

Ethnobotanical Survey of Plants Used As Remedy for Cancer in Imo State, Nigeria

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Abstract

In the survey, an ethnobotanical inventory was carried out to study the plant families, species and parts of plants used as remedy for cancer. The result showed that a total of 76 plant species from 47 families mostly of the Euphorbiaceae, Fabaceae, Dioscoraceae and Zingiberaceae. The commonest plant species identified include; *Ricinus communis* L (Castor bean), *Manihot esculenta* Crantz (Cassava), *Tetrapleura tetraptera* Scum & Thonn (African yellow wood), *Curcuma longa* L (Turmeric), *Zingiber officinale* Roscoe (Ginger) and *Xylopi aethiopica* (Dunal) A. Rich (African pepper). All the plants studied in this survey have been used by the herbal practitioners and adjudged to be effective. Despite the inventory, more research is needed in the extraction and isolation of active chemical constituents in these medicinal plants for drug formulation and other vital pharmaceutical purposes.

Keywords: Ethnobotanical, survey, Cancer, active compound, Imo State, Nigeria.

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INTRODUCTION

Cancer is a dreaded disease which is best characterized by abnormal cell division and is caused by mutation of genes involved in the control of cell division. Cancer cells grow in uncontrollable manner, and result in malignant tumors which attack on the nearby parts of the body [1]. Cancer (malignant tumour) is an abnormal growth and proliferation of cells [2]. It is a frightful disease because the patient suffers pain, disfigurement and loss of many physiological processes. Cancer may be uncontrollable and incurable, and may occur at any time at any age in any part of the body. There are various factors involved in the genesis of cancer like toxic chemicals, excessive use of alcohol, exposure to environmental toxins, some poisonous plants like mushrooms and exposure to excessive sunlight, genetic problems, radiation, viruses, etc. It is caused by a complex, poorly understood interplay of genetic and environmental factors. However, the cause of many cancers remains unknown. The current standard approach of western medicine for treatment of cancer consists of an attempt to eradicate established tumor with combined treatment such as surgery, chemotherapy and radiation. However, this therapy has failed in many respects. In many cases it makes human life miserable and usually reduces the span of life. The patient remains sick due to toxic effects of radio and chemotherapies as these do not kill only cancer cells but normal cells also and produce low hematological

picture and low immune syndromes making the patient prone to opportunistic infections, reduce strength and vitality. The failure of modern therapies has prompted complementary and alternative medicine scientists to investigate the plant derived safe and effective therapeutic agents [3].

Cancer causes about 13% of all deaths [4]. Cancer kills annually about 3500 per million population around the world [2]. Cancers figure among the leading causes of morbidity and mortality worldwide, with approximately 14 million new cases and 8.2 million cancer related deaths in 2012 [5]. The number of new cases is expected to rise by about 70% over the next 2 decades. Among men, the 5 most common sites of cancer diagnosed in 2012 were lung, prostate, colorectum, stomach, and liver cancer. Among women the 5 most common sites diagnosed were breast, colorectum, lung, cervix, and stomach cancer. Around one third of cancer deaths are due to the 5 leading behavioural and dietary risks: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, alcohol use. Tobacco use is the most important risk factor for cancer causing around 20% of global cancer deaths and around 70% of global lung cancer deaths. Cancer causing viral infections such as HBV (Hepatitis virus), and HPV are responsible for up to 20% of cancer deaths in low- and middle-income countries [6]. More than 60% of world's total new annual cases occur in Africa, Asia and Central and

South America. These regions account for 70% of the world's cancer deaths. It is expected that annual cancer cases will rise from 14 million in 2012 to 22 within the next 2 decades [5].

Cancer is a leading cause of death worldwide, accounting for 8.2 million deaths in 2012 [5]. The most common causes of cancer death are cancers of: lung (1.59 million deaths), liver (745 000 deaths), stomach (723 000 deaths), colorectal (694 000 deaths), breast (521 000 deaths), oesophageal cancer (400 000 deaths) [5]. Breast cancer is the second overall cause of death for women [6]. Colorectal cancer is the third most lethal cancer worldwide. Both genders, male and female are equally affected by this deadly disease [7].

In Nigeria, there are about 100,000 new recorded cases of cancer yearly while there are currently about 2 million recorded cases on ground. Breast and cervical cancer are the commonest forms of cancer in Nigeria and they occur in women. Through the years, the cancer mortality rate has tripled and with the vastly inadequate health care system in Nigeria, the figures are poised to get even worse. However, the key to fighting cancer is early detection, as such, it is advised that we regularly conduct check-ups [8].

Several reports describe that the anticancer activity of medicinal plants is due to the presence of antioxidants in them. In fact, the medicinal plants are easily available, cheaper and possess no toxicity as compared to the modern (allopathic) drugs. Hence, this inventory contains 63 medicinal plants, which are the natural sources of anticancer agents. A large number of chemopreventive agents are used to cure various cancers, but they produce side effects that prevent their extensive usage. Although more than 1500 anticancer drugs are in active development with over 500 of the drugs under clinical trials, there is an urgent need to develop much effective and less toxic drugs. The plant kingdom plays an important role in the life of humans and animals [2].

According to the World Health Organization (WHO), about three quarters of the world's population currently use herbs and other forms of traditional medicines to treat diseases. Traditional medicines are widely used in India. Even in USA, use of plants and phytomedicines has increased dramatically in the last two decades [9]. The plant kingdom is playing an important role in cancer prevention and therapy in a number of ways:

(i) Medicinal plants represent a vast potential source for anticancer compounds. These compounds are extremely

complex molecular structures, which would be difficult to synthesize (or conceptualize) in the laboratory. The antitumour activity of medicinal plant derived compounds may result via a number of mechanisms, including effects on cytoskeletal proteins which play a key role in cell division, inhibition of DNA topoisomerase enzymes, antiprotease or antioxidant activity, and stimulation of the immune system, etc [10, 11].

(ii) Plants can delay or even prevent cancer onset.

(iii) Plants can support the immune system, thus improving body resistance to the disease and its treatments.

(iv) Plants can prevent and decrease side effects of conventional treatments.

(v) Plants can provide nutritional, as well as psychological support.

Therefore, it is a two-sided approach: One – plant derived molecules are used by conventional medicine as anti-cancer drugs. Secondly, plants are used as a part of complementary treatment, offering psychological, nutritional and physical support, thus increasing the quality of life [12]. Plants have been used in the treatment of cancer. The National Cancer Institute collected about 35,000 plant samples from 20 different countries, and has screened around 114,000 extracts for anticancer activity. 60% of the commercially available anticancer drugs are from natural sources [1].

STUDY SITE

Imo state was created on February 3, 1976. Imo state is located in the southeast region of Nigeria and its capital is Owerri which is its largest city. The total land area of the state is 5,530 sq km and a population of 3,934,899. It is located between Anambra State in the North, Rivers State in the South, Akwa Ibom State to the East and on the West by Delta State. The state lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E. Imo state is part of Igboland and the original inhabitants are Igbos, a culturally homogeneous group. Igbo is the language spoken throughout the state with different dialects spoken in different parts. Some other major towns in Imo state are Okigwe, Oguta, Orlu, Mbaise, Uzoagba and Emekuku. The state is rich in crude oil, natural gas and fertile, arable agricultural land. The people of Imo state are Igbo speaking state. They have a very rich cultural heritage which is portrayed in their dress, music, dance, festivals, arts and crafts. Imo State is divided into twenty seven local government areas [13, 14].



S/N	FAMILY	BOTANICAL NAME	COMMON NAME	LOCAL NAME	PART USED	ACTIVE COMPOUND	TYPE OF CANCER REMEDIED	REFERENCES
1	Euphorbiaceae	<i>Ricinus communis</i> L	Castor bean	Ogili Ugba, ogili isi	Seeds	Flavonoids, ricinoleic acid, P – coumaric acid, ferulic acid, O-coumaric acid, syringic, cinnamic, chlorogenic, neochlorogenic and gallic acid	Colon, liver and prostate	[15, 11]
2	Euphorbiaceae	<i>Jatropha gossypifolia</i> L	Bellyache bush	Ijikara,	Leaf		Breast	[16, 17]
3	Euphorbiaceae	<i>Jatropha curcas</i> L.	Physic nut.	Oluludu, Urukpa,			Breast	[18, 17]
4	Euphorbiaceae	<i>Manihot esculenta</i> Crantz	Cassava	Jigbo	Root	Linamarin	Prostate, breast	[19-21]
5	Euphorbiaceae	<i>Securinega virosa</i> (Roxb) Bail	Resurrection plant	Ulanjula, uratanjele	Leaf	Phenol, flavonoid	Breast	[22]
6	Euphorbiaceae	<i>Bridelia ferruginea</i> Benth		Ala	Leaf	Isopicrodeoxycholic acid, llotoxin	Breast	[23]
7	Fabaceae	<i>Glycine max</i> L	Soybean	Iru, Ogiri-Igala	Seed	Genistein, quercetin, saponins, isoflavonones and lectin	Breast, uterus, cervix, ovary, lung, stomach, colon,	[24]

							liver, kidney, prostate and thyroid	
8	Fabaceae	<i>Cajanus cajan</i> (L.) Millsp	Pigeon pea	Fio fio	Root	Hexadecanoic acid methyl ester, α -amyrin, β -sitosterol, pinostrobin, longistylin A, isoflavanone, phytoalexin, cajanol (5-hydroxyl-2-methoxyphenyl)-7-methoxychroman-4-one	Liver, breast	[25, 26]
9	Fabaceae	<i>Butea monosperma</i> (Lam.) Taub.	flame-of-the-forest, <i>bastard teak</i>	Uhie Nkū, Uhie	Flower	Cajanin, Cladrin, Medicarpin,	Liver, breast, skin	[27]
10	Fabaceae	<i>Glycyrrhiza glabra</i> L.	Licorice	Ututo Ogiri	Root	Flavonoids (flavonoids, flavonals, isoflavones, chalcones, licochalcones)	Breast, lung, stomach, colon, liver, kidney and prostate	[28]
11	Fabaceae	<i>Tetrapleura tetraptera</i> Scum & Thonn	African yellow wood, aidan tree	Oshosh o,	Leaf and stem	Quercetin,	Prostate	[29]
12	Dioscoraceae	<i>Dioscorea alata</i> L.	Water yam	Ji abana	Tuber	Diogenin	Breast, uterine, ovarian, esophageal	[30, 31]
13	Dioscoraceae	<i>Dioscorea bulbifera</i> L.	Air potato, air yam, bitter yam.	Adu, aduimu	Tuber	Diogenin	Esophageal	[32, 31]
14	Dioscoraceae	<i>Dioscorea rotundata</i> Poir	White yam	Jiaga,	Tuber	Diogenin	Esophageal, uterine and ovarian	[30]
15	Dioscoraceae	<i>Dioscorea cayenensis</i> Lam.	Yellow yam	Ji ofu, ji ukom.	Tuber	Diogenin	Prostate, uterine, ovarian and esophageal	[30]
16	Dioscoraceae	<i>Dioscorea batatas</i> L.	potato yam, aerial yam	Ji, ji abana;	Tuber	Diogenin	Uterine, ovarian and esophageal	[30]
17	Zingiberaceae	<i>Curcuma longa</i> L.	Turmeric	Mkpiri, Mbugbo	Stem (rhizome)	Curcumin (Di-fernyloyl-methane) and curcuminoids	Breast, lung, liver, colon, prostate, skin and stomach	[33-36]
18	Zingiberaceae	<i>Alpinia</i>	Great	Kusa	Rhizo	1-Acetoxychavicol	Prostate,	[37]

	ae	<i>galangal</i> Willd	galangal		me	acetate (ACA), galangin and pinocembin	skin, oral and breast	
19	Zingiberace ae	<i>Zingiber officinale</i> Roscoe	Ginger	Jinja	Stem (rhizo me)	6- shogaol	Prostate, breast, cervix, colon, ovary, rectum, urinary bladder and oral cavity	[38-40]
20	Zingiberace ae	<i>Curcuma zedoria</i> (Christm.) Roscoe	White turmeric, Zedoary	Iloko	Stem (rhizo me)	Sesquiterenes, curcuminoids	Breast	[41-43]
21	Amaryllidac eae	<i>Allium cepa</i> L	Onion	Ayu	Leaf (bulb)	Allypropyl disulphide, catechol, protocatechnic acid, thiopropiono aldehyde and thiocyanate	Ovarian, breast, stomach	[44]
22	Amaryllidac eae	<i>Aloe barbadens is</i> Mill.	Aloe vera	Ebube agu	Leaf	Emodin	Liver	[45, 46]
23	Amaryllidac eae	<i>Allium sativum</i> L	Garlic	Aayu, Ayo- ishi,	Leaf (bulb)	Allicin, allin	Brain, breast	[47]
24	Caesalpinac eae	<i>Cassia auriculata</i> (L.) Roxb.	Tanners cassia,	Ogaalu	Leaf	4-(4-chlorobenzyl) – 2,3,4,5,6,7- hexahydro- 7- (2- ethoxyphenonyl) benzo [h] [1,4,7] triazecin – 8 (1H) – one	Colon	[48]
25	Caesalpinac eae	<i>Cassia senna</i> L	Seena, Tinnervell ly Senna,	Atara	Leaf	Aloe – emodin, isorhamnetin and kaemperol	Stomach, colon	[49, 50]
26	Caesalpinac eae	<i>Cassia occidentali s</i> (L.) Link,	Coffee senna	Asesa	Leaf	Emodin, Aloe – emodin 1,8 – Dihydroxy 3 –hydroxy methylantraquinone	Liver, kidney	[51]
27	Convovulac eae	<i>Cuscuta trifolii</i> Bab.	Harper's Dodder		Leaf	Flavonoid; kaemperol, quercetin	Liver, spleen, prostate	[52]
28	Convovulac eae	<i>Ipomea batata</i> (L.) Lam	Sweet potato	Ji- oyibo, Ekimak o	Tuber	Anthocyanins; cyanidin, peonidin, polyphenol	Colon, prostate	[53]
29	Convovulac eae	<i>Ipomea digitata</i> L	Aligator Yam	Mgbá- n'àlà	Tuber	Glycoside; paniculatin	Stomach, skin	[54]
30	Lamiaceae	<i>Ocimum santum</i> L	Holy Basil	Ndeme	Aerial part	Urosolic acid, apigenin, rosamarinic acid, eugenol, rosmarinic acid, myretenal, inteolin, β- sitosterol, vinenin and carnosic acid	Skin, liver, oral, lung and cervical	[55, 56]
31	Lamiaceae	<i>Ocimum gratissium</i> L	clove basil, African	Nchuan wu	Leaf	Eugenol, methyl eugenol	Prostate	[57, 58]

			<i>basil,</i>					
32	Lamiaceae	<i>Hyptis suaveolens</i> (L.) Poit.	Bus tea,	Ijikara	Leaf, root	Podophyllotoxin	Colon, liver	[59, 60]
33	Asteraceae	<i>Helianthus annuus</i> L.	Sunflower	Fulawa onwa	Leaf, stems, Roots	Nevadensin (bioflavonoid)	Lung	[61]
34	Asteraceae	<i>Vernonia amygdalina</i> Delile	Bitter leaf	Onugbu	Leaf	Steroid saponins, luteolin, luteolin 7-O- β -glucuroniside, luteolin 7-O- β -glucoside, anthraquinones, vernoniosides A1,A2,A3,A4,B1,B2,C, D, E	Breast, stomach	[62-67]
35	Apocynaceae	<i>Cathartus roseus</i> (L.) G. Don	Madagascar periwinkle	Ijikere	Leaf	Vinblastine, vincristine and their derivative	Breast, ovary, cervix, lung, colon, rectum and prostate	[68, 69]
36	Apocynaceae	<i>Picralima nitida</i> (Staf.) Th & H. Durand	Akuamm plant	Osi-Igwe, òsú abwa	Leaf	Phenol, flavonoid	Breast	[16]
37	Combretaceae	<i>Terminalia catappa</i> L.	African nut tree, country-almond,	Mkpuru edo	Leaf	Saponin, saponin glycosides, steroid, cardiac glycoside,	Lung	[70, 71]
38	Combretaceae	<i>Guiera senegalensis</i> J.F. Gmel	English Moshi	Apa	Leaf	Polyphenols; guirenone, quercetin	Breast	[72, 73]
39	Solanaceae	<i>Solanum nigrum</i> L.	Black nightshade, wonder berry	Afufa	Fruit	Steroidal glycoalkaloids, steroid glycosides (spirostane, furostane, spirosolane), lurasin	Liver, breast	[74, 75]
40	Solanaceae	<i>Solanum lycopersicum</i> L.	Tomato	Tomereto	Fruit	Lycopene	Colon, prostate	[76, 77]
41	Annonaceae	<i>Annona senegalensis</i> Pers.	Wild custard	Uburu ocha	Leaf	Flavonoids, kaurenoic acid	Prostate, breast	[78, 79]
42	Annonaceae	<i>Xylopi aethiopica</i> (Dunal) A. Rich.	African pepper, guinea pepper	Uda.	Fruit		Colon, cervical	[80, 81]
43	Rubiaceae	<i>Uncaria tomentosa</i> (Willd. ex Schult.) DC.	Cat's claw	Ubuluin u.	Stem bark, root	Oxindole alkaloids	Breast, urinary	[82]
44	Rubiaceae	<i>Murinda lucida</i> Benth.	Brimstone tree	Eze Ogu, Njisi	Stem bark	Anthraquinones, anthraquinols	Liver, kidney	[83, 84]
45	Clusiaceae	<i>Garcinia</i>	Mangost	Okwe.	Fruit	Xanthenes; α -	Breast	[85, 86]

		<i>mangostoma</i> L	een			mangostin, β -mangostin, mangostanol, gertanin, garcinone and maclurin		
46	Clusiaceae	<i>Garcinia kola</i> Heckel	Bitter kola	Akuilu	Root	1-3, 8-11 benzophenones, biflavones, flavonones, apigenin	Liver, stomach	[87]
47	Beberidaceae	<i>Beberis vulgaris</i> L.	Barberry,	Uhuma obi-nwoke,	Fruit	Berberine, quercetin	Cervical, breast, prostate, stomach, oral and liver	[88-90]
48	Acanthaceae	<i>Andrographis paniculata</i> (Burm. f) Wall. Nees	Green chirayta, creat, king of bitters,	Egbu	Leaf, stem	Andrographolide	Breast, ovary, stomach, colon, prostate and kidney	[91, 92]
49	Meliaceae	<i>Azadirachta indica</i> A. Juss	Neem	Dogonyaro	Leaf, flowers and stem bark	Nimbidin, nimbin, liminoids, nimbolide, nimbinin, nimboline and nibidic acid	Breast	[93-95]
50	Plumbaginaceae	<i>Plumbago zeylanica</i> L	White leadwort	Inabiri, Onaya ako	Stem bark, root and leaf	Triterpenoids, anthraquinones, steroid glucosides	Lung, prostate	[96, 97]
51	Santalaceae	<i>Viscum album</i> L	Mistletoe	Ewe ato	Leaf	Iscador	All types of cancer	[98-101]
52	Graminae	<i>Cymbopogon citratus</i> (DC.) Stapf,	Lemon grass	Achara tii	Leaf	Linalool, sesquiterpene, phenolic acid	Cervical	[102-105]
53	Apiaceae	<i>Daucus carota</i> L	Carrot	Okùrù, ilá	Tuber (juice)	Falcarinol	Colon, Breast	[106]
54	Papaveraceae	<i>Sanguinaria canadensis</i> L	Bloodroot	Ochiricha, Offa	Leaf	Sanguinarine, chelerythrine, berberine and oxysanguinarine	Skin, Breast	[107]
55	Mimosaceae	<i>Calliandra portoricensis</i> (Jacq) Benth	Powder puff, fairy duster.	Eri Agbo	Leaf	Polyphenol, flavonoid	Prostate	[108]
56	Cactaceae	<i>Cactus grandis</i> Juss	Cactus pear	Macaloe,	Stem	Hexadecanoic acid	Ovarian	[109]
57	Caricaceae	<i>Carica papaya</i> L	Pawpaw	Nbirimbi	Fruit, leaf	Quercetin, lycopene, betacarotenoids, benzylisothiocyanate, benzylglucosinolate, chlorogenic acid, caffeic acid, protocatechuic acid	Cervix, breast, liver, lung, pancreatic	[110, 111]
58	Cistaceae	<i>Cistus ladanifer</i> L	Rockrose	Nishiki	Stem (Gum)	Quercetin, kaempferol, polyphenols	Breast	[112]
59	Ranunculac	<i>Nigella</i>	Black	Usolala-	Seed	Thymoquinone	Liver, skin,	[113-117]

	eae	<i>sativa</i> L	cumin	ocha	(oil)		pancreas, cervical, breast, bone, stomach, prostate, colon and brain	
60	Amaranthaceae	<i>Spinacia oleracea</i> L	Spinach	Ijikara,	Leaf	Sulfoquinovosyl Diacylglycerol, flavonoids	Liver, kidney, stomach, skin and prostate	[118, 119]
61	Bignoniaceae	<i>Kigelia Africana</i> (Lam.) Benth.	Cucumber tree	Ogilisofia.	Leaf, stem bark, fruits	Flavonoids; 6-hydroxyluteolin-7- α -glucoside and luteolin, flavonol; quercetin, flavonones	Breast, uterine	[120]
62	Simaroubaceae	<i>Hannoa klainneana</i> Pierre ex Engl.	Hotoro	Igigun	Leaf	Quassinoids	Breast, ovarian, stomach, colon	[121, 122]
63	Plantaginaceae	<i>Plantago major</i> L	Plantain	Ebegehi	Fruit, leaf	Aucubin, catalpol, acteoside	Skin	[123, 124]
64	Cucurbitaceae	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Watermelon	Ngbam	Seeds	Lycopene, citrulline	Prostate	[125, 126]
65	Rosaceae	<i>Prunus africana</i> (Hook f.) Kalkm	iron wood, stinkwood, African plum,	Osisigwe	Stem bark, flowers and fruits	Steroids; sitosterone, daucosterol	Prostate	[127]
66	Moringaceae	<i>Moringa oleifera</i> Lam.	Drumstick tree	Okweoyibo	Stem bark, seed, root, fruit	Quercetin, caffeoylquinic acid	Breast, colon, lung, skin, ovarian	[128, 129]
67	Araceae	<i>Colocasia esculenta</i> L	Cocoyam	Ede	Corm (tuber)	Cyaniding – 3-glucoside, anthocyaninsperlargonidin -3 – glucoside	Colon	[130]
68	Anacardiaceae	<i>Mangifera indica</i> Linn	Mango	okpokpa beke, mǎngòl ò	Leaf, fruit	Isomangiferin, tetracyclic triterpenoids, manglupenone, manglupenone	Breast, colon	[131]
69	Vitaceae	<i>Vitis vinifera</i> L	Grape	Oromaokpo	Seed	Polyphenols, quercetin, resveratrol	Skin, colon, prostate	[132-134]
70	Musaceae	<i>Musa sapientum</i> L	Banana	Unere, une	Fruit	Flavonoids, coumarins	Colorectal	[135, 136]
71	Palmae	<i>Elaeis guineensis</i> Jacq	African oil palm	Nkwu	Leaf	Vincristine, vinblastine, vindesine, etoposide, teniposide, saponin, terpenoids, steroids	Colon	[137]

72	Piperaceae	<i>Piper guineensis</i> Schum and Thonn	African black pepper;	Uziza	Seed, leaves	Piplartine, cepharadione	Lung	[138-140]
73	Nymphaeaceae	<i>Nymphaea lotus</i> L.	Water lily	Osibata	Leaf	Steroids, saponins	Breast, lung	[141]
74	Myristicaceae	<i>Pycnanthus angolensis</i> Welw Warb	African nutmeg,	Mba	Stem bark	Flavonoids, antihyperglyceric terpene-quinones, dihydro-gualaretic acid, isoflavonoids		[142-144]
75	Crassulaceae	<i>Bryophyllum pinnatum</i> Lam (Oken)	Air Plant, Life Plant, Africa never die, Resurrection plant,	Odaa opue	Leaf	Flavonol glycoside, quercitrin, steroids	Breast, cervical	[145, 146]
76	Nyctaginaceae	<i>Boerhaavia diffusa</i> L.	Red spiderling, spreading hogweed	Anyanwona	Aerial part, roots	Boeravinone, punarnavoside	Breast	[147]

Results from this inventory show that different traditional herbal practitioners use different plant species for the treatment of various cancers and therefore the knowledge of the therapeutic value of the plant species, disease conditions, vary from one practitioner to another.

The investigation shows that Euphorbiaceae, Fabaceae, Dioscoraceae and Zingiberaceae were the plant families mostly used in the treatment of cancer (Table-1). These plant families are among the most common plant families seen in Nigeria [148, 149].

It can be depicted from this finding that these plants possess some active compounds and metabolites for the treatment of cancer. Genistein from *Glycine max* blocks the supply of oxygen and nutrients to cancer cells. Isoflavones and saponins inhibit cancer cell proliferation and induce apoptosis [24, 2]. *Glycyrrhiza glabra* inhibits growth and spread of various kinds of cancers by inducing apoptosis and arresting cancer cell division [28, 2]. Curcumin in *Curcuma longa* arrest cancer cell proliferation in G2/S phase and induce apoptosis. Curcumin works in multidrug resistance breast cancer. It suppresses the adhesion of cancer cells and is effective in radiotherapy – resistant prostate cancer [33-36]. Pinocembrin in *Alpinia galangal* inhibits the growth and spread in colon cancer by arresting cell proliferation and inducing apoptosis. Galangin, a flavonoid protects against breast and prostate cancer [37, 2]. 6- shogaol in *Zingiber officinale* inhibits the growth and spread of cancer by apoptosis and autophagy [38-40].

Eugenol and vicienin in *Ocimum santum* inhibits the growth of various cancers such as liver and breast by blocking supply of oxygen and nutrients to the cancer cells, therefore killing them by starving. It also reduces side effects of chemotherapy and radiotherapy [2, 55, 56]. Vinca alkaloids in *Catharanthus roseus* arrests cancer cell proliferation by binding to tubulin in the mitotic spindle. It inhibits angiogenesis (formation of new blood vessels) and reduces apoptosis [68, 69, 2]. Steroid glycosides (spirostane, furostane, spirosolane) inhibits the growth of colon cancer while polysaccharides from *Solanum nigrum* inhibits cervical cancer growth and spread. It also induces apoptosis. Lumasins from *Solanum nigrum* is a cancer protective peptide.

Beberine (an isoquinoline alkaloid) from *Beberis vulgaris* possess anticancer property by arresting cancer cell cycle in G1 – phase and induces apoptosis. Beberine has anticancer activity against prostate and liver cancers. It increases the penetration of some chemotherapy drugs through the brain barrier, hence enhancing their effect on intracranial tumours. Phenolic compounds from *Beberis vulgaris* protect against breast, stomach and oral cancer [88-90, 2].

Andrographolide; a diterpene in *Andrographis paniculata* anticancer activity against cancer of the breast, ovary, stomach, colon, prostate and kidney. It exerts direct anticancer activity on cancer cells by arresting G0/G1 phase of cell cycle and inducing apoptosis [91, 92]. Niminoids from *Azadirachta indica* regress growth and spread of various cancers such as cancer of the breast, lung, stomach, prostate and skin.

Nimbolide inhibits growth and spread of different cancers by inducing apoptosis (cell death). Ethanolic extract of *Azadirachta indica* inhibits the growth and spread of prostate cancer by inducing apoptosis. It also reduces the side effect of chemotherapy and radiotherapy [2, 93-95]. Thymoquinone from *Nigella sativa* is effective in both hormone sensitive and hormone- refractory cancer. It kills cancer cells by binding to the asiolofoeutin (lectin) of the surface of cancerous cells causing their aggregation and clumping [113-117, 2].

Notable chemical and phytochemical works have been done on some of the plants investigated and include *Garcinia cola* [150-155], *Zingiber officinale* [156-159], *Nauclea latifolia* [160], *Berberis* species [161], *Carica papaya* [162, 163], *Ocimum gratissimum* [164-166], *Tetroleptura tetraptera* [164, 166].

The plants studied can be viewed as potential sources for vital drugs and hence should be explored for pharmaceutical and therapeutic value.

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