga LC. 2019. Medicinal plants used in management of cancer and other related diseases in Woleu-Ntem province, Gabon. European Journal of Integrative Medicine 29, 100924.

O'Brien KS, Soliman AS, Annan K, Lartey RN, Awuah B, Merajver SD. 2012. Traditional herbalists and cancer management in Kumasi, Ghana. Journal of Cancer Education 27:573-579.

Omogbadegun ZO. 2013. Medicinal plants-based foods for breast cancer treatment: an ethnobotanical survey and digitization. International Journal of Medicinal Plants and Alternative Medicine 1(8):137-163.

Rawat PS, Jaiswal A, Khurana A, Bhatti JS, Navik U. 2021. Doxorubicin-induced cardiotoxicity: An update on the molecular mechanism and novel therapeutic strategies for effective management. Biomedicine & Pharmacotherapy 139:111708.

Shah R, Rosso K, Nathanson SD. 2014. Pathogenesis, prevention, diagnosis and treatment of breast cancer. World Journal of Clinical Oncology *5*(3):283.

Shapiro CL, Recht A. 2001. Side effects of adjuvant treatment of breast cancer. New England Journal of Medicin, 344(26):1997-2008.

Shinkafi TS, Bello L, Hassan SW, Ali S. 2015. An ethnobotanical survey of antidiabetic plants used by Hausa–Fulani tribes in Sokoto, Northwest Nigeria. Journal of Ethnopharmacology 172:91-99.

Suffness M. 1993. Taxol: from discovery to therapeutic use. Annual Reports in Medicinal Chemistry 28: 305-314.

Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. 2021. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians 71(3):209-249.

Taebi R, Mirzaiey MR, Mahmoodi M, Khoshdel A, Fahmidehkar MA, Mohammad-Sadeghipour M, Hajizadeh MR. 2020. The effect of Curcuma longa extract and its active component (curcumin) on gene expression profiles of lipid metabolism pathway in liver cancer cell line (HepG2). Gene Reports 18:1-6.