

Species diversity in handling infertility in some Local Government Areas of Kano State, Nigeria

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ABSTRACT

Some medicinal plants used in Dawakin Tofa, Gabasawa, Rimin Gado, Tofa, Kano municipal, and Tudunwada Local Government Areas of Kano State, Nigeria were surveyed. This was researched with the aim of documenting traditional preparations used in handling infertility in the areas. Using a structured questionnaire, 80 respondents of different age groups including the educated and illiterates were interviewed. Fifty five plants were collected from markets in the study area. The plant families names, number of individual plant use for the ailments they are used to treat, total number of species used by all informants for ailment category, informant consensus factor and percentage fidelity level of each species was documented. The highest medicinal species studied belong to the Fabaceae family. Findings from this study also indicate that different species play harmonizing roles like womb cleansing, sperm count increment and libido boost in promoting fertility. Factors ranging from insecticide use (107), land expansion for agricultural use (76), fuel wood collection (62), overgrazing (36) to over harvesting (23) account for threats to the sustainable use of medicinal plant species in the study area. The principal plant part used in ethno-medicinal preparations in the study areas are leaves and roots. The major form in which the herbal remedies are administered is in their dried state. The chief modes of preparing these remedies are in powders and decoctions. Trees and herbs are the main habits of medicinal plants in the study areas. It is recommended that indigenes in the study areas make effort to cultivate medicinal plants to ensure sustainable use. Younger people should also show interest in acquiring ethno-medicinal knowledge which may be key in new drug discoveries.

Keywords: Ethnomedicine, Infertility, Plant diversity, Kano State, Fidelity level.

INTRODUCTION

Infertility is a condition in which a man is unable to impregnate a woman or a condition in which a woman is unable to get pregnant as a result of some biological or disease-induced factors [1]. More than 90% of male infertility cases are due to low sperm counts, poor semen quality or both. The cause of 30–40% of these cases of sperm abnormalities cannot be accounted for [1]. In some parts of Nigeria, studies have shown that the rate of infertility could be as high as 20% - 45% [2, 3]. Etuk [4] also pointed out that about 40% of infertility cases in Africa are attributed to male factors, another 40% are due to female factors, 15% are due to factors present in both partners, and the remaining 5% are due to cases where no causes are found in either partner after extensive investigations. Women are most fertile in their early twenties, while, fertility starts ebbing after they approach thirty [4]. Unlike male sterility which is caused by venereal diseases, diabetes, azoosperma, asthenozoosperma, tetrazoosperma, premature ejaculation [5], and hemorrhoid/pile [6], female infertility is caused by leucorrhoea, menopause, menstrual disorder, faulty uterus and ovaries [1]. In Nigeria, surveys have shown that the prevalence of infertility is on the increase. Currently, 30% or more of Nigerian women are affected [3]. The causes of infertility have been attributed to previous exposure to sexually transmitted diseases (STDs) and infections occurring after unsafe abortions [3, 7]. Alternative medicines have been reported to be efficacious in treating female infertility [8,

9]. Active principles such as phenols, alkaloids, saponins, and particularly flavonoids contained in plant materials are known to have estrogenic [10] and androgenic activities [8].

The practice of herbal medicine is gaining more acceptance in the world of conventional medicine, as clinical research, analysis, and quality control express the value of herbal medicines [11]. According to Bussmann and Glenn [12], herbal medicine is rapidly becoming of economic importance. Rural people and tribal communities who live in the forest areas predominantly depend on locally available medicinal plants to handle their health and cultural needs [6]. Ethnobotanical research can contribute to developing countries by documenting traditional forms of healthcare, discovering crude plant extracts with bioactive compounds and the invention of cheap drugs [13]. Thus, ethnobotany plays a crucial role in the study of traditional medicine [14]. This study is aimed at creating a database on the traditional knowledge of plants used in handling infertility, the forms and mode of administration and the possible methods of conserving these plants in six local government areas of Kano State, Nigeria.

MATERIALS AND MATERIALS

Study Area: This study was carried out in Kano State located at 11°30'N 8°30'E, Nigeria (Figure 1). Kano State comprises of about thirteen Local Government Areas. However for the purpose of this study, only six local governments were selected based on geographical spread, namely Dawakin Tofa, Gabasawa, RiminGado, Tofa, Kano municipal, and Tudunwada.



Fig. 1a. Map of Nigeria showing the location of Kano State

Method of collection: The study was conducted from the month of November 2014 to March 2015 using a structured questionnaire. A total of 80 informants consisting of 43 females and 37 males were interviewed. No special criteria were used to select informants, although the target audience were local healers, herb sellers, and aged couples. All respondents were interviewed based on their willingness to give out information in the questionnaires administered. Interviews were conducted with informants of different educational levels (illiterate, primary, secondary, university) in the cases of uneducated informants they were asked questions orally and their responses documented.

Specimen collection and identification: Fifty five (55) medicinal plants were collected from natural vegetation, herb markets and home gardens during the field walks. Markets from where some plants reported were purchased are; KasuwanRimi, Kasuwan Kurumi, Kasuwan Brigade, Middle road Sabongari, and Adobayero square. Voucher specimens were deposited in the University of Abuja herbarium. The specimens were identified majorly with the aid of textbooks.



Figure 1b: Map of Kano State showing the study areas.

Statistical analysis: Diverse uses of medicinal plants were evaluated by calculating use value (UV), informant consensus factor (ICF), and fidelity level (FL). UV was calculated by the equation:

$$UV_s = \sum_i UV_{is} / n_s$$

where, 'UV_s' indicates the use value of a particular species, 'UV_{is}' is the number of use reports mentioned by the informants for that particular plant species and 'n_s' is the total number of informants.

ICF was calculated using the equation:

$$ICF = (N_{ur} - N_t) / (N_{ur} - 1)$$

Where, 'N_{ur}' refers to the total number of use reports for a particular ailment category, and 'N_t' is the total number of species used for this ailment category.

Fidelity level (FL) expresses the priority of a species over the others in the management of a particular ailment and was calculated using the following formula:

$$FL = I_p / I_u \times 100$$

Where, 'I_p' is the number of informants stating the use of a species for a particular ailment category while 'I_u' is the number of informants stating the use of that plant for any sort of ailment category.

RESULTS

The demography; distribution of respondents in this study is shown on Table 1. Most respondents were male between the ages of 41-45. The most of the respondents were illiterates and herbalists. Table 2 shows 55 medicinal plant species belonging to 33 families, the parts used and dosages. Table 3 shows the threat factors to the plants collected in the study sites as reported by respondents.

The most plaguing threats to medicinal plants in the study areas are the gross use of insecticides which in the long run inhibit plant growth and/or reduce plant yields and land expansion for agricultural use. Table 4 shows the informant consensus factor of some plants used in handling some infertility related ailments.

Table 1: Demography of respondents in Kano State.

Demography		Total number	Percentage (%)
Gender	Male	50	62.5
	Female	30	37.5
Age group	26-30	10	12.5
	31-35	13	16.3
	36-40	21	26.3
	41-45	26	32.5
	46 and above	10	12.5
Occupation	Herbalists	50	62.5
	Herb sellers	20	25.0
	Others	10	12.5
Educational status	Illiterates	50	62.5
	Primary school	18	22.5
	Secondary school	12	15.0

Table 2: Identified species, their uses, formulations and dosages.

S/ N	BOTANICAL NAME	BOTANICAL FAMILY	LOCAL NAME	PART USED	ETHNO-MEDICINAL USES	HERBAL FORMULATION, ADMINISTRATION AND DOSAGES
1	<i>Abrus precatorius</i> L.	Fabaceae	Taagaraanaa	Leaves	Infertility	Leaves are dried, ground and taken with milk or water Administered orally Taken 3 times daily for 4 days
2	<i>Acacia macrothyrsa</i> Harms.	Fabaceae	Gwanoo	Root	Infertility	Roots are boiled, and the juice extracted Administered orally Taken as needed
3	<i>Acacia nilotica</i> L.	Fabaceae	Bagaaruwaa	Bark	Infertility	Bark boiled and the juice extracted Administered orally. One teacup is taken twice daily for 3 days
4	<i>Aframomum melegueta</i> K. schum.	Zingiberaceae	Cittaa	Fruit	Infertility	Fruit is ground and licked with honey Administered orally Taken once a day
5	<i>Azelia africana</i> Sm.	Fabaceae	Kaawoo	Bark	Induces fertility	Bark is boiled and juice extracted Administered orally Taken as needed
6	<i>Allium ascalonicum</i> Hort.	Amaryllidaceae	Shafa	Leaves	Infertility	Leaves are dried, ground and taken with porridge Administered orally Taken once a day for 2 weeks
7	<i>Ananas comosus</i> L.	Bromeliaceae	Abarbaa	Bark	Womb cleanser	Bark is boiled, juice extracted Administered orally Taken as needed
8	<i>Aneilema lanceolatum</i> Benth.	Commelinaceae	Karyagarama	Leaves	Erectile dysfunction	Ground into powder, taken with pap or water Administered orally Taken once daily for 3 days
9	<i>Azadirachta indica</i> A.Juss.	Meliaceae	doogonyaro	Leaves, Bark	Gastrointestinal	Leaves and bark are boiled, juice extracted Administered orally Taken as needed
10	<i>Bridelia ferruginea</i> Benth.	Phyllanthaceae	Kirii	Leaves	Infertility	boiled, juice extracted Administered orally taken twice daily for 3 days
11	<i>Burkea africana</i> Hook.	Fabaceae	Bakinmakarfo	Root	Sexual strength	Boiled extract is mixed with milk Administered orally Taken as needed
12	<i>Capsicum annum</i> L.	Solanaceae	Barkoonoo	Fruit	Infertility	Ground fruit is mixed with honey. Administered orally Taken as needed
13	<i>Cassia arereh</i> Del.	Caesalpiniaceae	Gama fada	Leaves	Impotence	Leaves are ground and added to stews. Administered orally Taken 3 times daily for 2 weeks
14	<i>Cassia singueana</i> Delile.	Caesalpiniaceae	Runfuu	Bark	Infertility	Bark is boiled Administered orally Juice is taken every morning for five days
15	<i>Celtis integrifolia</i> L.	Cannabaceae	Zuuwuu	Bark	Infertility	Administered Orally Decoction is taken once daily for 1 week
16	<i>Cissus</i>	Vitaceae	Daafarraa	Bark	Infertility	Made into a paste with red oil Administered orally

	<i>populnea</i> Guill. & Per.					Taken once daily for a month
17	<i>Combretum glutinosum</i> Perr. Ex DC.	Combretaceae	Tarauniyaa	Stem	Increase sperm count	Ground to powder and taken with meat, rice, or tea Administered Orally Taken thrice daily for 2 weeks
18	<i>Combretum molle</i> R.Br.exG. Don	Combretaceae	Wuyandamoo	Root	Induce fertility	Boiled and brewed with tea Administered orally Taken as needed
19	<i>Combretum sericeum</i> G.Don	Combretaceae	Taro	Leaves	Infertility	Ground leaves are used with tea Administered Orally Taken twice daily for 5 days
20	<i>Corchorus olitorius</i> L.	Malvaceae	Rama	Leaves	Infertility	Leaves are washed, dried, ground and mixed with rice Administered orally Taken 3 times daily for 2 weeks
21	<i>Dalbergia saxatilis</i> Hook. F.	Fabaceae	Farimakarfo	Bark	Sexual strength	Juice extracted and used to make stew Administered orally Taken as needed
22	<i>Evolvulus alsinoides</i> L.	Convolvulaceae	kaa fi maalam	Leaves	Impotence	Ground to powder taken with tea Administered orally Half table spoon ,once a day for 5 days is taken
23	<i>Fadogia agrestis</i> (Shweinf. Ex Hiern)	Rubiaceae	Bakingagai	Roots	Erectile dysfunction	Crushed to powder, taken with meat, rice, or tea without milk Administered Orally Taken as needed
24	<i>Ficus platyphylla</i> Delile.	Moraceae	Gamji	Leaves	Anti-inoceptive	Grounded leaves are made into paste and taken with boiled yam Administered Orally Taken for 3 weeks
25	<i>Ficus exasperate</i> Vahl.	Moraceae	Bauree	Leaves	Anti-inflammatory	Boil leaves and take with pap Taken 3 times daily for 10 days
26	<i>Garcinia kola</i> Heckel	Clusiaceae	Gooro	Fruit	Infertility	Chew fruit Taken daily as needed
27	<i>Gardenia aqualla</i> Stapf. & Hutch.	Rubiaceae	Gaude	Roots	Infertility	Extract is brewed with tea Administered orally Taken once a day for 2 days
28	<i>Guiera senegalensis</i> J.F. Gmel	Combretaceae	Saabaraa	Leaves, Roots	Inducing fertility	Ground leaves and root are used as spices in food. Administered orally Taken as needed
29	<i>Hibiscus cannabinus</i> L.	Malvaceae	Ramaa	Roots	Infertility	Extract is brewed with tea Taken twice daily for 10 days
30	<i>Hymenocardia acida</i> Tul.	Phyllanthaceae	Jan yaaro	Stem bark	Infertility	Juice extract is used without any supplement Administered Orally Taken 3 times daily for 5 days
31	<i>Kigelia africana</i> (Lam.)Benth.	Bignoniaceae	Rawuya	Leaves	Erectile dysfunction	Ground leaves are used as spice Administered orally Taken as needed
32	<i>Lamnea microcarpa</i> Engl. & K. Krause	Anacardiaceae	Faaruu	Bark	Infertility	Crushed and made into paste with honey Administered Orally Taken once a day for 2 weeks
33	<i>Leptadenia hastate</i> Pers.	Apocynaceae	Yaadiiyaa	Leaves,Stalk	Infertility	Oils are used to make stews Administered Orally Taken as needed
34	<i>Loudetia phragmitoides</i> C.E. Hubb	Poaceae	Gaude	Leaves	Infertility	Ground leaves are boiled and juice extracted. Taken 3 times daily for 10 days
35	<i>Mangifera indica</i> L.	Anacardiaceae	Mangwaroo	Bark	Gastrointestinal Disorder	Ground and made into a paste mixed with red oil Administered Orally Taken daily for 3 weeks
36	<i>Moringa oleifera</i> Lam.	Moringaceae	Zoogale	Leaves	Infertility	Extract juice Administered orally Taken as needed

37	<i>Panicum laetum</i> Kunth.	Poaceae	Bacakura	Root, Stem	Infertility	Juice is extracted and taken with tea. Administered orally Taken as needed
38	<i>Parinari polyandra</i> Benth.	Chrysobalanaceae	Kaikayii	Leaves, Stem	Womb cleanser	Decoction is added to porridge Administered Orally Taken once a day for 3 days
39	<i>Parinari robusta</i> Oliv.	Chrysobalanaceae	KasheKaaji	Leaves	Prostrate problems	Crushed and used without any supplement. Administered orally Taken 3 times daily for 5 days
40	<i>Parkia biglobosa</i> (Jacq.)R.Br . ex G.Don	Fabaceae	Doorawa	Bark	Enhance fertility	Crushed into powder and added to porridge. Administered orally Taken as needed
41	<i>Phoenix dactylifera</i> L.	Arecaceae	Dabiinoo	Shoot	Aphrodisiac	Ground and make into paste with red oil Administered orally Taken as needed
42	<i>Prosopis africana</i> (Guill. &Perr.)	Fabaceae	Kirya	Root, Stem	Infertility	Extracts are mixed with honey Administered Orally Taken 3 times daily for 10 days
43	<i>Pseudocedrela kotschyi</i> (Shweinf.) Harms.	Meliaceae	Tonaa	Leaves	Infertility	Ground to powder, boil, extract juice and add honey Administered orally Taken once a day for 5 days
44	<i>Raphionacme brownii</i> Scott-Elliott.	Asclepiadaceae	Barzo	Fruits	Infertility	Smoked, crushed and mixed with honey. Administered orally Taken once a day for 8 days
45	<i>Sclerocarya a birrea</i> (A. Rich.)Hochst.	Anacardiaceae	Danyaa	Bark	Infertility	Crushed and added to stews. Administered orally Taken as needed
46	<i>Scoparia dulcis</i> L.	Plantaginaceae	Rumafaada	Leaves	Enhance sexual strength	Ground into powder and drink with tea. Administered orally Taken twice daily for 3 days
47	<i>Securidaca longepedunculata</i> Fresen.	Polygalaceae	Sanyaa	Bark	Inducing fertility	Juice is extracted from bark Administered orally Taken once daily for 5 days
48	<i>Senna occidentalis</i> L.	Fabaceae	Rairai	Whole plant	Antifertility	Oils used with honey Administered orally Taken 3 times daily for 2 weeks
49	<i>Sesamum orientale</i> L.	Pedaliaceae	Riidii	Seeds	Infertility	Smoked and mixed with honey Administered orally Taken as needed
50	<i>Smilax anceps</i> Del.	Smilacaceae	KyarKusa	Fruits	Infertility	Crushed and mixed with honey or red oil Administered orally Taken every morning for 21 days
51	<i>Striga hermonthica</i> Del.	Orobanchaceae	Gaugaii	Stem	Increase sperm viability	Paste is mixed with honey Administered orally Taken 3 times daily for 4 weeks
52	<i>Syzygium aromaticum</i> L Merrill & Perry	Myrtaceae	Kanamfarii	Fruit	Aphrodisiac	Smoked and used with hot food Administered orally Twice daily for 4 days
53	<i>Tribulus terrestris</i> M.H.	Zygophyllaceae	Tsiidau	Bark	Infertility	Bark is boiled and juice extracted. Administered orally Taken once a day for 5 days
54	<i>Vernonia amygdalina</i> M.	Asteraceae	Shiwaakaa	Leaves	Increase Sperm count	Made into paste with honey. Administered orally Taken as needed
55	<i>Zingiber officinale</i> L.	Zingiberaceae	Cittaamaik wacyaa	Root	Aphrodisiac	Mixed with tea Administered orally Taken once daily

TABLE 3: Ranking factors considered as threats to wild ethno-medicinal plants.

Factors	DT	KM	G	T	TW	RG	Total	Rank
Over-grazing	12	15	5	4	0	0	36	1
Over-harvesting	7	12	3	1	0	0	23	2
Agriculture land expansion	38	19	7	5	7	0	76	3
Uncontrolled Fire Setting	1	0	0	0	0	0	1	4
Fuel wood collection	26	12	4	2	14	4	62	5
Insecticides	25	17	27	19	4	15	107	6

KEY:DT - DawakinTofa; TW- Tudum Wada; RG – RimmGado; T – Tofa; KM - Kano Municipal; G - Gabassawa LGA.

Table 4 reports the Fic, Nur and Nt of plants used in handling various ailments relating to infertility in Kano State, Nigeria. Plants with the highest Fic value were reported to be useful in handling cervical mucus, poor motility of sperm, absent period and progesterone imbalance. Table 5 shows the plants collected in the study and their percentage fidelity in managing known ailments amongst people in the area. A few plants display 100% fidelity levels in managing certain ailments including *Abrus precatorius*, *Ananas comosus*, *Burkea africana*, *Cassia arereh*, *Combretum glutinosum*, *Evolvulus alsinoides*, *Fadogia agrestis*, *Gardenia aqualla*.

Table 4: Fic values of traditional medicinal plants for treating infertility related ailments in Kano State.

S/N	Disease categories	Nur	Nt	Fic
1	Absent Period	150	22	0.86
2	Cervical Mucus	125	25	0.97
3	Estrogenic Balance	55	12	0.80
4	Heavy Menstrual Bleeding	75	20	0.74
5	Immune Related infertility	137	33	0.76
6	Libido Boosting	266	74	0.72
7	Pregnancy Preparation	33	10	0.72
8	Progesterone Balance	95	15	0.85
9	Low Sperm Count	189	84	0.56
10	Erectile Dysfunction	275	62	0.78
11	Blocked Sperm Count	45	13	0.73
12	Poor motility of sperm	189	11	0.95

KEY:Fic- Informant consensus factor; Nur- Number of individual plant use report for each ailment category; Nt- Number of taxa.

Table 5: Medicinal plants and their percentage fidelity levels in managing certain ailments.

S/N	Medicinal plant	Ailments	I _p	I _n	%FL
1.	<i>Abrus precatorius</i>	Infertility	10	10	100
2.	<i>Acacia macrothyrsa</i>	Infertility	17	19	89.5
3.	<i>Acacia nilotica</i>	Infertility	22	24	91.7
4.	<i>Aframomum melegueta</i>	Infertility	21	23	91.3
5.	<i>Azelia africana</i>	Infertility	23	25	92.0
6.	<i>Allium ascalonicum</i>	Infertility	22	23	95.7
7.	<i>Ananas comosus</i>	Infertility	14	14	100
8.	<i>Aneilema lanceolatum</i>	Infertility	12	14	85.7
9.	<i>Azadirachta indica</i>	Infertility	10	12	83.3
10.	<i>Bridelia ferruginea</i>	Infertility	13	14	92.9
11.	<i>Burkea africana</i>	Infertility	12	12	100
12.	<i>Capsicum annum</i>	Infertility	11	13	84.6
13.	<i>Cassia arereh</i>	Infertility	25	25	100
14.	<i>Cassia singuerana</i>	Infertility	12	13	92.3
15.	<i>Celtis integrifolia</i>	Infertility	13	15	86.7
16.	<i>Cissus populnea</i>	Infertility	11	12	91.7
17.	<i>Combretum glutinosum</i>	Infertility	17	17	100
18.	<i>Combretum molle</i>	Infertility	23	25	92.0
19.	<i>Combretum sericeum</i>	Infertility	22	24	91.7
20.	<i>Corchorus olitorius</i>	Infertility	9	11	81.8
21.	<i>Dalbergia saxatilis</i>	Sexual strength	12	13	92.33
22.	<i>Evolvulus alsinoides</i>	Infertility	12	12	100
23.	<i>Fadogia agrestis</i>	Anti-inflammatory	16	16	100
24.	<i>Ficus platyphylla</i>	Infertility	19	21	90.5
25.	<i>Ficus exasperate</i>	Infertility	20	21	95.2
26.	<i>Garcinia kola</i>	Anti-inoceptives	25	26	96.2
27.	<i>Gardenia aqualla</i>	Infertility	23	23	100
28.	<i>Guiera senegalensis</i>	Gastrointestinal	21	22	95.5
29.	<i>Hibiscus cannabinus</i>	Infertility	12	13	92.3
30.	<i>Hymenocardia acida</i>	Infertility	21	22	95.5
31.	<i>Kigelia africana</i>	Infertility	14	14	100
32.	<i>Lannea microcarpa</i>	Infertility	14	15	93.3
33.	<i>Leptadensia hastate</i>	Infertility	11	14	78.6
34.	<i>Loudetia phragmitoides</i>	Infertility	12	13	92.3
35.	<i>Mangifera indica</i>	Infertility	10	12	76.9
36.	<i>Moringa oleifera</i>	Infertility	12	14	85.7

37.	<i>Pancium laetum</i>	Infertility	10	12	83.3
38.	<i>Parinari polyandra</i>	Infertility	12	14	85.7
39.	<i>Parinari robusta</i>	Infertility	11	13	84.6
40.	<i>Parkia biglobosa</i>	Infertility	10	12	76.9
41.	<i>Pheonix dactylifera</i>	Infertility	11	13	84.6
42.	<i>Prosopis africana</i>	Infertility	12	12	100
43.	<i>Pseudocedrela kotschyi</i>	Infertility	13	14	92.6
44.	<i>Raphionacme brownie</i>	Infertility	10	11	90.9
45.	<i>Sclerocarya birrea</i>	Infertility	12	15	80.0
46.	<i>Scoparia dulcis</i>	Infertility	13	13	100
47.	<i>Securidaca longepedunculata</i>	Infertility	12	14	85.7
48.	<i>Senna occidentalis</i>	Infertility	10	10	100
49.	<i>Sesamum orientale</i>	Infertility	11	12	91.7
50.	<i>Smilax anceps</i>	Infertility	20	21	95.2
51.	<i>Striga hermonthica</i>	Infertility	23	23	100
52.	<i>Syzygium aromaticum</i>	Anti-inflammatory	22	23	95.6
53.	<i>Tribulus terrestris</i>	Infertility	24	25	96.0
54.	<i>Vernonia amygdalina</i>	Womb cleanser	12	14	85.7
55.	<i>Zingiber officinale</i>	Induce sperm	12	12	100

Key: 'I_p'- number of informants stating the use of a species for a particular ailment category; I_n- number of informants stating the use of a plant for any sort of ailment category.

Figure 1 shows the percentage of plant usage amongst people in the study area. The most used plant parts for ethno-medicine preparations in the study areas are the leaves and roots. Figure 2 shows percentage mode of preparing herbal medicine in study area. Traditional medicine for handling infertility in the Local Government Areas of Kano state understudied are majorly decoctions or in powder form. Figure 3 reports percentage forms in which herbal remedies are preserved in the study area. The plants are majorly preserved by drying. Figure 4 shows percentage habitat of medicinal plants in the study area. Most of the plants used in handling infertility are trees. Table 6 shows the plant families collected in this study and the percentage of their species collected. Fabaceae family was the most represented with 9 member plant species recorded as useful in handling infertility in the study area.

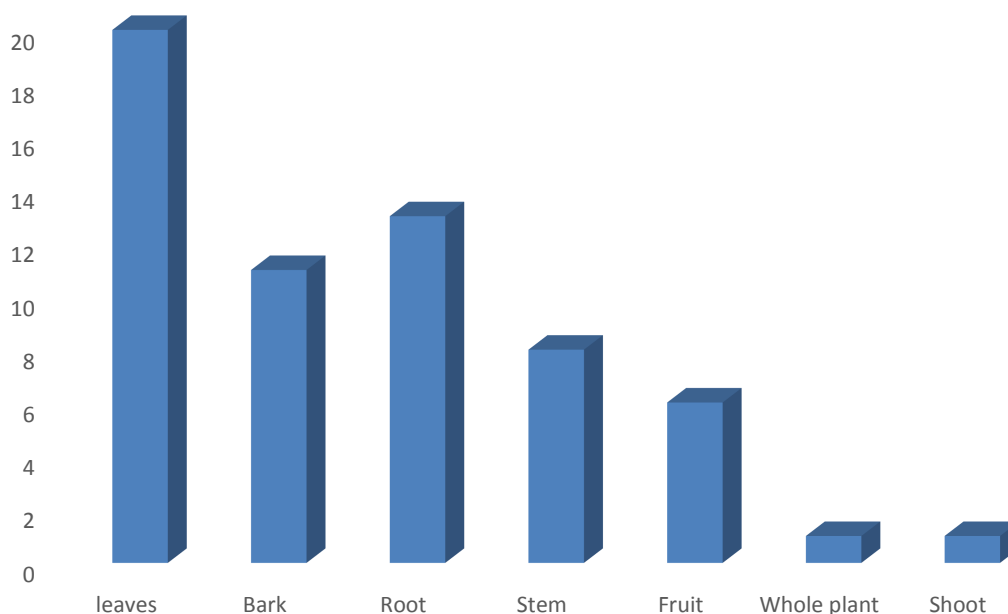


Figure 1: Plant parts used in ethno-medicine preparations in Kano State, Nigeria.

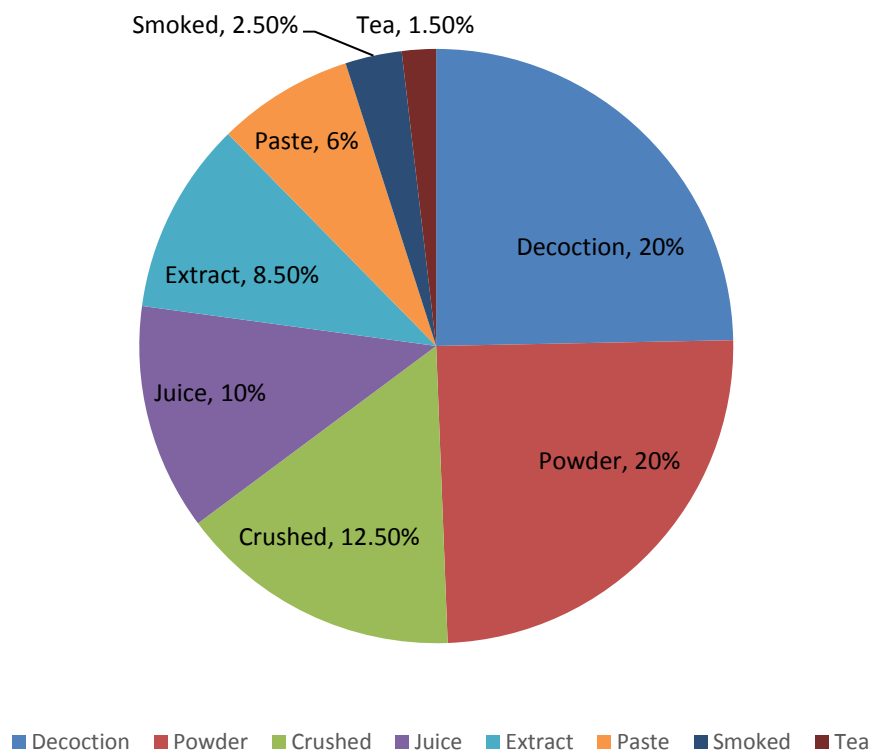


Figure 2: Mode of preparation of ethno-medicinal remedies in Kano State, Nigeria.

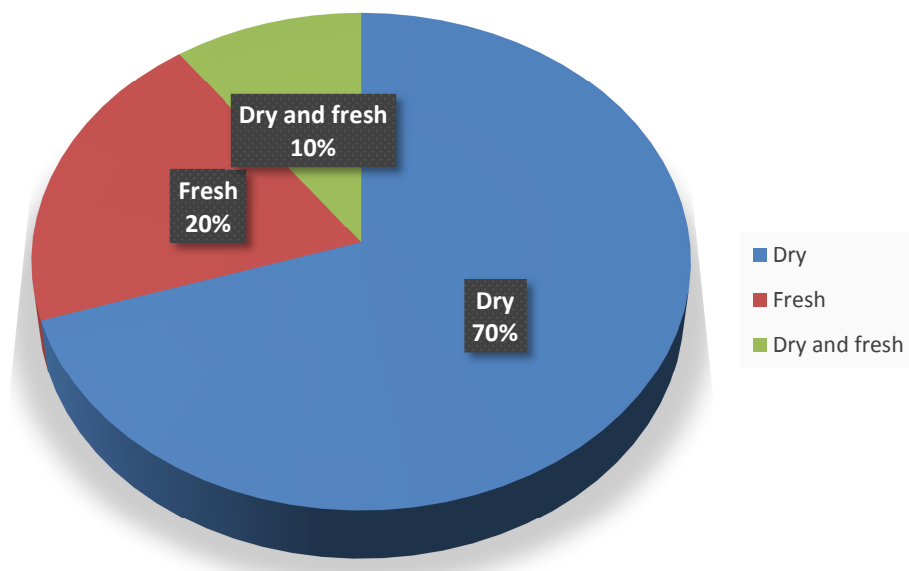


Figure 3: Form in which plant parts are used in ethno-medicinal preparations.

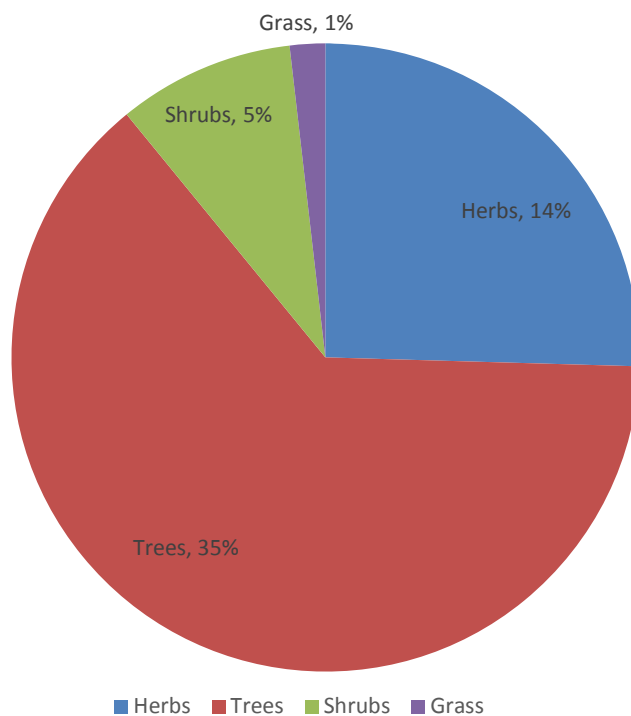


Figure 4: Habits of ethno-medicinal plants.

Table 6: Distribution within plant families of medicinal plant species.

Family	Number of species	% of species
Amaryllidaceae	1	1.85
Anacardiaceae	3	5.56
Apocynaceae	1	1.85
Arecaceae	1	1.85
Asclepiadaceae	1	1.85
Asteraceae	1	1.85
Bignoniaceae	1	1.85
Bromeliaceae	1	1.85
Commenlinaceae	1	1.85
Caesalpiniaceae	2	3.70
Convolvulaceae	1	1.85
Clusiaceae	1	1.85
Chrysobalanaceae	2	3.70
Cannabaceae	1	1.85
Combretaceae	4	7.41
Fabaceae	9	16.67
Meliaceae	2	3.70
Malvaceae	2	3.70
Moraceae	2	3.70
Moringaceae	1	1.85
Myrtaceae	1	1.85
Orobanchaceae	1	1.85
Plantaginaceae	1	1.85
Polygalaceae	1	1.85
Pedaliaceae	1	1.85
Phyllanthaceae	2	3.70
Poaceae	2	3.70
Rubiaceae	2	3.70
Solanaceae	1	1.85
Smilacaceae	1	1.85
Vitaceae	1	1.85
Zingiberaceae	2	3.70
Zygophyllaceae	1	1.85
TOTAL	55	100

DISCUSSION

The proclivity of African ethno-botanists to traditional medicines is an interesting discipline owing to the possibility of new drugs discoveries [15]. This has prompted many research teams to carry out studies on plants used in Africa by traditional healers against diseases. African traditional medicine has gained renewed interest in the health care services throughout the continent. This could be due to the increasing awareness of the curative abilities of alternative medicines, inadequate access to Western medicine and high cost of Western drugs [16, 17].

Findings from this study shows that most of the ethno medicinal plants used in the areas understudied are not cultivated but harvested from the wild. This is a similar trend in other countries like Uganda and Ethiopia [17]. This tells that there's over dependence on wild plant species. Thus, there is a need for cultivating these medicinal plants by traditional herbalists in the areas to make room for sustainable plant use.

Majority of the plants used in ethno-medicine in the study area were trees (Figure 4). This may be due to the fact that this growth form is available in almost all seasons in a year as reported by Albuquerque *et al.* [18]. Leaves were the most reported plant part used by the healers for the preparation of various medications in the study area (Figure 3). This corroborates with the findings of other ethno-medicine studies in southwestern parts of the country where most of the plant parts used in different preparations for remedy were also leaves [15]. More than one plant species have been reported to be used by healers in remedy preparations for various ailments (Table 4). This could be attributed to additives or synergistic effect that they could have during treatment [17]. Some plants are prepared singly and correspond with other findings in Bolivia [19]. Various additives such as edible oil, milk, honey, etc were used in remedy preparations (Figure 2; Table 2). Following the interview with traditional healers, it has been reported that majority had poor knowledge of dosage, antidotes and prescription of remedies to the patients. Most preparations were said to have no side effects except vomiting and in rare cases watery stools. These may be attributed to the low toxicity of medicinal plant species used by the local herbalist [17].

Fidelity levels (%FL) of plants used in managing infertility, inflammation, gastro-intestinal disorders and other stated ailments in the study area are reported on Table 5. It was observed that different plants play varying roles such as womb cleansing activities and sperm increment to facilitate fertility. From, the structured questionnaires, twelve disease categories relating to infertility were recorded (Table 4). Number of individual plant use report for each ailment category (Nur) was highest for plants used in handling erectile dysfunction (275) and boosting libido (266). The total number of species used by all informants for certain ailment categories (Nt) was greatest for plants used in managing low sperm count (84) and boosting libido (74). Table 6 shows the distribution of the 55 plants collected from the survey, their families and percentage species numbers. The greatest members of species (9) surveyed were in the Fabaceae family.

The major threats to the availability of medicinal plants in Kano State were loss of vegetation owing to massive insecticide use, over grazing, over harvesting, fuel wood collection and land use for agricultural purpose (Table 3). This could be attributed to the high harvest from the wild. Using fuel wood as an energy source from the wild is also a factor to deforestation as most of these fuel woods are fell. Despite the deterioration of natural habitats, the use of medicinal plants is still in practice amongst the people of Kano State. This seemingly low-impact of environmental degradation on traditional medicine practices was also pragmatic in Zambia [9]. It may be because the commonly used plants are often close by, uncultivated or in nearby plantations. Conversely, exploitation for medicinal purposes of certain plant species has led to their scarcity or disappearance [20]. The plant parts used and the way in which medicinal products are harvested also affect availability of the resources. Medicinal products, including barks, roots, and exudates, are widely used, but little is known about the sustainability of harvest strategies currently employed (Figure 1). Principally vulnerable are the species occurring at low densities, with their roots harvested [2]. In this case, more than 50% of the dwindling species were sought for their roots, which pose increased pressure on these species in the wild. Vulnerable also, are the species their bark or oils are extracted unsustainably [21]. *Harungana madagascariensis* for example, is widely used as an anti-malarial, by specialized healers and housewives. Unfortunately, the stem bark is easily removed and wholly extracted as the leaves, leading to gradual annihilation of the tree. According to the healers in this study, the plant only exists in the vicinity of a few marshy formations at present. *Zanthoxylum gillettii* is similar case study. But, this species owes its survival to its resilience and its height. *Icacina manniis* prized for its tuber. It is deemed effective against haemorrhoids and impotence. The collection of the whole tuber prevents any possibility of regeneration. Therefore, efforts need to be made to conserve the diversity of these vital resources.

Elderly, above 40 years were mainly involved in herbal practice comprising 54% (Table 1). These findings are in agreement with Togola *et al.* [16] who observed that only a few healers were below 40 years. While traditional healing methods continue to be well used, several young people's knowledge of them is limited. Certain plants disappear from the environment and older practitioners die, taking their specialist knowledge with them without

passing it to younger generations. Albuquerque *et al.* [18] argued that modernization also contributes to the fast eroding, corroding and at times, total disappearance of such knowledge. This suggests that, knowledge transfer to the younger generation is meager. The older people seem to keep indigenous knowledge of plant use to themselves maybe for confidentiality or apathy of the younger generation to show curiosity in traditional knowledge. It is important to point out that the situation might improve as more youths are now involved in practicing herbal medicine as realized from this study.

Togola *et al.* [16] reported that men dominated the practice of traditional medicine, and women seem to have less knowledge than men about traditional medicine. They attributed this to the fact that women mainly treat children and typical child diseases, while most men did not want to disclose the mystery shrouded in herbal medicine practice. However in this study, of the 80 persons interviewed, women (43) were most represented in the sample area than men (37). This could be due to the fact that women were always available at homes

Interestingly, some of the respondents acquired herbal practice or training verbally from mainly parents, grandparents, friends and spouses, while others acquired the knowledge by themselves and/or in dreams; none had formal training. This supports the findings of Soladoye *et al.*[22] that knowledge about plants can be obtained only by specialists or human teachers within an indigenous community. Soladoye *et al.*[22]reported also that knowledge is derived directly from the plants themselves and in dreams. Pei [14] pointed out that traditional medical knowledge and practices are passed orally from generation to generation. This unwritten guideline or mode of information transfer is, however, grossly inadequate as it lacks continuity. This implies that, with every specialist that dies without an apprentice, the great medical knowledge base of his culture dies with him. Other reasons for the rapid disappearance of this knowledge are adoption of global products, especially by younger people, extinction of species, urbanization and destruction of habitat, breakdown in traditional structure and certain natural causes like famine, flood, and wars [23]. Majority of the respondents were illiterates. High illiteracy level may account for a reason why knowledge of medicinal properties and uses of plants are not taken into accounts. This suggests that ethno-botanical knowledge can best be obtained from indigenous people who use plants. The very low percentage of herbalists interviewed also show the dying interest in herbal medicine as a profession, since many people rather practice it either as self-help or on part-time bases.

In conclusion, medicinal plants are of vast value in Kano State. The local healers have amazing methods of treatments to cure various diseases at cheaper cost, which has immense socio and economic impact in the lives of the people. It is recommended to undertake detailed ethno-botanical studies of the Northeast Region involving as many tribes as possible. This will help unearth a lot more information on plants of ethno-botanical value before some of these plants become extinct. Once unearthed and conserved, this information can be utilized for the benefit of mankind on a larger scale. The conservation of ethno-botanical resource and wild relatives of crop plants is vital for future breeding programmes.

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