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Ethnobotanical Survey of some Plants Used for the Management of Hypertension in the Igala Speaking Area of Kogi State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author SEA conceived the study, designed the instrument used, provided the general guide and prepared the final manuscript. Author MAD conducted the field survey, while author ODO performed most of the literature search and wrote the initial draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The ethno medicinal applications of plant species used primarily to manage hypertension among the Igala people of Kogi State, Nigeria were surveyed. A total of ten plant species belonging to nine families were found to have varying applications against the disease. The plants include *Kigelia africana* (Bignoniaceae), *Ficus capensis* (Moraceae),

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Crossopteryx febrifuga (Rubiaceae), *Phyllanthus amarus* (Euphorbiaceae) and *Paullinia pinnata* (Sapindaceae). Others are *Rauwolfia vomitoria* (Apocynaceae), *Calotropis procera* (Asclepiadaceae), *Persea americana* (Lauraceae), *Anacardium occidentale* (Anacardiaceae) and *Newbouldia laevis* (Bignoniaceae). The results are discussed with respect to the morphological types, reported phytochemical constituents and other medicinal uses of the plants. It is concluded that there is need to scientifically evaluate these plants for therapeutic efficacy against hypertension and related cardiovascular disorders that the plants are reportedly used for in the traditional medicine of the Igala people of Kogi State, Nigeria.

Keywords: *Ethnobotanical survey; traditional medicine; Igala; Kogi State; Nigeria.*

1. INTRODUCTION

Non-communicable diseases (NCDs) are medical conditions or diseases which are non-infectious. They are diseases of long duration and slow progression and include heart disease, stroke, cancer, diabetes, chronic kidney diseases, osteoporosis, Alzheimer's disease, cataracts and more. The World Health Organization (WHO) in 2010 [1] reported that NCDs are to be by far the leading cause of mortality in the world, representing 60% of all deaths. Risk factors such as a person's background, lifestyle and environment are known to increase the likelihood of certain NCDs. About 7.5 million people die because of high blood pressure and by 2030 deaths due to chronic NCDs are expected to increase to 52 million per year while deaths caused by infectious diseases, maternal and peri-natal conditions and nutritional deficiencies are expected to decline by 7 million per year during the same period [2]. In Nigeria, cardiovascular diseases, including hypertension is responsible for 12% of the total mortality amounting to 991.6 million deaths annually [1], and hence, the urgent need to find a sustainable solution.

High blood pressure (hypertension) is a medical condition during which the systolic/diastolic pressure of the heart exceeds 120/80mmHg. There are many potential causes of hypertension, but sometimes the disease is asymptomatic. It is regarded as the silent killer because 30% of the people that have it do not realize it. It is the number one modifiable cause of stroke because lowering blood pressure reduces the chance of stroke by 35 to 40% while other conditions including heart attack and heart failure can be reduced by 25 and 50% respectively [3].

For many centuries medicinal preparations derived from plants have been used to manage diseases affecting man and the vegetation in the tropics are rich in different species of medicinal plants. Many drugs commonly used today are of herbal origin; about 25% of the prescription drugs dispensed in the United States contain at least one active ingredient derived from plant material, some are made from plant extracts, others are synthesized to mimic a natural plant compound [4]. 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 danger that the knowledge of herbal medicine may die along with the aging generation of herbal medical practitioners [5]. Therefore, the need to document and preserve the knowledge through ethno-botanical survey is justified. Therefore, in this paper, we provide report on the medicinal plants used by the Igala people of Kogi State, Nigeria in treating hypertension.

2. MATERIALS AND METHODS

The home of the Igala people is situated east of the River Niger and Benue confluence and astride the Niger in Lokoja, Kogi State of Nigeria. The area is approximately between latitude 6°30 and 8°40 north and longitude 6°30 and 7°40 east and covers an area of about 13,665 square kilometers (Fig. 1). The Igala population is estimated at two million. They can also be found in Delta, Anambra, Enugu and Edo States of Nigeria. The Igala language is closely related to the Yoruba and Itsekiri languages [6].



Fig. 1. Map of Kogi State, Nigeria showing Igala speaking area

The interview method employed is basically as described by Atawodi and coworkers [7]. The research design as contained in the instrument used for the study is reproduced in the attached appendix. Interview and detailed discussions were conducted with local herbalists (who happened to be all male) aged between 55 and 85 years old that have vast experience in treating wide range of diseases, including high blood pressure, with herbal preparations. Each plant recorded was mentioned by at least two respondents among a total of twenty that were interviewed. The low number of respondents was due to the fact that herbalism is a fast disappearing profession in this part of the world, and finding herbalists who were renowned and willing to participate in the study was an uphill task. The plants' identities were confirmed at the Herbarium Section of the Department of Biological Sciences, Ahmadu Bello University, Zaria, and that of National Institute for Pharmaceutical Research and Development (NIPRD) Idu, Abuja, Nigeria, where voucher samples were deposited.

3. RESULTS AND DISCUSSION

Ten (10) plants were identified for the management of hypertension and they include *Kigelia africana*, *Ficus capensis*, *Crossopteryx febrifuga*, *Phyllanthus amarus* and *Paullinia pinnata*.

Others were *Rauwolfia vomitoria*, *Calotropis procera*, *Persea americana*, *Anacardium occidentale* and *Newbouldia laevis*. Among them are six trees, three shrubs and one herb and the methods of preparation ranged from decoction to hot or cold infusion of plant materials to produce extracts that are taken in prescribed dosages (Table 1).

The ethnobotanical survey of plants used for the management of hypertension in the Igalaspeaking area of Kogi State, Nigeria revealed ten plants belonging to nine different families, with the *Bignoniaceae* family having two plants. The study reveals trees as the mainly used morphological type or habit, followed by shrubs and herbs. This is not surprising considering that Igalaland where the survey was conducted is in the Sudan Savannah where the vegetation is predominated by trees. Besides, trees, in addition to the leaves and flowers, have big and harvestable stem barks and roots, and hence offer greater varietal opportunities for use as separate medicinal components, unlike shrubs that are often used as whole plants. The use of plants as therapeutic agents has existed before the beginning of recorded history and has formed the basis of useful drugs since they are less toxic than synthetic drugs. Therefore, survey and screening of plants for medicinal activities present avenues for discovery of new drugs [8].

The plants gathered in this survey also possess other documented medicinal uses. For instance, *Kigelia africana* is widely used throughout Africa for a variety of purposes, such as skin complaints, anaemia, sickle cell anaemia, epilepsy, respiratory ailments, hepatic and cardiac disorders and nutritional illnesses such as kwashiorkor, rickets, wasting diseases and weakness. The leaves are sometimes used in preparing a general tonic for improved health and growth. Aqueous fruit preparations are applied as a wash or rubbed to promote weight gain in infants. In West Africa, a preparation in which the dried bark is macerated, is used to treat syphilis, while in Cote d'Ivoire, renal and bladder ailments are treated with medicaments containing the bark and leaves of *K. africana* and several other medicinal plants. Sexual complaints such as infertility, poor libido, sexual asthenia and impotence are treated with medicines containing the fruits, roots or leaves. A small amount of the unripe fruit is chewed as a sexual stimulant or added to beer as an aphrodisiac. Due to its analgesic and anti-inflammatory properties, many topical preparations containing *K. africana* parts are used to relieve rheumatism, sprains, hematoma and bruises. A decoction of the fruit and bark is used to treat toothache and headache. Snake bite antidotes are made with an infusion of the fruits, stem, leaves, twigs or bark [9]. The antidiarrhoeal activity of the leaf [10] and an anticancer activity of the fruit [11] have also been reported. The many medicinal properties of *K. africana*, including the management of hypertension maybe due to the presence of numerous secondary metabolites, such as iridoids, naphthaquinones, flavonoids, coumarin derivatives, lignans, sterols and volatile constituents [12].

Among the Igede people of Benue State, Nigeria, some workers reported the ethno medicinal uses of the leaves of *Ficus capensis* in treating diarrhoea, using decoction method [13]. The leaves are also used to treat dysentery, oedema, epilepsy and rickets among some tribes in Edo/Delta areas. It is also used in circumcision, leprosy, infertility, gonorrhoea, threatened abortion and respiratory disorders [14]. A decoction of the leaves and stem bark is used to treat oedema, dysentery and epilepsy. It is also a growth promoter in children, when they drink and bath with it [15]. In a study of the aqueous extract of *Ficus capensis* leaf on gastrointestinal motility, oral administration of 100-400mg/kg body weight of the extract exhibited a dose-related reduction in the gastrointestinal tract motility. Phytochemical screening of the powdered leaves revealed the presence of saponins, steroidal glycosides, flavonoids and tannins [16], one or more of these may be responsible for the high blood pressure lowering capacity of the plant.

An infusion of the leaves of *C. febrifuga* is used for the treatment of malaria and as a lotion for itching in Northern Nigeria, while the fruits are used in Mali for infections of the respiratory apparatus, as an anti-tussive and a febrifuge. In French Guinea and Sierra Leone, a strong infusion of the bark is used for fevers and as an astringent for dysentery and diarrhoea [17]. Among the Nupe people of Nigeria, a decoction of *C. febrifuga* twigs and leaves is taken orally or used in bathing the affected body parts to treat fever, scabies, skin diseases, gonorrhoea and ease respiratory troubles [18]. Betulic acid isolated from the stem bark showed cytotoxicity against a human colon carcinoma cell line. The bark is used by South African witchdoctors for ordeal trials. Leaf extracts yielded the flavonoids quercetin-3-arabinoside, quercetin-3-galactoside, quercetin-3-glucoside, myricetin-3-galactoside, quercetin-3-rutinoside, vitexin, isovitexin, two compounds tentatively identified as the xylosides of vitexin and isovitexin, orietin and isoorietin. Two bisdesmosidic saponins were also isolated from the roots. A triterpene saponin, with an ursadienediolic acid aglycone part was isolated from the root bark and its structure was determined [19]. These compounds may be responsible for lowering high blood pressure in man.

Phyllanthus amarus has a long history of usage by the folk because of its rich medicinal values. It possesses potent anti-inflammatory, antihepatotoxic, antilithic, analgesic, hypotensive, antispasmodic, antiviral, antibacterial, diuretic, anti mutagenic and hypoglycaemic properties. A large number of phytochemicals have been found only in the *Phyllanthus* genus, which could possess anti-hypertensive property. Many of the active constituents present in various parts of the plant are lignans, glycosides, flavonoids, alkaloids, ellagitannins and phenylpropanoids found in the leaf, stem and root of the plant. Common lipids and sterols also occur in the plant [20].

A decoction of the leafy twigs of *Paullinia pinnata* is used in West Africa for jaundice, yellow fever and heart irregularities while the decoction of the leaves is used for diarrhoea, dysentery and colic. The root is reported to be used in northern parts of Nigeria in the management of convulsion [21]. *Phyllanthus pinnata* is used in treating sore throat and ophthalmia and as an emmenagogue and an antisickling agent. It is reported to contain alkaloids, saponins, tannins and inulin [22].

Among the many herbal medicinal uses of *Rauwolfia vomitoria* are the treatment of hypertension, insomnia, nervous disorder, jaundice, diarrhoea dysentery, scabies, mental disorders, anthelminthes and malaria. It is also used against snake bite and gastrointestinal disorder [22]. *Rauwolfia vomitoria* is a common herb used traditionally for psychiatric management in Nigeria. Its extracts have anti-inflammatory, antipyretic, antidiabetic and anticancer effects and it is reported to be relatively safe with a LD₅₀ of 17.5g/kg. Indole alkaloids with yohimbane skeleton, namely yohimbine, reserpine, rescinnamine, raucaffricine, ajmaline and ajmalicine have been identified as biologically active in the plant [23] and these could include the ability to lower high blood pressure.

Different parts of *Calotropis procera* have been used in Indian traditional medicine for the treatment of leprosy, ulcers, tumors, piles and diseases of spleen, liver and abdomen. Chemical investigations on *C. procera* resulted in the isolation of octacosanoic acid, semiarenome and trematol, a triterpenoid alcohol [24]. The root bark and leaves of *C. procera* are used by various tribes of central India as a curative agent for jaundice. The root is used as a carminative in the treatment of dyspsia. The aqueous extract of the latex has been shown to inhibit cellular infiltration and afford protection against development of neoplastic changes in the transgenic mouse model of hepatocellular carcinoma. The chloroform extract of the root has been shown to exhibit protective activity against carbon tetrachloride-

induced liver damage, while the methanol extract possess antioxidant activity [24]. The numerous folk medicinal uses including anti-hypertensive activity could be ascribed to the phytochemicals of the plant, which are alkaloids, benzollicolone, colotropin, calotoxin, uscharin, usharidin, calactin, voruscharine and mudarin [18].

Persea americana (avocado pear) fruits have been shown to inhibit prostate cancer, and certain compounds in them seek out pre-cancerous and cancerous oral cancer cells and destroy them without harming healthy cells. The fruit, like olive oil, is rich in oleic acid which helps to prevent breast cancer. Avocado pear has more of the carotenoid lutein than any other commonly consumed fruit. Lutein protects against macular degeneration and cataract, two debilitating age-related eye diseases. *Persea americana* is rich in β -sitosterol, a compound that lowers cholesterol. It is the best fruit source of vitamin E, an essential vitamin that protects against many diseases and helps maintain overall health. An efficient herbal remedy prepared from the leaf and bark is used for the treatment of all kinds of cough as well as in treating digestive disorder. The rind from the fruit is used to expel intestinal worm and the seed is used to treat diarrhoea. Extracts of *P. americana* is traditionally used to treat hypertension and diabetes mellitus. Phytochemical analysis of the seed of the plant revealed the presence of tannins, saponins, flavonoids and cyanogenic glycosides which were proved to possess hypolipidemic properties [25] and could also be anti-hypertensive.

In Jamaica, a decoction of *Anacardium occidentale* (cashew) leaves in combination with *Dryopteris* sp. *Peperomia pellucida* and maiden hair fern is used for the treatment of colds and a wide range of ailments. Cashew leaves are sometimes used in bush baths for fever and it is recommended as a wash for ulcers. In some parts of Africa, young leaves are used in the treatment of dysentery, diarrhoea and piles, while the infusion of the leaves and bark are used for dysentery, toothache and sore gums. Such infusions are astringents and contain tannins. In the eighteenth and nineteenth centuries, the astringent cashew apple or the expressed juice (fermented or in wine) were also considered valuable in the treatment of gastric or intestinal disorders and dropsy. The ripe fruit was said to be diuretic and antiscorbutic, while some consider the punch prepared from it as an aphrodisiac. The shell of the seed contains gallic acid and anacrid, the red-brown oil contains cardole ($C_{32}H_{52}O$) and anacardic acid. The oil is a vesicant and has been used to remove warts, corns, freckles, chigoes and in parts of Africa for carious teeth [26]. The nut oil is used topically as an antifungal and for healing cracked heels. The fats and oils in cashew nuts contain 54% monounsaturated (oleic acid), 18% polyunsaturated (linoleic acid) and 16% saturated fatty acids (palmitic and stearic acids). Phenols, sitosterin, tannins and resorcinol derivatives are also found in the plant [18]. The anti-hypertensive properties of *A. occidentale* may be due to some of these phytochemicals.

A decoction of *Newbouldia laevis* leaves is used to treat breast cancer and fever, while the fibrous stem bark is used as an abortifacient. Round worm, elephantiasis, dysentery, migraine, malaria and epilepsy are treated with an infusion of the root and leaves. Alkaloids, tannins and saponins are reported to be in the plant [18] and may be responsible for its ability to reduce high blood pressure. Also, maceration of the mixture of the leaves of *N. laevis* and *Cassia obtusifolia* when taken orally has been found effective against cough, while a decoction of *N. laevis* leaves with *Cassytha filiformis* stem taken twice a day is used in the treatment of hypertension. Other workers have reported that exudates from the scrapings of the inner root bark squeezed onto the wound are used to treat sores and wounds [13].

Table 1. Some medicinal plants used for the management of hypertension in the Igala-speaking area of Kogi State, Nigeria

S/n	Botanical name	Family name	Voucher no.	Vernacular name	Morphological type	Part used	Freq-uecy	Preparation
1	<i>Kigelia africana</i> (Lam.) Benth.	<i>Bignoniaceae</i>	NIPRD-5879	Ebie(I), Ayan (Y). Rawuya (H), Uturubein (H)	Tree	Stem bark Fruit Root/leaf	17	Decoction Cold infusion Decoction
2	<i>Ficus capensis</i> Thunb	<i>Moraceae</i>	NIPRD-5873	Ogbaikolo (I), Opoto(Y), Uwar yara (H)	Tree	Leaf	11	Decoction
3	<i>Crossopteryx febrifuga</i> (Afzel. ex G. Don) Benth.	<i>Rubiaceae</i>	NIPRD-5878	Ohiapele (I), Kasfiya(H), Ayeye(Y)	Tree	Leaf	13	Decoction
4	<i>Phyllanthus amarus</i> Schum.&Thonn	<i>Euphorbiaceae</i>	NIPRD-5884	Ogwu manachi(I), Iyin olobe(Y), Majiryan kurmi(H)	Herb	Leaf	15	Infusion
5	<i>Paullinia pinnata</i> L	<i>Sapindaceae</i>	NIPRD-5876	Egwubi omakpa (I), Kakasela(Y), Furen amarya(H)	Shrub	Leaf Root/leaf	12	Decoction Decoction
6	<i>Rauwolfia vomitoria</i> Afzel	<i>Apocynaceae</i>	NIPRD-5870	Ockafa (I), Asofeyeje(Y) Wadda(H)	Shrub	Root	9	Decoction
7	<i>Calotropis procera</i> (Ait.) Ait. f.	<i>Asclepiadaceae</i>	369	Bombom (I), Bomubomu(Y), Tumfafiya(H)	Shrub	Leaf	8	Infusion of fresh leaf
8	<i>Persea americana</i> Mill	<i>Lauraceae</i>	992	Pear (Common)	Tree	Leaf, fruit, seed	14	Decoction, fruit is eaten Seed powder added to drinks
9	<i>Anarcadium occidentale</i> L	<i>Anacardiaceae</i>	991	Cashew, Kaju(Y), Akwe-olu(I)	Tree	Leaf	12	Decoction
10	<i>Newbouldia laevis</i> (P. Beauv.) Seamen ex Bureau	<i>Bignoniaceae</i>	2881	Ogichi, Akoro(Y), Aduruku(H)	Tree	Root, stem bark, leaf	7	Decoction

(I)= Igala name; (Y) = Yoruba name; (H) = Hausa name

4. CONCLUSION

The incidence of hypertension as a non-communicable diseases whose death toll across the world has become a concern for all populations, makes it necessary for local remedies to be sought worldwide. The Igala people of Kogi State have over time explored their vegetation to contend with diseases including hypertension, and their reliance on herbal medicine is underscored by the faith they have in the practice. This survey therefore, has documented an important aspect of the culture of the people, apart from providing a reference material for future drug development. Scientific verification of some of these ethno-medical claims is currently ongoing in our laboratories.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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