



Ethnobotanical survey of plants used in cancer therapy in Iwo and Ibadan, South-Western of Nigeria

[Estudio etnobotánico de plantas utilizadas en terapia contra el cáncer en Iwo e Ibadan, suroeste de Nigeria]

Funmilayo I.D. Afolayan*, Kabirat A. Sulaiman, Waliyat T. Okunade

Cell Biology and Genetics Unit, Department of Zoology, University of Ibadan, Ibadan, Nigeria.

*E-mail: fid.afolayan@mail.ui.edu.ng, fidifede@gmail.com

Abstract

Context: The increase in cancer morbidity and mortality, as well as high cost and adverse effects of the available cancer therapies, necessitate the need for the discovery of new and safe anticancer agents. Many medicinal plants, which have served as sources of beneficial drugs were revealed through an ethnobotanical survey.

Aims: To reveal and document the medicinal plants used in treating cancer in Iwo and Ibadan, South-Western, Nigeria.

Methods: The Snowball method was used to search and select the participants who included herb sellers, traditional medical practitioners, and herbalists. A structured questionnaire was used to obtain information, which included herbal recipes, dosage, and methods of preparation of the herbs. Relative frequency citation (RFC), family use value (FUV) and medicinal use-value (MUV) were calculated.

Results: A total number of 92 plant species belonging to 51 families were revealed. *Citrus limon*, *Xylopiya aethiopica* and *Crotalaria pallida* had the highest RCF of 0.25, 0.22 and 0.17, respectively, while the family *Leguminosae* (10.99%) had the highest number of plants species. Three of the plants had the highest MUV of 0.12 while *Bignoniaceae* family had the highest FUV. Various parts of the plants were used in preparing these.

Conclusions: Many plants used in treating cancer have been revealed in this study. Therefore, scientific validation of the biological properties of the species, both singly and in combination as used, is strongly recommended.

Keywords: cancer; ethnobotany; Nigeria; plants; treatment.

Resumen

Contexto: El aumento de la morbilidad y mortalidad por cáncer, así como el alto costo y los efectos adversos de las terapias disponibles contra el cáncer, requieren la necesidad de descubrir agentes anticancerígenos nuevos y seguros. Muchas plantas medicinales que han servido como fuentes de medicamentos beneficiosos fueron reveladas a través de una encuesta etnobotánica.

Objetivos: Revelar y documentar las plantas medicinales utilizadas en el tratamiento del cáncer en Iwo e Ibadan, suroeste de Nigeria.

Métodos: El método Bola de Nieve se utilizó para buscar y seleccionar a los participantes que incluyeron vendedores de hierbas, médicos tradicionales y herbolarios. Se utilizó un cuestionario estructurado para obtener información, que incluyó recetas a base de hierbas, dosis y métodos de preparación de las hierbas. Se calcularon las citas de frecuencia relativa (RFC), el valor de uso familiar (FUV) y el valor de uso medicinal (MUV).

Resultados: Se reveló un número total de 92 especies de plantas pertenecientes a 51 familias. *Citrus limon*, *Xylopiya aethiopica* y *Crotalaria pallida* tuvieron el mayor RCF de 0,25; 0,22 y 0,17, respectivamente, mientras que las familias *Leguminosae* (10,99%) tuvo el mayor número de especies de plantas. Tres de las plantas presentaron el MUV más alto de 0,12, mientras que la familia *Bignoniaceae* tuvo el FUV más alto. Varias partes de las plantas se utilizaban para preparar estas.

Conclusiones: Muchas plantas utilizadas en el tratamiento del cáncer han sido reveladas en este estudio. Por lo tanto, se recomienda encarecidamente la validación científica de las propiedades biológicas de las especies, tanto de forma individual como en combinación.

Palabras Clave: etnobotánica; Nigeria; plantas; tratamiento.

ARTICLE INFO

Received: January 22, 2020.

Received in revised form: March 11, 2020.

Accepted: March 12, 2020.

Available Online: March 21, 2020.

Declaration of interests: The authors declare no conflict of interest.

Funding: This research was not funded and did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.



INTRODUCTION

According to the World Health Organization (W.H.O), cancer is the second leading cause of death globally, and responsible for 9.6 million deaths in 2018. About 1 in 6 deaths was due to cancer (W.H.O, 2018). Cancer is a disease that affects both animals and man of all ages. It is a disease that is characterized by uncontrolled cell proliferation in the body leading to impaired functions and high mortality. All cancers are caused by abnormalities in the genetic material of the transformed cells and these abnormalities may be due to the effect of carcinogens such as tobacco, smoke, radiation, chemicals or infectious agents. About 70% of all cancer deaths occurred in developing countries, even though the incidence rate is higher in developed nations (Akinde et al., 2015; Popoola et al., 2016; W.H.O, 2018).

This increase in cancer mortality may be attributed to the swift changes in the society and economy due to uptake of lifestyles associated with the industrialized countries (Bray et al., 2013). Cancers commonly diagnosed among the Nigerian include cancers of the breast, hematological malignancies, cervical, ovarian, liver and prostate in descending order (Akinde et al., 2015). Conventional treatments are chemotherapy, radiation and surgery, however, high cost of this available cancer therapy and possible side effects of cytotoxic drugs used in cancer treatment has prompted the need for new drug-lead from natural plant source (Arunadevi and Anantharaj, 2013).

Past history on the traditional uses of plants, parts of plants and isolated phytochemicals for the prevention, management and treatment of various health ailments is quite remarkable (Oloyede et al., 2012). A medicinal plant is any plant, which in one or more of its organs contains substances that can be used for the therapeutic purposes or which are precursors for the synthesis of useful drugs (Chukwuma et al., 2015), while ethnobotany is the study of the traditional use of one or more plant part in the treatment of various diseases. Traditional medicine on the other hand is the total combination of knowledge and practice explainable or

not, used in diagnosing, preventing and/or eliminating a physical, mental or social disease and which may rely exclusively on past experience and observation handed down from generation to generation verbally or in writing (Soladoye et al., 2010). Since time immemorial, plant has been a source of food and medicine to people and animals. The use of plants by early man was established by trial and error. Since plants were eaten by animals and this does not result to fatality, it was adopted by man as food and sometimes as medicine. Prior to the introduction of orthodox medicine, people have been depending on herbs for treatment of various diseases. However, the activities of man, such as agriculture, industrialization and urbanization lead to an increased loss of biodiversity, coupled with the apparent lack of interest by the younger generation in sustaining indigenous knowledge in herbal medicine. Consequently, there is the fear that the knowledge of herbal medicine may die along with the aging generation of herbal medical practitioners (Muthu et al., 2006).

Furthermore, many medicinal plants (even those considered as weeds) have been revealed through ethnobotanical survey. Some of the plants that have been claimed to be effective in the treatment of cancer include *Andrographis paniculata* (Manivel et al., 2016), *Sophora interrupta* (Mathi et al., 2014). Many of these plants have also been used in the treatment of other diseases and are claimed to be effective. For example, *Zingiber officinale* has been used in the treatment of diseases such as hepatitis, bronchial problem, cramps, digestive disorders (Awoyemi et al., 2012). Although, there are synthetic drugs and plant lead drugs that have been developed to target cancer (Fadeyi et al., 2013). For instance, vinca alkaloids, vinblastine and vincristine, which are useful in cancer treatment were isolated from *Catharanthus roseus* (Moudi et al., 2013). However, increase in cancer morbidity and mortality rates worldwide, as well as side effects of the available drugs call for quick intervention (Popoola et al., 2016; W.H.O, 2016). Since plants have been implicated as the storehouses and sources of safer and cheaper

chemicals (Nisha et al., 2018). Hence, the need to keep searching for more effective and non-toxic chemical compounds of plant origin.

There have been some report on plants with anticancer properties from different locations in Nigeria, but none has been reported from Iwo and Ibadan, therefore, this study was conducted to reveal and document the various plants remedies used for the treatment of cancer disease in the study areas. This is important in order to make the information accessible to different calibers of people who are interested in cost-friendly herbal treatment, and for proper documentation to ensure preservation of culture and tradition.

MATERIAL AND METHODS

Anthropological information

This survey was carried out in Iwo local government, Iwo, Osun State, which is situated at latitude 7°38'N; longitude 4°11'E in the northern hemisphere and Ibadan, Oyo State, which can be found

at latitude 7°23'47"N and longitude 3°55'0"E. Iwo is one of the ancient towns, which can be found in Iwo local government area of Osun state with 214 km² area of land and 191,377 populations according to the 2006 National Population Census, while Ibadan is a city found in Oyo State and Southwestern part of Nigeria. Ibadan forms the largest part of Oyo State and the second largest city in Africa after Cairo. Ibadan has the total area of 9880 km² of land with 5,719,853 inhabitants as at 2006 census both in the metropolis and the urban area. These two towns are majorly inhabited by the Yorubas but few other tribes such as the Fulani, Hausas and Igbos can be found. Farming is the major occupation of the local inhabitants of these towns. Figs. 1 and 2 below are the maps showing the study areas. Numerous studies have been conducted with main focus on areas where cancer is endemic neglecting the fact that a diseased person can travel miles in search for cure and there are local places with embedded knowledge, which are still yet to be explored in search for anticancer plants.

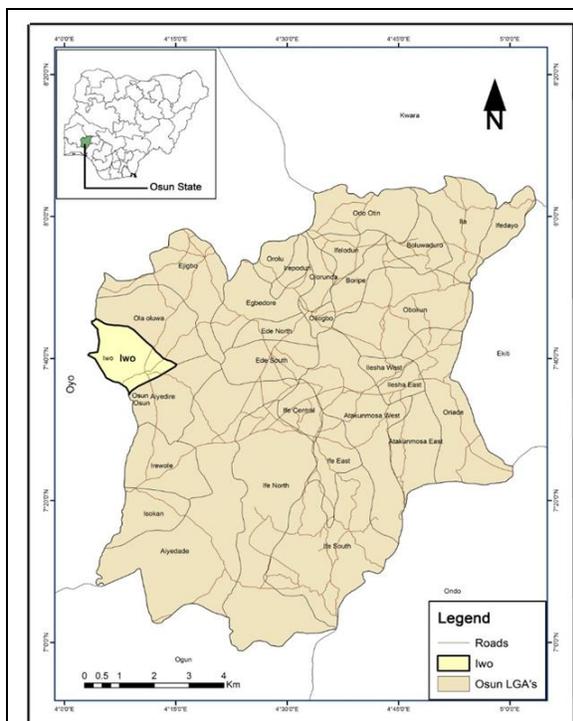


Figure 1. A map showing location of Iwo town in Osun State.

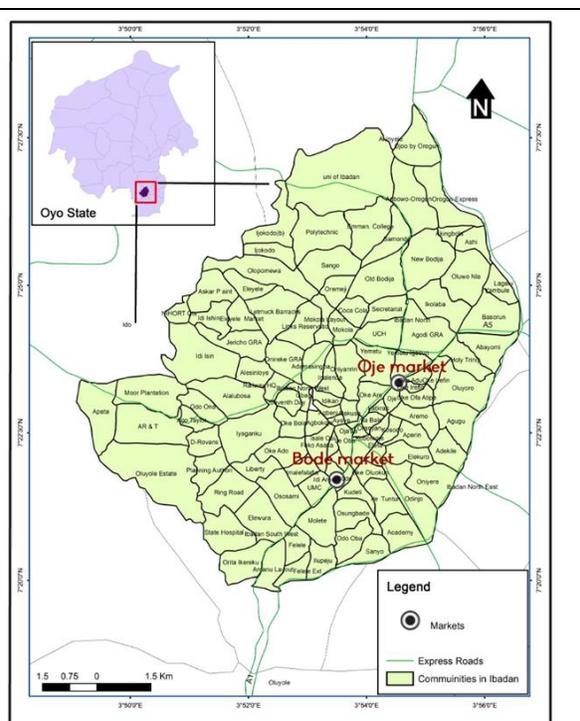


Figure 2. A map showing location of the study areas within Ibadan, Oyo State

Survey and data collection

The survey was carried out within the span of three weeks in the month of November in 2017 by two trained geneticists and two informants among local inhabitants. Snowball method (Atkinson and Flint, 2001) was used to search for respondents. To enhance proper documentation, a structured questionnaire (which had been interpreted to the local Yoruba language) was used to obtain information from the respondents. Such information includes the local plant names, useful plant parts, methods of herbal preparation, dosage and other medicinal uses. Some of the respondents mentioned the locations of some of the plants within the town.

Several plants were documented with the local names provided by the informants. A literature search was used to interpret local names to scientific and common names. The names from literatures and the proper taxa nomenclature was validated in the plant list database at www.plantlist.org

Ethical consent

Written informed consent was presented to each informant to solicit for their participation in the study after the aims and objectives had been carefully explained.

Statistical analysis

The demographic information of the respondents were analysed by descriptive statistics, while the information gathered on the plants were subjected to various quantitative indices such as relative frequency citation (RFC), Medicinal use value and Family use value according to Hoffman and Gallaher (2017); Alade et al. (2018); and Yabrir et al. (2018).

Relative frequency citation (RFC) was calculated using the formula [1]:

$$RFC = FC/N \quad [1]$$

where FC (frequency of citation) was the num-

ber of informants who mentioned the use of the species and N was the total number of informants that participated in the survey. This index estimated the local importance of each species ($0 < RFC < 1$).

The Use-Value (UV) used to underscore the relative importance of the species known locally was calculated using the formula [2]:

$$UV = \sum U_i / N \quad [2]$$

where: U_i is the number of uses mentioned by each informant for a given species and N is the total number of informants.

The medicinal use-value (MUV) and family use-value (FUV) were then recorded for each category.

Family use-value (FUV) was calculated using [3]:

$$FUV = \sum UV_s / n_s \quad [3]$$

where: $\sum UV_s$ is the use-values of all the species reported by respected family and n_s are the total number of species within a family.

RESULTS

The survey entailed 60 Yoruba respondents, which comprises of traditional medical practitioners (36.67%), herb sellers (46.67%), herbalists (15%) and 1.67% pharmacognosist. The male respondents (51.67%) were slightly higher than the females (48.33%).

Most of the respondents fell within the age range of 51-60 years (40%), followed by those within 31-40 (16.67%) while few (5%) were within the range of 21-30 years. The highest level of education recorded among the respondents was secondary school (45%), followed by primary school (35%), only few had tertiary education (6.67%) while some were illiterate. The summary of the demographic information was given below in Table 1. Majority of the respondents acclaimed their knowledge to be from their ancestors while some paid to acquired it.

Table 1. Demographic information of respondents.

Variables	Categories	Frequency	Percentage (%)
Gender	Male	31	51.67
	Female	29	48.33
Age (years)	21-30	3	5.00
	31-40	10	16.67
	41-50	8	13.33
	51-60	24	40.00
	61-70	9	15.00
	71-80	6	10.00
Level of education	Illiterate	8	13.33
	Primary	21	35.00
	Secondary	27	45.00
	Tertiary	4	6.67
Occupation	Traditional medical practitioners	22	36.67
	Herb sellers	28	46.67
	Herbalists	9	15.00
	Pharmacognosist	1	1.67

A total numbers of 92 plants that belong to 51 families (Table 2) were mentioned as part of herbal remedies used in the treatment of different cancer types in the study areas, out of which one couldn't be identified with the local name given. The relative frequency of citation for all the plants species revealed in this study ranges from 0.02-0.25. The most frequently mentioned plants with their relative frequency of citation were *Citrus limon* (0.25), *Xylopiya aethiopica* (0.22), *Crotalaria pallida* (0.17), *Nymphaea lotus* (0.15), *Pistia stratiotes* (0.13), *Allium sativum* (0.13) and *Kigelia africana* (0.10) while most of the plants species belong to the family *Leguminosae* (10.99%), *Euphorbiaceae*, *Annonaceae* and *Apocynaceae* (4.4%) as presented in Table 2 and Fig. 3. The plants family name, scientific names, local names, plants part used, plants habit, methods of preparation, dosage and other medicinal uses are presented in Tables 2 and 3. The mode of administration of the herbs varied from oral ingestion (drinking, licking and eating), steam bath, and topical application and also in the method of prep-

aration. The methods encountered in this study include infusion, decoction, squeezing and drying to turn the plant into powder (Table 3). The most frequently used plant part was the leaves (34.82%), followed by the root and stem barks (15.17%), seed (12.5%), fruit (9.82%), juice (4.46%), the whole plant, tuber and flower (1.78%) while the bulb, rhizome and frond were the least used part with 0.89% each (Fig. 4). Table 4 contains twenty plants, which were used singly (monotherapy) in the herbal recipe while the plants that were used in combination of two, three and four are listed in Table 5. The plants species with the highest medicinal use value (MUV) of 0.12 were *Jatropha curcas*, *Khaya ivorensis* and *Kigelia africana* (Table 2). *Bignoniaceae* family has the highest family use value (FUV) of 7.00 (Table 2).

DISCUSSION

The knowledge of herbal medicine is gradually vanishing because of lack of truthful documentation of this valuable heritage.

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types.

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
<i>Amaranthaceae</i>									2.00	
1		<i>Amaranthus spinosus</i> L.	Tete elegun	Spiny amaranth	Herb Tree	Whole plant	0.03	0.03		Blood pressure
2		<i>Chenopodium ambrosioides</i> L.	Ewe-imi	Wormwood	Tree	Leaves	0.02	0.03		Anthelmintic
<i>Amaryllidaceae</i>									4.50	
3		<i>Allium sativum</i> L.	Ayu	Garlic	Herb	Bulb	0.13	0.10		Ringworm, ulcer, detoxification, antibiotics, body supplement
4		<i>Crinum jagus</i> (J.Thomps.) Dandy	Isu merin	Crinum	Herb	Tuber	0.03	0.05		Asthma, cough
<i>Anacardiaceae</i>									2.50	
5		<i>Mangifera indica</i> L.	Mangoro	Mango	Tree	Bark	0.05	0.03		Malaria
6		<i>Spondias mombin</i> L.	Yeye	Hog plum	Tree	Bark	0.02	0.05		Yaws, fever
<i>Annonaceae</i>									3.25	
7		<i>Annona senegalensis</i> Pers.	Abo	African custard apple	Tree	Bark, root	0.05	0.07		Dysentery, cough, toothache.
8		<i>Uvaria afzelii</i> G.F. Scott-Elliot	Gbogbonse	Cluster pear	Tree	Bark	0.02	0.07		Liver, kidney, bladder infections
9		<i>Uvaria chamae</i> P.Beauv.	Eruju	Bush banana	Large shrub	Root	0.05	0.03		Malaria
10		<i>Xylopiya aethiopica</i> (Dunal) A.Rich.	Eru Alamo	Ethiopian pepper	Tree	Leaves, dried fruit	0.22	0.05		Cough, bronchitis
<i>Apocynaceae</i>									3.00	
11		<i>Asclepias curassavica</i> L.	Kurere	Milk weed	Weed	Root	0.02	0.03		Gastro-intestinal disorders
12		<i>Calotropis procera</i> (Aiton) Dryand.	Bomubomu	Giant milk weed	Shrub	Root, leaf	0.03	0.05		Anthelmintic, ulcer
13		<i>Picralima nitida</i> (Stapf) T.Durand & H.Durand	Eso abere	Picralima	Tree	Seeds	0.03	0.07		Fever, hypertension, herpes
14		<i>Rauwolfia vomitoria</i> Afzel.	Oloora igbo	Poison's devil pepper	Shrub	Root	0.03	0.05		High blood pressure, hypertension
<i>Araceae</i>									2.00	
15		<i>Pistia stratiotes</i> L.	Ojuoro	Water lettuce	Floating herb	Leaf, root	0.13	0.03		Wound healing

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types. (continued...)

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
									6.00	
<i>Areaceae</i>										
16		<i>Cocos nucifera</i> L.	Agbon	Coconut	Tree	Juice	0.03	0.13		Antibiotics, bronchitis, migraine, laxative, diuretic, uterine disease, hair loss, etc.
17		<i>Elaeis guineensis</i> Jacq.	Ope	Oil palm tree	Tree	Juice and Kernel from fruit	0.05	0.07		Stomach disorders, mental disorder and asthma
									3.00	
<i>Aristolochiaceae</i>										
18		<i>Aristolochia repens</i> Mill.	Akogun	Dutchman's pipe, snake work	Tree	Bark/Seed	0.03	0.05		Guinea-worm, skin diseases
									6.00	
<i>Asphodelaceae</i>										
19		<i>Aloe vera</i> (L.) Burm.f.	Eti erin	Aloe	Forb/herb	Leaf juice	0.08	0.10		Wound healing, skin rash, antiviral and antibacterial effects
									2.50	
<i>Asteraceae</i>										
20		<i>Achillea millefolium</i> L.	Yaro	Yarrow, nosebleed	Tree	Leaves	0.02	0.05		Wound, piles
21		<i>Ageratum conyzoides</i> (L.) L.	Imi	Goat weed	Shrub	Leaves	0.02	0.03		Diarrhoea
									2.00	
<i>Basellaceae</i>										
22		<i>Basella alba</i> L.	Amunututu	Indian spinach	Vine climber	Leaf, root	0.02	0.03		Blood tonic
									7.00	
<i>Bignoniaceae</i>										
23		<i>Kigelia africana</i> (Lam.) Benth.	Pandoro	Sausage tree	Tree	Leaves, fruits, bark, root	0.10	0.12		Kidney disorders, malaria, dysentery, rheumatism, pile, parasitic infections
									3.50	
<i>Burseraceae</i>										
24		<i>Canarium schweinfurtii</i> Engl.	Awogba	Bush candle tree	Tree	Bark	0.02	0.05		Ringworm, gonorrhoea
25		<i>Dacryodes edulis</i> (G.Don) H.J.Lam	Ewe pear	Native pear	Tree	Leaves	0.05	0.07		Acute malaria, wounds, stretch mark remover
									3.00	
<i>Cannaceae</i>										
26		<i>Canna indica</i> L.	Ido	Indian shot	Shrub	Leaves	0.02	0.05		Asthma, malaria

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types. (continued...)

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
<i>Clusiaceae</i>										2.00
27		<i>Garcinia kola</i> Heckel	Orogbo	Bitter cola	Tree	Root	0.05	0.03		Cough
<i>Combretaceae</i>										4.00
28		<i>Combretum mucronatum</i> Schumach. & Thonn.	Ogan	Combretum	Tree	Leaves	0.02	0.07		Wound, cough and dysentery
<i>Compositae</i>										1.67
29		<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Akintola	Siam weed	Shrub	Root	0.03	0.03		Wound healing
30		<i>Taraxacum officinale</i> (L.) Weber ex F.H.Wigg.	Yanrin	Dandelion	Herb	Root	0.02	0.02		-
31		<i>Tithonia diversifolia</i> (Hemsl.) A.Gray	Jogbo	Wild sunflower	Shrub	Leaves	0.02	0.03		Typhoid fever
<i>Crusulaceae</i>										2.00
32		<i>Bryophyllum pinnatum</i> (Lam.) Oken	Abamoda	Miracle leaf	Herb Shrub	Leaf, root	0.02	0.03		Sexually transmitted infection
<i>Cucurbitaceae</i>										2.50
33		<i>Citrullus colocynthis</i> (L.) Schrad.	Egusi-Bara	Kalahari melon, watermelon	shrub	Seed	0.03	0.07		Purgative, contraceptive, hypertension
34		<i>Momordica balsamina</i> L.	Ejinrin	Balsam apple	Tree	Leaves	0.02	0.02		
<i>Euphorbiaceae</i>										3.25
35		<i>Croton lobatus</i> L.	Eru Alamo	Cascarilla	Tree	Leaves	0.02	0.07		Guinea worm, convulsions, skin diseases
36		<i>Jatropha curcas</i> L.	Lapalapa funfun	Purging nut	Large shrub	Leaf	0.05	0.12		Malaria, anthelmintic, eczema, scabies, fever, herpes
37		<i>Jatropha gossypifolia</i> L.	Lapalapa pupa	Cotton leaf	Shrub	Leaf	0.02	0.02		Mouthwash
38		<i>Plukenetia conophora</i> Müll.Arg.	Asala/awusa	African walnut	Climber	Seed, leaf	0.02	0.02		-

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types. (continued...)

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
<i>Fabaceae</i>									2.67	
39		<i>Abrus precatorius</i> L.	Owere njeje	Crab eye	Shrub	Seed	0.02	0.07		Contraceptive, ulcer, cold
40		<i>Azelia africana</i> Pers.	Apa	Lenke, apa, pod mahogany	Tree	Fruit, seed	0.02	0.03		Stomach disorders
41		<i>Albizia lebbek</i> (L.) Benth.	Igbagbo	Silk flower, lebbek	Shrub	Leaves	0.03	0.03		Mouthwash
<i>Hypoxidaceae</i>									4.00	
42		<i>Curculigo pilosa</i> (Schumach. & Thonn.) Engl.	Epakun	Golden eye grass	Shrub	Leaves	0.02	0.07		Aphrodisiac, gonorrhoea, purgative
<i>Iridaceae</i>									4.00	
43		<i>Gladiolus ferrugineus</i> Goldblatt & J.C.Manning	Baka	Sword lily	Shrub	Leaves	0.02	0.07		Dysentery, mental disorders, constipation
<i>Lamiaceae</i>									3.50	
44		<i>Hyssopus officinalis</i> L.	-	Hyssop	Herb	Leaf	0.02	0.05		Antidiuretic and laxative agent
45		<i>Ocimum gratissimum</i> L.	Efinrin	Basil	Tree	Leaves	0.02	0.07		Antimicrobial, diabetes, piles
<i>Lauraceae</i>									2.00	
46		<i>Persea americana</i> Mill.	Piha	Avocado pear	Tree	Fruit	0.02	0.03		Blood pressure
<i>Leguminosae</i>									2.40	
47		<i>Caesalpinia bonduc</i> (L.) Roxb.	Seyo	Peacock flower	Shrub	Seed	0.02	0.03		Fever
48		<i>Cajanus cajan</i> (L.) Millsp.	Otili	Pigeon pea	Shrub	Leaves, seed	0.02	0.05		Laxative, smallpox
49		<i>Calliandra haematocephala</i> Hassk.	Tude	Powder puff tree	Shrub	Root	0.03	0.02		-
50		<i>Canavalia ensiformis</i> (L.) DC.	Popondo	Jack bean, sword bean, horse bean	Shrub	Seeds, fruit	0.05	0.05		Antibiotic, antiseptic
51		<i>Crotalaria pallida</i> Aiton	Emile	Rattle pods	Herb	Leaf	0.17	0.02		-
52		<i>Delonix regia</i> (Hook.) Raf.	Paranseke	Flame of the forest	Tree	Root, bark	0.03	0.02		-
53		<i>Lonchocarpus sericeus</i> (Poir.) DC.	Ipapo	Lilac tree	Tree	Bark, leaves.	0.02	0.07		Skin disease, convulsion, and laxative

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types. (continued...)

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
54		<i>Senna alata</i> (L.) Roxb.	Asunwon	Candle bush	Shrub	Leaves	0.02	0.07		Skin diseases, abortifacient, ringworm
55		<i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby	Kasia	Cassia tree	Tree	Bark, flower	0.05	0.03		Antidiuretic
56		<i>Tetrapleura tetraptera</i> (Schum. & Thonn.) Taub.	Aidan onigunmerin	Aridan	Tree	Fruit	0.03	0.05		Asthma, cough
Malvaceae									4.00	
57		<i>Bombax buonopozense</i> P.Beauv.	Ponpola	Akata, red silk cotton tree	Tree	Leaves	0.02	0.05		Stomachache, blood tonic
58		<i>Ceiba pentandra</i> (L.) Gaertn.	Araba	White silk cotton tree	Tree	Seed	0.02	0.08		Diabetes, fever, gonorrhoea, asthma
59		<i>Cola acuminata</i> (P.Beauv.) Schott & Endl	Obi	Kolanut	Tree	Fruit	0.02	0.07		Stimulant, fever, malaria
60		<i>Grewia pubescens</i> P.Beauv.	Igbo	Raisin	Tree	Bark	0.02	0.05		Dysentery, antidote for snake bite
Melastomataceae									5.00	
61		<i>Dissotis rotundifolia</i> (Sm.) Triana	Ajalu gborangan	-	Tree	Leaves	0.02	0.08		Aphrodisiac, cough, antimicrobial, weight control
Meliaceae									5.00	
62		<i>Khaya ivorensis</i> A.Chev.	Oganwo	Mahogany	Tree	Bark	0.03	0.12		Malaria, jaundice, Anthelminthic, anaemia, arthritis, skin diseases.
63		<i>Pseudocecrela kotschy</i> (Schweinf.) Harms	Emi yemi	Pseudocecrela	Tree	Bark	0.02	0.07		Dysentery, leprosy, haemorrhoids
Moraceae									2.00	
64		<i>Ficus exasperata</i> Vahl	Ipin	Sandpaper plant	Tree	Bark	0.02	0.05		Wounds, coughs
65		<i>Milicia excelsa</i> (Welw.) C.C.Berg	Iroko	African teak	Tree	Ota iroko, bark	0.03	0.02		
Moringaceae									6.00	
66		<i>Moringa oleifera</i> Lam.	Ewe igbale	Moringa	Tree	Leaf	0.05	0.10		Stroke, blood pressure, Inflammatory disease, pancreas diseases, asthma

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types. (continued...)

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
<i>Musaceae</i>										3.00
67		<i>Musa × paradisiaca</i> L.	Ogede agbagba	Plantain	Tree	Fruit	0.02	0.05		Epilepsy, anaemia
<i>Myrtaceae</i>										4.00
68		<i>Eugenia aromatica</i> O.Berg	Kanafuru	Clove tree	Tree	Flowers (dried)	0.05	0.07		Toothache, antibacterial, preservative
<i>Nyctaginaceae</i>										3.00
69		<i>Boerhaavia diffusa</i>	Etiponla	Hogweed	Shrub	Leaves	0.02	0.05		Pregnancy test, jaundice.
<i>Nymphaeaceae</i>										3.00
70		<i>Nymphaea lotus</i> L.	Osibata	Water lily	Floating herb	Leaf	0.15	0.05		Wound healing, rheumatism
<i>Olacaceae</i>										3.00
71		<i>Olax subscorpioides</i> Oliv.	Ifon	-	Tree	Root	0.03	0.05		Asthma, diabetes
<i>Phyllanthaceae</i>										3.00
72		<i>Bridelia ferruginea</i> Benth.	Ira	Ira	Tree	Leaves	0.02	0.05		Diabetes, dysentery
<i>Plumbaginaceae</i>										2.00
73		<i>Plumbago zeylanica</i> L.	Inabiri	Doctor bush	Shrub	Root	0.03	0.03		Sexually transmitted infections
<i>Poaceae</i>										4.00
74		<i>Cymbopogon citratus</i> (DC.) Stapf	Ewe tea	Lemon grass	Shrub	Leaves	0.02	0.08		Malaria, cough, stomach tonic
75		<i>Eleusine indica</i> (L.) Gaertn.	Gbegi	Iron/Goose grass	Weed	Leaves	0.02	0.05		Venereal diseases, anthelmintic
<i>Polypodiaceae</i>										1.00
76		<i>Platyterium alcinorne</i> Desv.	Edo tiro	Staghorn/Elkhorn fern	Frond	Fronds	0.03	0.02		
<i>Ranunculaceae</i>										6.00
77		<i>Nigella sativa</i> L.	Black seed	Black cumin plant	Herb	Seed	0.05	0.10		Any disease
<i>Rosaceae</i>										1.00
78		<i>Prunus dulcis</i> (Mill.) D.A.Webb	Fruit	Almond	Tree	Leaf, fruit	0.02	0.02		-

Table 2. Profile of plants claimed by the respondents in the treatment of different cancer types. (continued...)

No.	Family	Scientific names	Local name	Common names	Habit	Plant part used	RFC	UV	FUV	Other medicinal uses
<i>Rubiaceae</i>									3.00	
79		<i>Morinda lucida</i> Benth.	Oruwo	Brimestone tree	Tree	Bark	0.05	0.05		Malaria, typhoid
<i>Rutaceae</i>									4.00	
80		<i>Citrus aurantiifolia</i> (Christm.) Swingle	Osan were	Lime	Tree	Juice extract	0.05	0.10		Fever, jaundice, scurvy, abdominal ulcer, antimicrobial
81		<i>Citrus limon</i> (Lg.) Osbeck	Orombo	lemon	Tree	Fruit rind, juice	0.25	0.07		Gastric disorder, malaria, typhoid
82		<i>Citrus paradise</i> Macfad.	Osan oyinbo	Grapefruit	Tree	Seed	0.02	0.03		Malaria
<i>Santalaceae</i>									4.00	
83		<i>Viscum album</i> L.	Afomo	Mistletoe	Shrub	Whole plant	0.02	0.07		Hypertension, diabetes, anaemia
<i>Sapotaceae</i>									5.00	
84		<i>Vitellaria paradoxa</i> C.F.Gaertn.	Emi	Shea butter	Tree	Shea butter, root	0.12	0.08		Wounds, sores, skin disease, cold, cough
<i>Solanaceae</i>									1.00	
85		<i>Solanum lycopersicum</i> L.	Tomato	Tomato	Vine/berry	Fruit	0.02	0.02		Cancer prevention
<i>Urticaceae</i>									2.00	
86		<i>Urtica dioica</i> L.	Yesi	Stinging nettle	Herb	Leaf	0.03	0.03		Eye problem
<i>Verbenaceae</i>									3.00	
87		<i>Lippia multiflora</i> Moldenke	Efinrin omu	Sweet-leaf	Shrub	Leaves	0.02	0.05		Hypertension, cough
<i>Vitaceae</i>									5.00	
88		<i>Ampelopsis brevipedunculata</i> (Maxim.) Trautv.	Soro	Porcelain vine	Shrub	Leaves	0.02	0.08		Piles, diarrhoea, scabies, abortifacient
<i>Zingiberaceae</i>									4.67	
89		<i>Aframomum melegueta</i> K.Schum.	Atare	Alligator pepper	Shrub	seeds	0.03	0.05		Cough and malaria
90		<i>Curcuma longa</i> L.	Atale pupa	Turmeric	Shrub	Tuber	0.02	0.10		Jaundice, eye wash, skin diseases, malaria, yellow fever
91		<i>Zingiber officinale</i> Roscoe	Atale funfun	Ginger	Herb	Rhizome	0.07	0.08		Asthma, obesity, piles hepatitis
92	Unknown specie		Aroseko		Tree	Bark				Stomach ulcer

The Plant List database (2013) was adapted for the proper writing of nomenclature for taxa. RFC: Relative frequency citation; FUV: Family use-value; UV: Medicinal use-value.

Table 3. Some of the local preparation of plant extracts used in the treatment of different cancer types both in Iwo and Ibadan, Southwest Nigeria.

No.	Herb	Herbal recipes and dosage	Method of preparation	Cancer type
1	<i>Crotalaria pallida</i>	The fresh leaves of <i>C. pallida</i> are thoroughly washed to rid them of dirt and dried under shade then grind into powder. One teaspoonful to be taken per day with yam flour meal (amala). It is neither age nor sex dependent.	Powder, concoction	Liver, breast
2	<i>Rauwolfia vomitoria</i>	The root of <i>R. vomitoria</i> is thoroughly washed and prepared by boiling with fermented corn water and other ingredients. Take 4 tablespoonful or 1 wine glass full orally in the morning. For breast cancer treatment, it can also be applied topically for quick desired effect. Best discarded after two weeks or when the herb loses its taste.	Decoction	Any
3	<i>Vitellaria paradoxa</i>	Cut the root of <i>V. paradoxa</i> into bits and wash thoroughly to avoid any dirt, then soak in water along with other ingredients. The herb is applied topically for the treatment of breast cancer.	Infusion	Breast
4	<i>Uvaria chamae</i>	Cut the root of <i>U. chamae</i> into bits, wash thoroughly and boil with lemon fruit. It is taken orally and used for bathing.	Decoction	Breast, cervical
5	<i>Olax subscorpioidea</i> and <i>Xylopi aethiopica</i>	Cut the root of <i>O. subscorpioidea</i> and wash thoroughly to rid it of contaminants. Wash the grains of selim (<i>X. aethiopica</i>) and line the cooking pot with it, then place the root over it, pour fermented corn water and boil. One wine glass full is to be taken orally twice per day.	Decoction	Breast
6	<i>Plumbago zeylanica</i>	Cut the root of <i>P. zeylanica</i> , wash thoroughly and soak with water along with other ingredients. One wine glass full is to be taken orally thrice daily. Note: this should not be taken by pregnant women.	Infusion	Lung, breast
7	<i>Pistia stratiotes</i>	The leaves and roots of <i>P. stratiotes</i> and <i>N. lotus</i> are rinse thoroughly and then boiled with fermented corn water only. It is applied topically for two weeks.	Decoction	Breast, skin
8	<i>Calotropis procera</i> , <i>Xylopi aethiopica</i> and <i>Citrus limon</i>	The root of <i>Calotropis procera</i> is cut into bits and wash thoroughly along with the leaf. The two are boiled together with <i>Xylopi aethiopica</i> , <i>Citrus limon</i> fruit in clean water.	Decoction	Liver, lung, breast
9	<i>Moringa oleifera</i>	Fresh <i>M. oleifera</i> seeds are washed, dried in the sun, ground into powder and then pour into <i>C. aurantium</i> juice. One wine glass full to be taken per day.	Powder	Breast, lung
10	<i>Amaranthus spinosus</i> , <i>Xylopi aethiopica</i> and <i>Allium sativum</i>	The whole plant of <i>A. spinosus</i> and <i>X. aethiopica</i> are washed to remove contaminants. The <i>X. aethiopica</i> is put first into the pot, followed by <i>A. sativum</i> and <i>A. spinosus</i> . Then, pour fermented corn water and boil. It is to be taken orally with a wine glass very early in the morning and late at night.	Decoction	Breast
11	<i>Plukenetia conophora</i>	The seeds and the leaves of <i>P. conophora</i> are dried at room temperature and ground into powder. Then it is poured into honey and 2 tablespoonfuls are taken per day.	Infusion	Any
12	<i>Citrus paradise</i> and <i>Persea americana</i>	Dry the seed of <i>C. paradise</i> at room temperature, pound to dehusk and turn into powder. Dry <i>P. americana</i> fruit and grind into powder. Mix the two powders together and pour into honey. The preparation is to be taken as 120 mL per day.	Infusion	Any
13	<i>Citrus limon</i>	#1: Squeeze the <i>C. limon</i> juice and take it fresh daily. Lemon therapy is used for six months, usually in the cycle of 10 days. It starts with only one in the first day and increases by one every day until the 11th day when it begins to descend back one by one. #2: <i>C. limon peel</i> contains lemon oil. Peel the <i>C. limon</i> rind and dry under room temperature, grind into powder. It can be combined with lemon juice for use.	Juice, powder	Any
14	<i>Basella alba</i>	Fetch the fresh leaves of <i>Basella alba</i> , wash thoroughly and blend together. Take 250 mL 3-4 times daily.	juice	Any

Table 3. Some of the local preparation of plant extracts used in the treatment of different cancer types both in Iwo and Ibadan, Southwest Nigeria. (continued...)

No.	Herb	Herbal recipes and dosage	Method of preparation	Cancer type
15	<i>Cocos nucifera</i> and <i>Citrus aurantiifolia</i>	The <i>C. nucifera</i> water and honey are blend together for use. <i>C. aurantium</i> juice can also be added for addictive effect.		Any
16	<i>Urtica dioica</i>	The leaves of <i>U. dioica</i> are dried under room temperature, turn into powder and add water. The preparation is then polarized. It is to be taken 120 mL daily.	Infusion	Breast, prostate
17	<i>Lycopersicum esculentum</i>	Collect the fresh fruit of <i>L. esculentum</i> daily and blend for drinking.	Juice	Any
18	<i>Aloe vera</i>	Wash the leaves of <i>A. vera</i> thoroughly, remove the gel and blend for drinking. Leave out the root of <i>A. vera</i> when harvesting the plant to promote regeneration.	Juice	Any
19	<i>Delonix regia</i> , <i>Xylopia aethiopica</i> and <i>Zingiber officinale</i>	The root and stem barks of <i>D. Regia</i> are cut and wash thoroughly. They are then boiling along with <i>X. aethiopica</i> and <i>Z. officinale</i> . It is to be taken orally every morning and night until the patient is cured. It can also be applied topically in the case of breast cancer.	Decoction	Any
20	<i>Calliandra haematocephala</i>	Cut the root of <i>C. haematocephala</i> into bits. Wash thoroughly and soak with fermented corn water and carbonated drink (7up). One tumbler is to be taken per day. The herb is best discarded after two weeks.	Infusion	Breast
21	<i>Mangifera indica</i> , <i>Morinda lucida</i> , <i>Garcinia kola</i> , and <i>Xylopia aethiopica</i>	Cut the stem barks of <i>M. indica</i> and <i>M. lucida</i> , root bark of <i>G. kola</i> and wash thoroughly. Boil them together with dried fruit of <i>X. aethiopica</i> . Two tablespoonfuls of this are to be taken every morning.	Decoction	Liver, lung, breast
22	<i>Nigella sativa</i>	#1. Grind dried seeds of <i>N. Sativa</i> into powder and mix thoroughly with honey. One tablespoonful of the mixture should be taken orally daily.	Infusion	All
23	<i>Kigelia africana</i> , <i>Bidens pilosa</i> , <i>Eugenia aromaticum</i> , <i>Croton lobatus</i> , <i>Boerhavia diffusa</i> , <i>Dacryodes edulis</i> , <i>Achillea millefolium</i> , <i>Aristolochia repens</i> , and <i>Citrus aurantiifolia</i> .	The ingredients in this recipe are: <i>K. africana</i> , <i>B. pilosa</i> , <i>E. aromaticum</i> , <i>C. lobatus</i> , <i>B. diffusa</i> , <i>D. edulis</i> , <i>A. millefolium</i> , <i>A. repens</i> , and <i>C. aurantiifolia</i> . All plants are boiled in <i>C. aurantiifolia</i> extract. Care must be taken so as not to make the concoction boil over. After boiling the pot used must not be allowed to touch the ground. Reasons for this were not given when asked. Application is oral. Dosage is at least twice a day at no specific time. And as for patients that don't take up to the recommended dosage, they get relief at a slower rate and longer time than patients who do. There is no time frame in which the concoction is taken. Treatment is for complete cure and not for managing the cancer	Decoction	All
24	<i>Lippia multiflora</i> , <i>Bombax buonopozense</i> , <i>Nymphaea lotus</i> , <i>Pista stratiotes</i> , <i>Nymphaea lotus</i> , and <i>Vitellaria paradoxa</i>	Lay <i>L. multiflora</i> , <i>B. buonopozense</i> and <i>N. lotus</i> at the bottom of the pot, then add other herbs and boil with water. Thereafter, <i>P. stratiotes</i> , <i>N. lotus</i> , <i>L. multiflora</i> are all grinded with soap. Use the decoction together with the soap to wash the breast lesion, while <i>V. paradoxa</i> is applied on the breast to soften lumps or lesions. This is done twice daily. Also, the decoction is to be taken orally twice daily.	Decoction	Breast cancer
25	<i>Caesalpinia bonduc</i>	The <i>C. bonduc</i> is put in a pot and cooked thoroughly with water along with other ingredients. The herb is taken twice daily even after symptoms have disappeared.	Decoction	Stomach cancer
26	<i>Platycerium alcornoe</i> , <i>Kigelia africana</i> , <i>Citrus aurantiifolia</i>	Soak the <i>P. alcornoe</i> and <i>K. africana</i> inside lime water (<i>C. aurantiifolia</i>) along with normal salt for a few days. The infusion is then taken orally twice daily at no specific time.	Infusion	All

Table 3. Some of the local preparation of plant extracts used in the treatment of different cancer types both in Iwo and Ibadan, Southwest Nigeria. (continued...)

No.	Herb	Herbal recipes and dosage	Method of preparation	Cancer type
27	<i>Milicia excelsa</i> , <i>Azizelia africana</i> , <i>Khaya ivorensis</i> , and <i>Eugenia aromaticum</i>	<i>M. excelsa</i> , <i>A. africana</i> , <i>K. ivorensis</i> and <i>E. aromaticum</i> are to be cooked with runoff water. The herb is to be taken orally three times a day. This Recipe is for complete cure. There are no precautions involved.	Decoction	All
28	<i>Afromamum melegueta</i> , <i>Kigelia africana</i> , and <i>Milicia excelsa</i>	Burn <i>A. melegueta</i> , <i>K. africana</i> and <i>M. excelsa</i> together. The remnant should be taken orally with cold corn meal (pap). Dosage is condition dependent. Patient is relieved after a few weeks. There are no side effects and the only precaution involved is to take the ashes with corn meal.		All
29	<i>Mormodica balsamina</i> , and <i>Jatropha curcas</i>	Squeeze <i>M. balsamina</i> and <i>J. curcas</i> with salt (as you do with bitter leaf) to extract the juice in the plants. A little water is added to increase the volume of the juice and for easy extraction. Mode of application is oral. Patient should take two tablespoon full twice daily. There are no side effects and no allergic reactions.	Decoction	All
30	<i>Aloe vera</i>	Cut up <i>A. vera</i> into smaller bits and soak it in 40% alcoholic drink (schnapps). Application is oral and patient should take two tablespoon full twice a day. Dosage is condition dependent. Patients show signs of relief after a while from his/her urine passage although this takes up to two weeks. There are no side effects and no allergic reactions. The only precaution is to soak the <i>Aloe vera</i> in schnapps.	Tincture	Stomach
31	<i>Musa paradisiacal</i> and <i>Moringa oleifera</i>	Cut unripe <i>M. paradisiaca</i> into pieces, place under sun at noon until it is completely dry. Also, dry the <i>M. oleifera</i> leaves under the sun at high noon. Cook both with water. Application is oral. Patient drinks the herb everyday as much as possible as one would drink water. Patient can also substitute the herb for water. Signs of relief should be seen from excretes of the patient. The Recipe is for complete cure and not for management and it takes up to a week. There are no side effects and no allergic reactions.	Decoction	All
32	<i>Abrus precatorius</i>	<i>Abrus precatorius</i> is placed inside a pot to cover the bottom of the pot; broken pieces of a clay pot and black soap are then placed on the plant and burnt. The resulting ashes are taken with lime water once a day as follows; a pinch of the ash with one tumbler of lime water. Dosage is condition dependent. Patient feels lighter and healthier after a few weeks (up to 4 weeks). The only precaution is to follow the methods of preparation and application carefully.	Powder	NS
33	<i>Kigelia africana</i> , <i>Dacryodes edulis</i> , <i>Cajanus cajan</i> , <i>Cymbopogon citratus</i> , <i>Lippia multiflora</i> and <i>Allium sativum</i>	The plants are all cooked in water thoroughly. The only precaution is not to under cook the herbs. Decoction should be drunk as often as possible or in place of water. There is no dosage, no restrictions, no side effects and no allergic reactions. This recipe is also used for stroke and high blood pressure.	Decoction	Bladder cancer
34	<i>Canna indica</i> and <i>Dacryodes edulis</i>	The two plants are squeezed with water. The amount of leaves used should be just only what will be enough to be used at once. It is used for cancer prevention as well as complete cure. Take a tablespoon full three times a day. Side effect is drowsiness.	Decoction	Liver cancer
35	<i>Coccos nucifera</i> , <i>Picralima nitida</i> , <i>Eugenia aromaticum</i> , <i>Aristolochia repens</i> and <i>Dissotis rotundifolia</i>	All plants are cut, grinded and soaked in coconut water for three day for maximum effect. Two tablespoons of the recipe should be taken at least thrice a day. After about three weeks, patient should start seeing changes. For maximum effect, this recipe is to be taken for up to three months and after, to prevent relapse. Recipe is for cancer management and not complete cure. No side effects and no precaution.	Infusion	All

Table 3. Some of the local preparation of plant extracts used in the treatment of different cancer types both in Iwo and Ibadan, Southwest Nigeria. (continued...)

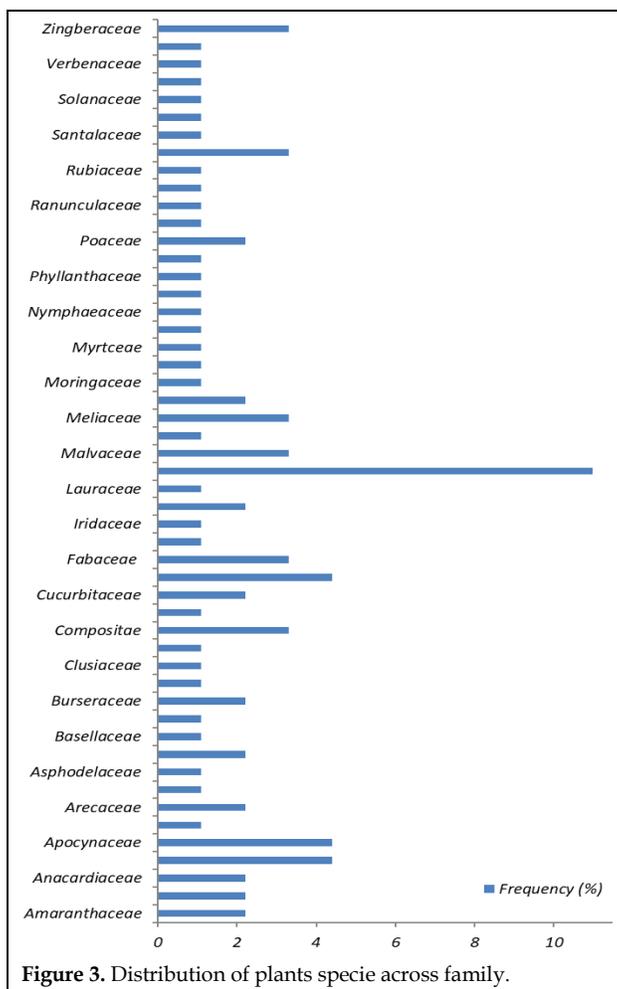
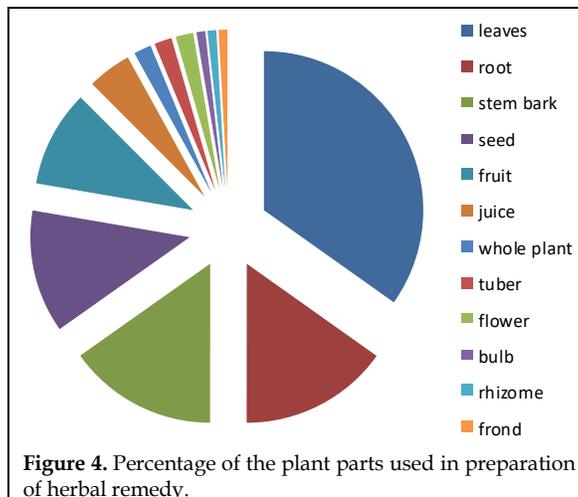
No.	Herb	Herbal recipes and dosage	Method of preparation	Cancer type
36	<i>Citrullus colocynthis</i>	<i>C. colocynthis</i> seeds are burnt along with potash, black soap and local salt. Then put the remnant into a container and mix with alcohol or cold palm oil but not with water; reasons were not given. Dosage is 5ml (size of a bottle cap) twice a day and condition dependent. The only precaution is not to mix the residue with the water.	Tincture	All
37	<i>Cola acuminata</i> , <i>Allium sativum</i> , <i>Zingiber officinale</i> , and <i>Curcuma longa</i>	The bulbs of <i>C. acuminata</i> and <i>A. sativum</i> are boiled together with the rhizome of <i>Z. officinale</i> and <i>C. longa</i> . One glass cup of the recipe is to be taken orally twice daily. Dosage is condition dependent and it takes at least two weeks before patient feels relief. There are no side effects, no allergic reactions and no precautions about preparation and application.	Decoction	Breast
38	<i>Spondias mombin</i> , <i>Ficus aspericilia</i> , <i>Gladiolus ferruginea</i> , <i>Curculigo pilosa</i> , <i>Citrullus colocynthis</i> , <i>Citrus aurantifolia</i>	Soak or boil the stem barks of <i>S. mombin</i> and <i>F. aspericilia</i> together with the leaves of <i>G. ferruginea</i> and <i>C. pilosa</i> as well as the seeds of <i>C. colocynthis</i> in <i>C. aurantifolia</i> water or ordinary water. The recipe should be taken twice daily and should not be abused to avoid diarrhoea.	Decoction or infusion	Any

Table 4. Plants that are used singly in the treatment of cancer in the study areas.

No.	Scientific names
1	<i>Crotalaria pallida</i>
2	<i>Rauwolfia vomitoria</i>
3	<i>Vitellaria paradoxa</i>
4	<i>Plumbago zeylanica</i>
5	<i>Moringa oleifera</i>
6	<i>Pleukenetia conophora</i>
7	<i>Citrus limon</i>
8	<i>Basella alba</i>
9	<i>Cocos nucifera</i>
10	<i>Urtica dioica</i>
11	<i>Lycopersicon esculentum</i>
12	<i>Aloe barbadensis</i>
13	<i>Calliandra haematocephala</i>
14	<i>Nigella sativa</i>
15	<i>Hyssopus officinalis</i>
16	<i>Senna siamea</i>
17	<i>Taraxacum officinalis</i>
18	<i>Caesalpinia bonduc</i>
19	<i>Aloe vera</i>
20	<i>Citrullus colocynthis</i>

Table 5. Medicinal plants that are used in groups for cancer therapy.

No.	Group of plants
Groups of two plants	
1	<i>Uvaria chamae</i> , <i>Citrus limon</i>
2	<i>Olax subscorpioidea</i> , <i>Xylopi aethiopica</i>
3	<i>Pistiastra tiotes</i> , <i>Nymphae lotus</i>
4	<i>Moringa oleifera</i> , <i>Citrus limon</i>
5	<i>Citrus Paradise</i> , <i>Persia americana</i>
6	<i>Prunus dulcis</i> , <i>Allium sativum</i>
7	<i>Jatropha gossypifolia</i> , <i>Citrus limon</i>
8	<i>Canna indica</i> , <i>Dacryodes edulis</i>
9	<i>Crinum jagus</i> , <i>Tetrapleura tetraptera</i>
10	<i>Mormodica balsamina</i> , <i>Jatropha curcas</i>
11	<i>Musa paradisiaca</i> , <i>Moringa oleifera</i>
12	<i>Abrus precatorius</i> , <i>Citrus aurantiifolia</i>
13	<i>Canna indica</i> , <i>Dacryodes edulis</i>
14	<i>Croton lobatus</i> , <i>Elaeis guineensis</i>
Group of three plants	
15	<i>Calotropis procera</i> , <i>Xylopi aethiopica</i> , <i>Citrus limon</i>
16	<i>Amaranthus spinosus</i> , <i>Xylopi aethiopica</i> , <i>Allium sativum</i>
17	<i>Delonix regia</i> , <i>Xylopi aethiopica</i> , <i>Zingiber officinale</i>
18	<i>Prunus dulcis</i> , <i>Citrus limon</i> , <i>Kigelia africana</i>
19	<i>Citrus aurantiifolia</i> , <i>Platycerium alaicorne</i> , <i>Kigelia africana</i>
20	<i>Aframamum melegueta</i> , <i>Kigelia africana</i> , <i>Milicia excelsa</i>
Group of four plants	
21	<i>Morinda lucida</i> , <i>Mangifera indica</i> , <i>Garcinia cola</i> , <i>Xylopi aethiopica</i>
22	<i>Milicia excelsa</i> , <i>Azelia africana</i> , <i>Khaya ivorensis</i> , <i>Eugenia aromaticum</i>
23	<i>Cola acuminata</i> , <i>Allium sativum</i> , <i>Zingiber officinale</i> , <i>Curcuma longa</i>
Group of five or more plants	
24	<i>Kigelia africana</i> , <i>Eidens pilosa</i> , <i>Eugenia aromaticum</i> , <i>Croton lobatus</i> , <i>Boerhvia diffusa</i> , <i>Dacryodes edulis</i> , <i>Achillea millefolium</i> , <i>Aristolochia repens</i> , <i>Citrus aurantiifolia</i>
25	<i>Grewia pubescens</i> , <i>Pseudocedrela kotschyi</i> , <i>Lonchocarpus sericeus</i> , <i>Uvaria afzelii</i> , <i>Tithonia diversifolia</i> , <i>Lippia multiflora</i> , <i>Pista stratiotes</i> , <i>Nymphaea lotus</i> , <i>Bombax buonopozense</i> , <i>Vitellaria paradoxa</i> , <i>Bridelia ferruginea</i> , <i>Khaya ivorensis</i>
26	<i>Kigelia africana</i> , <i>Dacryodes edulis</i> , <i>Cajan uscajan</i> , <i>Cymbopogon citratus</i> , <i>Lippia multiflora</i> , <i>Allium sativum</i>
27	<i>Coccos nucifera</i> , <i>Picralima nitida</i> , <i>Eugenia aromaticum</i> , <i>Aristolochia repens</i> , <i>Dissotis rotundifolia</i>
28	<i>Vitellaria paradoxa</i> , <i>Pseudocedrela kotschyi</i> , <i>Eleusine indica</i> , <i>Elaeis guineensis</i> , <i>Nymphaea alota</i> , <i>Pista stratiotes</i>
29	<i>Senna alata</i> , <i>Citrullus colocynthis</i> , <i>Gladiolus ferruginea</i> , <i>Curculigo Pilosa</i> , <i>Spondias mombin</i> , <i>Ficus exasperata</i>
30	<i>Asclepias curassavica</i> , <i>Canavalia ensiformis</i> , <i>Ficus exasperata</i> , <i>Annona senegalensis</i> , <i>Elaeis guineensis</i>



Although some traditional healers and aged men and women are still practicing and using this art of healing, younger generations hardly believe in or have interest in traditional medicine (Ekor, 2013).

The number of male to female with the knowledge of herbal medicine procured from the study areas in this research is in contrast with similar research carried out in the South-Eastern part of Nigeria (Alade et al., 2018) but in favor with the report of Yabrir et al. (2018) carried out in Algiers. Also, the low levels of education among the traditional healers were observed by Alade et al. (2018).

A total number of 92 plants that belong to 51 families were mentioned as part of herbal remedies used in the treatment of different cancer types in the study areas. The most frequently mentioned plants with the highest RFC as *Citrus limon*, *Xylopiya aethiopica*, *Crotalaria pallida*, *Nymphaea lotus*, *Pistiastratiotes*, *Allium sativum* and *Kigelia africana* were also reported by Soladoye et al. (2010) when similar study was conducted in Ogun State, Nigeria. Only *C. pallida* among the seven plants was not reported by Soladoye et al (2010) as frequently used cancer herb. The remaining six and many others are consistent with the work. The reason may be because the predominant tribe, Yoruba, in Ogun State, a Southern state in Nigeria, is the same as that of our study areas. Only two of the frequently mentioned plants are analogous to the plants revealed by similar study carried out by Ngulde et al. (2015) in Borno State, a Northern part of Nigeria, where the predominant tribe is Hausa. The differences observed in the plants used for cancer treatment within the same country may be as a result of dissimilarity in culture and vegetation in the Northern and Southern Nigeria.

Our study further shows that about 20 of these plants are used alone (monotherapy) in the treatment and management of cancer while the rest are used in the combination of two, three, four, five and more, which are mostly prepared by decoction and infusion with their mode of application mostly being ingestion and topical application. This was similarly reported by Soladoye et al. (2010). Some of these plants are similar to those used to

prepare anticancer remedy in other parts of the world (Madhuri and Pandey, 2009). For instance, *Allium sativum*, *Aloe vera*, *Plumbago zeylanica* and *Zingiber officinale* were reported by Sharma et al. (2012) in India and *Lycopersicum esculentum*, *Jatropha curcas* and *Plumbago zeylanica*, reported by Ayele (2018) in Ethiopia.

The ability of the respondents to be able to describe cancer, especially breast cancer, shows that the people in the study areas are well aware of the risk of cancer. There is also high tendency that the plants revealed in this study actually possess anticancer effect because most of the respondents claimed to have previously treated patients suffering from the cancer(s). In addition, the respondents who were literate claimed that the kind of treatment given is informed by diagnosis from a recognized hospital such as University College Hospital (UCH), Ibadan, a well-known teaching hospital in Nigeria. It was reiterated by many respondents that the methods of preparation and the recommended dosage should be strictly followed for maximal efficiency. Also, over dosage should be avoided at all cost to prevent unwanted reactions in the patient such as stomach disorder; some of the respondents affirmed (Odugbemi et al., 2007; Soladoye et al., 2010).

Several scientific reports have shown that some of the anticancer acclaimed plants and their secondary metabolites actually possess anticancer properties (Bakarnga-Via et al., 2014; Iweala et al., 2015; Raimondo et al., 2015; Fetse, 2016; Yang et al., 2017; Abdulahi et al., 2018; Seca and Pinto, 2018). Although some of the plants revealed in this study have been reported to possess anticancer properties, the exact mode of mechanism is still unknown and a lot still needs to be done to reveal the active chemical compounds in each of the 92 plants species found in this research that could serve as potential source of new drugs with little to no toxic effect (Karimi et al., 2012; Hindi and Chabuck, 2013; Tyagi and Agarwal, 2017).

Some challenges were however encountered during the study. The chief among the problems is the fact that many respondents were reluctant in revealing more than one plant and refused to men-

tion other materials/ingredients used in preparing the anticancer remedy, claiming that the plant mentioned was the main component of the herb. Some thought the complete information should be divulged only to family members or whosoever properly enrolled for apprenticeship and serve them. This is because they perceived it as legacy that should be passed down to their next generation. Unfortunately, many of these children usually have little or no interest in it. This problem is similar to what was encountered in the Northern part of the country when similar study was conducted (Ngulde et al., 2015).

CONCLUSIONS

This study has attempted to pinpoint 92 plants species that are claimed to be effective in the management and treatment of cancer by 60 respondents, which include herbalists, herb sellers, pharmacognosist and traditional medical practitioners in Iwo Local Government area, Iwo Osun State and Ibadan, Oyo State Southwest Nigeria. The result of this study further revealed that indigenous medicinal plants exist in Iwo, Osun State and Ibadan, Oyo State Nigeria and can be a source of new anticancer drug-lead.

Scientific research should be carried out on these plants to ascertain their anticancer potentials. Also, toxicity study of these remedies is important especially the remedies with many plants because there may be antagonistic interactions among the plants, which may pose risk to the patients using them. The scientific tests to prove the efficacy and safety of the plants will determine the continual use or disuse of the plants. Furthermore, cultivation and replacement of the plants should be encouraged to ensure conservation and avoid extinction.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGMENTS

The respondents in the different study areas of this study are well appreciated for their cooperation. The authors confirm that there has been no financial support for this work.

REFERENCES

- Abdullahi AD, Mustapha RK, Yau S, Adam MS (2018) Exploring the Nigerian medicinal plants with anticancer activities: A pharmacological review. *Modern Chem* 6: 35–38.
- Akinde OR, Phillips AA, Oguntunde OA, Afolayan OM (2015) Cancer mortality pattern in Lagos University teaching hospital, Lagos, Nigeria. *J Cancer Epidemiol* 2015: Article ID 842032.
- Alade GO, Frank A, Kola'K A (2018) Animals and animal products as medicines: A survey of Epie-Atissa and Ogbia people of Bayelsa State, Nigeria. *J Pharm Pharmacogn Res* 6: 483–502.
- Arunadevi R, Anantharaj M (2013) Ethnobotanical survey of plants used for respiratory disorders in Cuddalore District, Tamil Nadu, India. *Int J Trad Nat Med* 1: 32–38.
- Atkinson R, Flint J (2001) Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social Res Update* 33: 1–4.
- Ayele TT (2018) A review on traditionally used medicinal plants/herbs for cancer therapy in Ethiopia: Current status, challenge and future perspectives. *Organic Chem Curr Res* 7: 1–8.
- Awoyemi OK, Abdulkarim IA, Ewa EE Aduloju AR (2012) Ethnobotanical assessment of herbal plants in South-Western Nigeria. *Acad Res Int* 2(3): 50-56.
- Bakaranga-Via I, Hounda JB, Fokou PV, Tchokouaha LR, Gary-Bobo M, Gallud A, Garcia M, Walbadet L, Secka Y, Dongmo PM, Boyom FF (2014) Composition and cytotoxic activity of essential oils from *Xylopi aethiopia* (Dunal) A. Rich, *Xylopi parviflora* (A. Rich) Benth.) and *Monodora myristica* (Gaertn) growing in Chad and Cameroon. *BMC Complement Altern Med* 4: 125.
- Bray F, Ren JS, Masuyer E, Ferlay J (2013) Global estimates of cancer prevalence for 27 sites in the adult population in 2008. *Int J Cancer* 132(5):1133–1145.
- Chukwuma EC, Soladoye MO, Feyisola RT (2015) Traditional medicine and the future of medicinal Plants in Nigeria. *J Med Plant Stud* 3: 23–29.
- Ekor M (2013) The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Front Pharmacol* 4: 177.
- Fadeyi SA, Fadeyi OO, Adejumo AA, Okoro C, Myles EL (2013) *In vitro* anticancer screening of 24 locally used Nigerian medicinal plants. *BMC Complement Altern Med* 13: 79.
- Fetse JP, William K., Adosraku RK (2016) Ethnopharmacological importance of *Xylopi aethiopia* (Dunal) A. Rich (Annonaceae) – A Review. *Br J Pharm Res* 11(1): 1–21.
- Hindi NKK, Chabuck ZAG (2013) Antimicrobial activity of different aqueous lemon extracts. *J Appl Pharm Sci* 3: 74–78.

- Hoffman B, Gallaher T (2007) Importance indices in ethnobotany. *Ethnobot Res Appl* 5: 201-218.
- Iweala EE, Liu F-F, Cheng R-R, Li Y, Omonhinmin CA, Zhang Y-J (2015) Anti-cancer and free radical scavenging activity of some Nigerian food plants *in vitro*. *Int J Cancer Res* 11: 41-51.
- Karimi E, Oskoueian E, Hendra R, Oskoueian A, Jaafar HZ (2012) Phenolic compounds characterization and biological activities of *Citrus aurantium* bloom. *Molecules* 17: 1203-1218.
- Madhuri S, Pandey G (2009) Some anticancer medicinal plants of foreign origin. *Curr Sci* 96: 779-783.
- Manivel G, Senthilraja P, Manikandaprabhu S, Durga G, Prakash M Sakthivel G (2016) 6-Oxa-3-thiaoctanoic acid has potential inhibitors against thyroid cancer-in-silico analysis. *Int J Pharm Sci Res* 7(12): 4963-4970.
- Mathi P, Nikhil K, Ambatipudi N, Roy P, Bokka VR, Botlagunta M (2014) In-vitro and in-silico characterization of *Sophora interrupta* plant extract as an anticancer activity. *Bioinformation* 10(3): 144-151.
- Moudi M, Go R, Yien CY, Nazre M (2013) Vinca alkaloids. *Int J Prevent Med* 11: 1231-1235.
- Muthu C, Ayyanar M, Raja N, Ignacimuthu S (2006) Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India. *J Ethnobiol Ethnomed* 2: 43.
- Ngulde SI, Sandabe UK, Hussaini IM (2015) Ethnobotanical survey of anticancer plants in Askira/Uba local government area of Borno State, Nigeria. *Afr J Pharm Pharmacol* 5: 123-130.
- Nisha SN, Jothi BA, Geetha B, Hanira S (2018) Phytochemical analysis of *Pistiastratiotes* by GC-MS analysis. *Nat J Multidis Res Dev* 3: 4-6.
- Odugbemi TO, Akinsulire OR, Aibinu IE, Fabeku PO (2007) Medicinal plants useful for malaria therapy in Okeigbo, Ondo State, Southwest Nigeria. *Afr J Trad Complement Altern Med* 4: 191-198.
- Oloyede AM, Okpuzor J, Omidiji OO, Nwosuh CI, Nwakiti OO (2012) *In vitro* cytotoxic activity of some medicinal plants used in traditional medicine for breast cancer management in Southwestern Nigeria. *Nat Sci* 10(7): 37-42.
- Popoola TD, Awodele O, Omisanya A, Obi N, Umezina C, Fatokun AA (2016) Three indigenous plants used in anti-cancer remedies, *Garcinia kola* Heckel (stem bark), *Uvaria chamae* P.Beauv. (root) and *Olax subscorpioidea* Oliv. (root) show analgesic and anti-inflammatory activities in animal models. *J Ethnopharmacol* 194: 440-449.
- Raimondo S, Naselli F, Fontana S, Monteleone F, Dico AL, Saieva L, Zito G, Fluga A, Manno M, Di Bella MA, De Leo G (2015) *Citrus limon*-derived nanovesicles inhibit cancer cell proliferation and suppress CML xenograft growth by inducing TRAIL-mediated cell death. *Oncotarget* 6(23): 19514-19527.
- Seca AM, Pinto DC (2018) Plant secondary metabolites as anticancer agents: successes in clinical trials and therapeutic application. *Int J Mol Sci* 19(1): E263.
- Sharma A, Dangwal LR, Bhushan U, Bhushan P, Rana CS (2012) Ethno-botanical survey of some anticancer medicinal plants from Garhwal Himalaya (Uttarakhand) India. *J Biodivers Environ Sci* 12: 1-7.
- Soladoye MO, Amusa NA, Raji-Esan SO, Chukwuma EC, Taiwo AA (2010) Ethnobotanical survey of anti-cancer plants in Ogun State, Nigeria. *Ann Biol Res* 4: 261-273.
- Tyagi T, Agarwal M (2017) Gas chromatography-mass spectrometry analysis of bioactive constituents in the ethanolic extract of *Pistiastratiotes* L. *Int J Basic Appl Med Sci* 7: 14-21.
- W.H.O. - World Health Organization (2016) World Cancer Fact Sheet.
- W.H.O. - World Health Organization (2018) Cancer: Key facts. <https://www.who.int/news-room/fact-sheets/detail/cancer>. 2018. Retrieved in 7 February, 2019.
- Yabrir B, Touati M, Adli B, Bezini E, Ghafoul M, Khalifa S, Guit B (2018) Therapeutic use of spontaneous medicinal flora from an extreme environment (dune cordon) in Djelfa region, Algeria. *J Pharm Pharmacogn Res* 5: 358-373.
- Yang C, Chen H, Chen H, Zhong B, Luo X, Chun J (2017) Antioxidant and anticancer activities of essential oil from Gannan navel orange peel. *Molecules* 22(8): E1391.

AUTHOR CONTRIBUTION:

Contribution	Afolayan FID	Sulaiman KA	Okunade WT
Concepts or ideas	x		
Design	x		
Definition of intellectual content	x		
Literature search		x	x
Experimental studies			
Data acquisition		x	x
Data analysis		x	x
Statistical analysis		x	
Manuscript preparation		x	
Manuscript editing	x		
Manuscript review	x	x	x

Citation Format: Afolayan FID, Sulaiman KA, Okunade WT (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.