

Phytochemical Analysis of Medicinal Plants Used for the Management of Hypertension by Esan people of Edo State, Nigeria

J.K. Mensah, R I. Okoli,¹ A. A. Turay,² and E.A. Ogie-Odia

Department of Botany

¹Department of Pharmacology and Therapeutics

²Department of Medical Laboratory Sciences
Ambrose Alli University, P.M.B 14, Ekpoma, Nigeria

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Abstract

Hypertension is one of the principal health problems in the society and a leading cause of cardio-vascular deaths in various communities worldwide. Over 33 plants and their products have been reported in Nigeria and other West African countries to offer remedies for the management of hypertension. In Esanland of Edo State, Nigeria, 14 endemic plant species distributed in 12 taxonomic families have been identified by various traditional health practitioners as being effective and commonly used to manage hypertension (*Psidium guajava*, *Piper guineense*, *Loranthus spectobulus*, *Talinum triangulare*, *Senna occidentalis*, *Rauwolfia vomitoria*, *Allium sativum*, *Allium cepa*, *Carica papaya*, *Euphorbia hirta*, *Ocimum gratissimum*, *Persea americana*, *Peperomia pellucida*, and *Vernonia amygdalina*). Qualitative phytochemical analyses of the plant parts have revealed the presence of various components of medical importance including tannins, flavonoids, cardiac glycosides, alkaloids, saponin and inulins. Cardiac glycosides were present in all the species studied while alkaloids were present in all except *A. sativum*, *A. cepa*, *O. gratissimum* and *P. americana*. Saponins were present in all except the seeds of negro coffee (*S. occidentalis*), while tannins were present in all except bulbs of garlic (*A. sativum*). This preliminary study draws attention to the need for further studies of the active principles identified in the reported species for the treatment of hypertension in Esanland in order to understand their mode of action in controlling hypertension.

Key words; Medicinal plants, hypertension, phytochemistry.

Introduction

Hypertension is one of the principal health problems in the society and an important cause of cardio-vascular deaths in various communities worldwide. It is a silent - killer whose onset of complications is insidious. Such complications as cardiac remodeling, hypertrophy, renal impairment, nephropathies and ocular complications such as retinopathies and cardiovascular accident or stroke (Benowitz, 2001) are associated with hypertension.

Traditionally the use of plant parts as source of herbal preparations for treatment of various ailments are based on the experience passed from generation to generation, virtually by oral tradition and through practice and forms part of the indigenous knowledge of people of any locality (Olowofela, 1991; Sofowora, 1993). Most of these herbal remedies are known by our traditional healers and elderly men and women of families in our rural areas. The herbal knowledge or

practices known by traditional healers are jealously guarded with utmost secrecy for economic reasons. According to Obute (2007), many traditional herbal practitioners also tend to hide the identity of plants used for different ailments largely for fear of lack of patronage should the patient learn to cure himself. Thus to mystify their trade, cultivation of the plant is not encouraged, consequently collection is virtually from the wild.

Fortunately, some elders of the rural societies do willingly impart this knowledge to interested people sometimes on payment of an inducement fee and this has helped in the propagation of some herbal knowledge in this country.

Infusions and decoctions have historically been the traditional dosage forms for orally administered medicinal plants. These infusions and decoctions are usually good for extracting water soluble active ingredients such as glycosides, mucilage, alkaloids, polysaccharides and tannins, but are limited by their unpleasant taste, shelf life; and the poor solubility of many phytochemicals in water. As a result, many modern herbal practitioners prefer tinctures and fluid extracts to infusions and decoctions. The use of alcohol / water mixture as solvent is efficient in extracting a wide variety of active ingredients. In addition alcohol is a good preservative for herbal preparations compared to water. Many herbal preparations are yet to be scientifically investigated. Some of the plants also contain potentially poisonous substances including mutagens, and carcinogens whose long term adverse effect may not be immediately obvious to the herbalists (Awosika, 1993). The authors of this report are not unmindful of the fact that like all other drugs some of the various herbal preparations are likely to have adverse effects. Furthermore, the concomitant ingestion of herbs and drugs or different herbal preparations is also of particular concern as there is potential for herb-drug or herb-herb interaction to occur (GHP 2007).

A number of medicinal plants abound in Nigeria's flora (Gbile, 1986) which is the richest country in West Africa with regards to medicinal plant resources. The country exhibits a wide range in terms of climate and topology which has a bearing on its vegetation and floristic composition. Some of the information on these medicinal plants are in books written by Dalziel (1937, 1948) Oliver, (1960), Ayensu (1978), Sofowora (1982, 1993) Gbile (1986), Gill (1992), Awosika, (1993), Iwu, (1993), Kafaru (1994), Dokosi, (1998), and Odugbemi (2006) Other records on herbs that are used to manage common ailments in Nigeria are scattered in the works of Adegoke *et al.* (1968), Gbile and Adesina (1987), Anonymous, (1993), Obute (2007), Okoli *et al.* (2007) and Mensah *et al.* (2008) among others.

Herbal preparations are used in traditional medicine as crude drugs in various dosage forms, as whole, crushed, powdered forms, decoctions, dried extracts, infusions, poultices and tinctures (GHP 2007). Many of these plants have been investigated in recent times and found to contain active substances that are medically useful, whereas many more are yet to be scientifically investigated. A number of plant extracts used by natives in various parts of the world as arrow and ordeal poisons were later found to contain cardiac glycosides useful for the treatment of heart failure while others like physostigmine from the seed of *Physostigma venenosum* from Nigeria affect cardiac functions and are used in ordeal trials (Lawrence *et al* 1997). *Rauwolfia serpentina* which contains the alkaloid reserpine, was perhaps the first herbal preparation used for the treatment of hypertension. A West African species *R. vomitoria* has been used for treating the same disease and other ailments by local herbalists for a long time. This species gives much higher yield than *R. serpentina* but yet to be exploited commercially. The drug Digitalis was mentioned in literature in 1250B.C in the writings of Welsh physicians. Until recently, products from *Digitalis* namely digitoxin and digoxin which are pure glycosides were the popular drugs for the management of congestive heart failure (Ghani, 1986, Ayitey Smith, 1989). Currently, diuretics and calcium chemical blockers have taken over as the drugs of choice for the treatment of the ailment in orthodox medicine.

Traditional health practitioners in Esanland regularly employ a large number of tropical plants in various herbal

preparations to manage different ailments endemic to the area. Their sources include common vegetables/fruits, leaves and root/stem barks of endemic plants. The purpose of this publication is to provide a bibliographical source for the study of various plants for the treatment of hypertension in Nigeria. It also reports on various herbal plants available in Esanland of Edo State of Nigeria used in the treatment of the disease and the active principles contained in them.

Materials and Methods

Survey of literature

An initial literature survey was undertaken to enumerate herbal plants used in the management of hypertension in West-Africa with emphasis on Nigeria. Local and national publications were assessed and then documented to serve as bibliographical source for the study of various plants for the treatment of hypertension.

Survey of medicinal plants used for managing hypertension in Esanland, Edo State.

Patients who had records of the ailment volunteered information about various herbal homes where they received treatments. Consequently, relevant data were generated by visits to the herbal homes and twelve elderly women in ten settlements in Esanland where the patients had directed the researchers to obtain indigenous knowledge for the management of hypertension, were interviewed. The herbalists were accompanied to the bush/forest for direct collection of plants used for the management of hypertension. The information about the local names, usages, parts of plants used, methods of preparation and administration of plants was obtained from local healers, herbalists, experienced parents and patients by filling in questionnaires during personal interviews with them.

Further literature search was undertaken to corroborate the claims by traditional healers as to which plants are used to manage hypertension. Plant samples which were not readily identified in the field were taken to the Department of Botany, Ambrose Alli University, Ekpoma, Edo State of Nigeria for proper identification. The plants which were identified for managing hypertension in the various herbal homes and by the elderly during field collection in Esanland were subjected to further phytochemical studies.

Collection of Samples and Phytochemical analysis

The fresh plant/plant parts collected through the method describe above were screened, together with their families and vernacular names. The leaves/plant parts were washed under running tap water, and dried in an oven at 70⁰ C for 24 hours. With the aid of mortar, pestle, miller, grinder, these plant parts were homogenized to fine powder and stored in airtight bottles or containers for phytochemical analysis. One gram of powder was subjected to qualitative phytochemical tests for alkaloids (Myers Reagent), saponins (chloroform and H₂SO₄ tests), inulin (Molischs Reagent) cardiac glycosides (Keller-Kiliani test) and tannins (Ferric salt tests) adopting the procedures described by Stephen (1970); Obute (2007) and Parekh and Chanda (2007).

Results and Discussion

The literature search revealed about 33 plants which are used for various herbal preparations for the management of hypertension (Table 1). The list is however not exhaustive but gives a representation of what is available in West Africa and Nigeria in particular. Of the 33 plants recorded in this report, the material of interest is the leaf in 58%; roots account for 18% while stem barks and fruits/seeds accounted for 12 % each.

The plants which were identified for managing hypertension in the various herbal homes and by the elderly during field collection in Esanland were *Psidium guajava*, *Piper guineense*, *Loranthus spectobulus*, *Talinum triangulare*, *Senna occidentalis*, *Rauwolfia vomitoria*, *Allium sativum*, *Allium cepa*, *Carica papaya*, *Euphorbia hirta*, *Ocimum gratissimum*, *Persea americana*, *Peperomia pellucid* and *Vernonia amygdalina*.

Most of the plants used for managing hypertension were of general distribution and usage in West Africa and elsewhere on the African continent; while others were limited to specific localities. This confirms the assertion that traditional healing practices and indeed management of hypertension in local communities of West Africa is part of their cultural heritage and an indigenous knowledge developed to manage endemic diseases. The popularity and use of the different plants is therefore based on the flora of each locality.

A total of 14 plants species distributed in 12 taxonomic families were noted in this work for the management of hypertension in Esanland. The plant species listed (Table 2) have been found useful in the treatment of hypertension and other disease conditions based on the endemic health problems of the different settlements within the study area. Edo State serves as a good reservoir for a variety of plant species and the conservation of medicinal plants because of its rich tropical vegetation which are preserved in 48 forest reserves occupying 23% of the land area of the State (439,139ha ; Azeke, 2002) The part of interest in the majority of the species encountered is the leaf. Included in the list of plant for treating hypertension are edible vegetables such as water leaf, bitter leaf, garlic, climbing black pepper and scent leaf which are available in various open markets within the study area. However, the local herbalists were quick to point out that they do not usually administer leafy vegetables to their patients as remedy for hypertension because their effects are slow. Consequently only patients with mild cases of the disease condition are put on vegetable soups while more potent herbs (mistletoe, pawpaw, bitter and avocado pear leaves) are administered alone or in combinations with other herbs to those with relatively more serious conditions.

In the present study, the plants which were identified by various herbalists in Esanland for the management of hypertension were examined for alkaloids, inulins, flavonoids, cardiac glycosides, tannins and saponins. The results of the various phytochemical tests revealed that alkaloids, saponins, inulins, tannins, flavonoids and cardiac glycosides were present in the plants studied (Table 3). Cardiac glycosides were present in all the species studied while alkaloids were present in all except *A. sativum*, *A. cepa*, *O. gratissimum*, *P. americana*. Saponins are present in all except the seeds of negro coffee (*S. accidentalis*), while tannins are present in all except bulbs of garlic (*A. sativum*). Flavonoids were absent in the leaves of scent leaves (*O. gratissimum*), pawpaw (*C. papaya*), pear leaves (*P. americana*) silver bush (*P. pellucida*), and climbing pepper (*Piper guineensis*). From the present study as well as interviews with the local herbalists. It could be concluded that plants that possessed tannins, cardiac glycosides and alkaloids are the most effective for managing hypertension and also providing protection for the heart. The general use of plants such as *A. sativum*, *A. cepa*, *C. papaya*, *E. hirta*, *O. gratissimum*, *P. americana*, *P. pellucida*, *P. guajava*, *P. guineensis*, *V. amygdalina*, *R. vomitoria*, *L. spectobulus*, *T. triangulare*, and *S. occidentalis* in the management of hypertension and other disease condition in Esanland has also been reported in other parts of Nigeria and West Africa (Ampofo,1977, Amer and Court, 1980, Sofowora, and Odebiyi, 1987, Addae-Mensah and Musanga 1989, Gill,1992 and GHP 2007,).

Herbal preparations

The different herbs encountered at the different herbal homes have different medicinal properties and many of them have multiple uses and hence used for the management of more than one ailment. Thus Esan people have used some of these medicinal plants for controlling and managing hypertension and other types of ailments over the years. Gill (1992), Anslem (2006) and Okoli *et al* (2007) have reported the effectiveness of garlic, leaves of avocado pear, pawpaw, bitter and mistletoe for the treatment of hypertension in Nigeria. Similarly, Ayitey - Smith (1989) has reported the used of avocado pear, and bitter leaf for the management of hypertension and other disease condition in Ghana. Garlic has been confirmed to be very effective in the treatment of hypertension. The bulbs of garlic are blended

with honey for the purpose of hypertension. The unripe rind of pawpaw is peeled and soaked in water and after three days, a cup is taken daily. The leaves are also used for treating hypertension. Leaves of avocado pear are cut into pieces, dried and made into tea, for the management of hypertension. Odugbemi (2006) has also documented the efficacy of the cotyledons of avocado pear seed for the treatment of hypertension. The cotyledons are cut into pieces, dried and grinded into powder. A dessert spoonful in 200ml hot water taken after meals gives relieve for the ailment. According to Odugbemi (2006) silver bush (*P. pellucida*) is also very effective in the treatment of hypertension. This is also in line with earlier reports by Ayitey-Smith (1989) in Ghana, and Anslem (2006) in Nigeria. *P. guajava* leaves are soaked in salt water, washed and squeezed and product made up with fresh water to give a greenish liquid that is taken, one glass two times daily for one week to increase blood level and offer protection against heart attack. According to Addae- Mensah (1989) and Odugbemi (2006), climbing black pepper has been confirmed to be very active in the treatment of hypertension. Also, the fresh leaves of *V. amygdalina* are chewed and swallowed or ground, or stirred in water, and the liquid taken, to manage hypertension (Ayitey-Smith, 1989 and Okoli *et al* 2007). Gill (1992) has reported that a typical herbal preparation for managing hypertension in South west Nigeria contains *Gladiolus*, *Sanseveira* and *Citrus* spp.

Conclusion and Recommendations

Each community in Nigeria and indeed Esanland has its peculiar way of treating different ailments, and many plants are usually found useful for the treatment of common diseases such as hypertension. Efforts should be made at creating medicinal plant gardens and generally encourage the development of medicinal plants as a way of enhancing adequate health care for the people considering the rising incidence of complications and death due to hypertension.. Medicinal plant products still remain the primary source of supply of many important drugs in orthodox medicine today. Since there are so many of these naturally occurring substances of plant origin (which cover a wider range than synthetic chemicals), it is obvious that the plant kingdom offers a better opportunity of providing useful medicinal compounds for the treatment of hypertension. Furthermore, elucidating the chemical structure of active components of herbs also makes room for synthetic modifications for better pharmacokinetic profiles. It is believed that the plants used by the Esan people of Edo State, Nigeria could be potential sources of drugs if the active ingredients are identified and adequately characterized. Also self reliance (as it relates to local sourcing / manufacturing of drugs) is worth considering as it is an area in which most developing countries have a strong potential which can help to improve the people's health standard. It is important to remark that traditional medicine is at a transitional stage in the development of modern medicines in developing countries, thus progressive and conscious efforts must be made to accelerate the transformation. Furthermore, intensive and systematic research programmes must be drawn up and implemented for the purpose of accelerating the transformation by putting science into the art of traditional medicine. Until this is achieved, traditional medicine must play a complementary role in our health care delivery system of the indigenous communities in Esanland of Edo State, Nigeria.

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Table 1. Some plants listed for treatment of hypertension in West Africa.

S/Nr.	Plants	Plant material of interest	Reference
1.	<i>Bridelia furruginea</i> Benth	Leaves	Addae - Mensah, 1992, Ampofo,1977
2.	<i>Cryptolepis sanguinolenta</i> (Lindl.) Schit	Roots	Raymond-Hamet,1938
3.	<i>Elaeophorbium drupifera</i> (Thonn.) Stapf	Roots	Eno and Owo, 1999
4.	<i>Fagara xanthoxyloides</i> Lam.	Root and stem bark	GHP, 2007
5.	<i>Allium sativum</i> L.	Bulbs	Barrie <i>et al</i> , 1987 Anslem, 2006.

6.	<i>Zingiber officinale</i> Roscoe	Rhizomes	GHP 2007
7.	<i>Psidium guajava</i> L.	Leaves	GHP, 1992,
8.	<i>Heliotropium indicum</i> L.	Leaves	Burkill, 1985 Kerharo and Adams, 1974.
9.	<i>Citrus aurantifolia</i> Christm.	Leaves, Fruit juice.	Abimbola- Sodipe, 1986
10.	<i>Lippia multifolia</i> Mold	Leaves	Mwangi, 1990.
11.	<i>Azadirachta indica.</i> A.Juss	Leaves	Chaltopadhyay, 1997
12.	<i>Senna occidentalis</i> (L.)Link.	Seeds	Ayitey Smith, 1989
13.	<i>Paullina pinnata</i> L.	Leaves	Broadbent, 1962 Zamble <i>et al</i> , 2006
14.	<i>Papaya carica</i> L.	Unripened fruits Leaves	Eno <i>et al</i> , 2000. Ayitey- smith, 1989
15.	<i>Phyllanthus ninuri</i> Lour	Leaves	GHP, 1992
16.	<i>Rauwolfia</i> <i>vomitoria</i> Afzel	Roots	Raymond - Hamet, 1944, Oliver 1960, Aslem, 2006 La Barre ,1973.
17.	<i>Strophantus hispidus.</i> A.P. de Candolle	Roots	GHP (2007)
18.	<i>Scoparia ternata</i> Forssk	Leaves	GHP (2007)
19.	<i>Venonia amygdalina</i> Del.	Leaves	Gill 1992
20.	<i>Persea africana</i> Mill	Leaves, Seed cotyledons	Ayitey - Smith, 1989 Gill, 1992. Abimbola - Sodipe, 1986.
21.	<i>Canthium subcordatum</i> DC	Stem barks	Ayitey - Smith, 1989.
22.	<i>Loranthus spectobulus</i> , L.	Leaves	Kafaru (1994) Gill, 1992
23.	<i>Gladiolus sp.</i> L	Inner bars	Abimbola- Sodipe, 1986
24.	<i>Khaya senegalensis</i> (Desr.) A. Juss	Stem barks	Gill, 1992
25.	<i>Erythrophleum suaveolens</i> (Guill & Perr.) Brenan	Root barks	Gbile, 1986
26.	<i>Ficus asperifolia</i> Miq.	Leaves	Anslem, 2006
27.	<i>Talinum triangulare</i> (Jacq.) Wild.	Leaves/Roots	Anslem, 2006

28.	<i>Lantana camara</i> L.	Leaves	Anslem, 2006
29	<i>Dichapetium heudebtii</i> Engl.	Leaves	Okoli et al 2007
30	<i>Lophira alata</i> Banks ex Gaertn.f..	Stem barks	Gill, 1992
31	<i>Magnifera indica</i> L	Stem barks	Gill, 1992
32	<i>Detarium microcarpum</i> Guill & Perr.	Leaves	Gill, 1992
33	<i>Gongrenema latifolia</i> L.	Leaves	Okoli et al. 2007

Table 2. Ethno botanical information on Medicinal plant species used in Edo State for the treatment of hypertension.

S/n.	Plant species	Family	Common names	Local names (Esan)/ Benin	Part used	Preparation and administration
1.	<i>Allium sativum</i>	Alliaceae	Garlic	Ayi	Bulb	Bulbs are minced (5 - 10) and blended with honey three spoons are taken three times daily.
2.	<i>Allium cepa</i>	Alliaceae	Onion	Anubasa	Bulb	Bulbs are minced (5 - 10) with a bottle of honey four spoons is taken three times daily.
3.	<i>Carica papaya</i>	Caricaceae	Pawpaw	Okodu	Leaf	Leaf is crushed, little quantity of H ₂ O and native chalk is added to it, the extract is taken orally.
4.	<i>Euphorbia hirta</i>	Euphorbiaceae	Asthma weed	Azugben	Leaf	It is prepared as soup, and taken orally.
5.	<i>Ocimum gratissimum</i>	Laminaceae	Scent leaf	Ebelanma khokho	Leaf	A glass of leaf extract is taken before meal.
6.	<i>Persea americana</i>	Lauraceae	Avocado pear	Olumuebo	Leaf	Fresh leaves are ground, boiled in water, half a tumbler is taken.
7.	<i>Peperomia pellucida</i>	Piperaceae	Silver bush	-----	Leaf	Leaves are washed, air dried and made into powdered form, which is then taken as tea.
8.	<i>Psidium guajava</i>	Myrtaceae	Guava	Gova	Leaf	Infusion of the matured leaves is taken orally 1 cup, 1 – 3 times daily.
9.	<i>Piper guineenses</i>	Piperaceae	Climbing black pepper	Usira	Leaf	Leaves are prepared as soup.

10.	<i>Vernonia amygdalina</i>	Asteraceae	Bitter leaf	Oriwo	Leaf	Leaves prepared as soup or infusion and taken orally after meal at night.
11.	<i>Rauvolfia vomitoria</i>	Apocynaceae	Serpent wood	-----	Root	Infusion of the roots is taken as tea.
12.	<i>Loranthus spectobulus</i>	Loranthaceae	Mistletoe	-----	Leaf	Infusion taken as tea
13.	<i>Talinum triangulare</i>	Portulacaceae	Water leaf	Ebe-dondo	Leaf	Leaf infusions are taken as tea or cut roots into pieces and made as decoction.
14.	<i>Senna occidentalis</i>	Fabaceae	Negro coffee	-----	Seeds	Roasted, grounded and taken as beverage

Table 3. Phytochemical Analysis of Screened Medicinal Plant Species.

S/n	Plant Species	Tannins	Saponins	Flavonoids	Cardiac glycosides	Alkaloids	Inulin
1.	<i>Allium sativum</i>	-	+	+	+	-	+
2.	<i>Allium cepa</i>	+	+	+	+	-	+
3.	<i>Carica papaya</i>	+	+	-	+	+	+
4.	<i>Euphorbia hirta</i>	+	+	+	+	+	+
5.	<i>Ocimum gratissimum</i>	+	+	-	+	-	+
6.	<i>Persea americana</i>	+	+	-	+	+	+
7.	<i>Peperomia pellucida</i>	+	+	-	+	-	+
8.	<i>Psidium guajava</i>	+	+	+	+	+	+
9.	<i>Piper guineensis</i>	+	+	-	+	+	+
10.	<i>Vernonia amygdalina</i>	+	+	+	+	+	+
11.	<i>Rauvolfia vomitoria</i>	+	+	+	+	+	+
12.	<i>Loranthus spectobulus</i>	+	+	+	+	+	+
13.	<i>Talinum triangulare</i>	+	+	+	+	+	-
14.	<i>Senna occidentalis</i>	+	-	+	+	+	+