

## A Comprehensive Review on Anti-Hypertensive Activity of Some Medicinal Plants

\*Ayisha Farhana.J<sup>1</sup>, Sarala.A<sup>2</sup>, Dr.Senthil kumar S.K<sup>3</sup>, Bathrinarayanan.M<sup>4</sup>,  
Dharshansarathy.R<sup>5</sup>, Dhanashree.M.R<sup>6</sup>, Dharani.E<sup>7</sup>.

1. <sup>1,4,5,6,7</sup>Students B.pharm, 7<sup>th</sup> Semester, Arunai College Of Pharmacy, Tiruvannaamalai,

2. Associate Professor, Department of Pharmaceutical Chemistry, Arunai College Of Pharmacy, Tiruvannamalai.

3. Professor, Dr.Senthil kumar S.K, Arunai Of Pharmacy, Tiruvannaamalai.

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### ABSTRACT:

Hypertension is a chronic condition that can lead to several health problems, such as cardiovascular diseases, myocardial infarction, stroke, retinopathy and renal failure. It is best to manage high blood pressure with a healthy diet. In this comprehensive review, you will find information about medicinal plants used to lower blood pressure (anti-hypertensives). The way to collect data is by using Google Scholar. The results obtained from tracing information indicate that in the last 20 years of research, there were some medicinal plants (without review articles) used as antihypertensive drugs. These medicinal plants are Ipomoea hederacea, Petroselinum crispum, Phragmanthera incana, Eucommia ulmoides, Persea americana, Seleginella vogelii, Erythrina senegalensis, Morinda lucida, and Calpurnia aurea. These plants contain alkaloids, flavonoids, tannins, saponins, terpenoids and steroids..

**Keywords:** Hypertension, Anti-Hypertension, Medicinal plants, Lower-blood pressure, L-NG-Nitroarginine methyl ester, GC-MS (Gas chromatography-Mass Spectroscopy).

### I. INTRODUCTION:

A condition in which the force of the blood against the artery walls is too high is called as a hypertension. Usually, hypertension is defined as blood pressure above 140/90mmHg and is considered severe if the pressure is above 180/120mmHg. High blood pressure can damage arteries by making them less elastic, which decreases the flow of blood and oxygen to the heart and leads to heart diseases such as cardiac failure, coronary artery disease, stroke, renal injury and even mortality. According to the World Health Organization (WHO), hypertension affects more

than 1 billion people around the world and accounts for about 12.8% of all annual deaths globally. Although many effective synthesis drugs have been employed in hypertension treatment, undesirable adverse drug reactions usually appear after long-term administration. The use of medicinal plants is very common because these remedies are easily available and less expensive than novel pharmaceuticals. Herbs do not cause side effects such as weakness, dizziness, dry mouth, insomnia, abnormal heartbeats, depression, etc. Hence, the present study focuses on different medicinal plants worldwide used for hypertension. Therefore, there is a great deal of interest in using natural plant extract as an alternative treatment for hypertension.<sup>4</sup>

### II. METHODOLOGY:

Journals are searched electronically using Research Gate in, Google Scholar, Science Direct, Research Gate and journals. 20 years of period of journals I'm searching for antihypertensive activity from plants. The scientific names of some plants with antihypertensive properties were the search terms used in the query. This article demonstrating the preclinical proof of plants' antihypertensive activity. I'm mentioning the plant parts and extraction methods are being used, as well as the type of evaluation being done for antihypertensive activity.

1. Literature search database: Science Direct, Google Scholar, Research Gate
2. Period: Passed the 20-year time period of journals.
3. Studies are included in this comprehensive review.

**Ipomoea hederacea:**

Seeds of *Ipomoea hederacea* Jacq. Family: Convolvulaceae, are traditionally used to treat high blood pressure and cardiac diseases. It is commonly known as ivy-leaved morning glory, also called Kaladana, and is a flowering plant in the bindweed family. The species is native to tropical plants in the Americas and has more phytoconstituents like carboxylic acid, flavonoids, oligopeptides, and tripeptides. Aqueous ethanolic extract and activity-based fractions of *I. hederacea* were evaluated using invasive blood pressure measuring techniques, isolated tissue experiments, fructose-induced hypertension/metabolic syndrome, and biochemical analysis. Phytochemical analysis of the active fraction was performed with the aim of identifying the chemical composition of *I. hederacea* seeds. LC-MS analysis was also performed to identify the compounds proposed to be present in the active fraction of *I. hederacea* seeds. Crude extract or fractions of *I. hederacea* showed a dose-dependent (0.0-0.100mg/kg) dependent significant hypertension effect in normotensive anesthetized rats, similar to verapamil (0.01-30mg/kg)<sup>1</sup>.

**Petroselinum crispum:**

Parsley (*Petroselinum crispum*) Family: Apiaceae, which is a popular aromatic vegetable and a part of the daily diet in the Mediterranean area. This plant is widely used in alternative medicine as a remedy against hypertension; it is also used for GI disorders, such as diabetes, mellitus, skin disease, fever, ulcers, rheumatism, diuretics, antiseptics, UTIs and antidotes. It contains active compounds like phenolic compounds, flavonoids, apigenin, apiin, 6-acetylapiin essential oil, myristicin and apiol. The aqueous extract of the aerial parts of parsley (AEPC) was prepared and its antihypertensive activity was evaluated using in vivo and in vitro studies. Demonstrated in normal rats. Anti-hypertensive agents such as thiazide, loop and k-sparing diuretics, central alpha2-adrenergic agonists, peripheral adrenergic neuronal blocking agents and direct-acting vasodilators. These drugs have some side effects like muscle cramps, dizziness and tiredness, while some herbs and their derivatives are often safe and do not lead to such side effects. In the current study, the effect of the aqueous *P. crispum* extract on blood pressure was investigated in L-name and normotensive as well as its effect on vasorelaxant activity in vascular aortic

rings. The study showed that the aqueous *P. crispum* extract induced a decrease in blood pressure parameters in both L-Name and normotensive rats. In addition, the extract induced a pronounced vasorelaxation response in the vascular aortic segments of rats, resulting in hypotension<sup>2</sup>.

**Phragmanthera incana:**

*Phragmanthera incana* belongs to the Loranthaceae family. Balle is a member of the African mistletoes that has been reported to be used in ethnomedicine for the treatment of hypertension. It is also used as an anti-inflammatory, antioxidant and anti-diabetic agent. It contains phytochemicals like peptides, flavonoids, alkaloids, lectins, polypeptides, arginine, histamine, polysaccharides, tannins, terpenoids, glycosides, gallic acid, flavocoumarin and also Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>+</sup> and Ca<sup>+</sup>. *Phragmanthera incana* leaf ethanolic extract (PILEE) in NG-nitro-L-arginine methyl ester (L-NAME)-induced hypertensive rats. The phytochemical analysis of PILEE was determined using the gas chromatography-mass spectrophotometry (GC-MS) method. Antihypertensive activity was investigated in rats that received PILEE (50, 100 and 200mg/kg) or captopril (40mg/kg) daily for 28 days together with oral administration of L-NAME (40mg/kg). Blood pressure parameters were measured on days 7, 14, 21 and 28. Blood was obtained for the determination of serum nitrite, interleukin-6 (IL-6) and tumor necrosis factor alpha. The heart, liver and kidneys were used to determine the oxidative stress induced (malondialdehyde, reduced glutathione and catalase). The cardiac tissue was processed for histopathological changes<sup>3</sup>.

**Eucommia ulmoides:**

*Eucommia ulmoides* Oliv., also called Du-Zhong, Family: Eucommiaceae, is a traditional medicinal plant in China, Korea, and Japan. Accumulating evidence suggests *Eucommia ulmoides* Oliv can exert several pharmacological effects, such as anti-inflammatory, antioxidant, antibacterial and anti-hyperglycemic activities. *E. ulmoides* effects of the aqueous extract of *E. ulmoides* Oliv. on blood pressure in SHR Rats to investigate whether the aqueous extract of *E. ulmoides* Oliv. male flowers exhibits antihypertensive activity in spontaneously hypertensive rats. We administered the aqueous

extract of *E. ulmoides* Oliv. male flowers to spontaneously hypertensive rats and measured its effects on blood pressure. As shown after treatment with the aqueous extract of *E. ulmoides* Oliv, the blood pressure of SHR rats was reduced in a dose-dependent manner. For example, before the aqueous extract administration, the values of blood were nearly equal among the low-dose group ( $173.14 \pm 5.40$  mmHg), medium-size group ( $173.86 \pm 4.16$  mmHg) and high-dose group ( $172.14 \pm 2.28$  mmHg). After 3 weeks of administration, the blood pressure was decreased to  $132.40 \pm 5.24$  mmHg at the low dose,  $125.19 \pm 4.29$  mmHg at the medium dose and  $121.60 \pm 4.29$  mmHg at the high dose. Then, after 4 to 7 weeks administration, the value of blood pressure was nearly reduced to the same degree among the three groups. Effects of 7-week treatment with *E. ulmoides* Oliv. male flower extract on systolic blood pressure in SHRs Data were expressed as the mean  $\pm$  SEM.  $P < 0.001$  (high-dose group) compared with the control group;  $P < 0.01$ ,  $P < 0.001$  (medium dose group) compared with the control group; 2-way analysis of variance. However, we did not identify the antihypertensive components in the aqueous extract of the male flower. Recently, many studies demonstrated that four categories extracted from the leaf and bark of EU, including lignans, iridoids, flavonoids and terpenoids, have antihypertensive action and have separated iridoids and flavonoids from the male flowers of EU. Therefore, it is likely that iridoids and flavonoids may account for the antihypertensive effect of the male flowers of EU. Of course, further study will be needed to determine the antihypertensive components of the male flowers of EU. In conclusion, the aqueous extract of *Eucommia ulmoides* Oliv, male flowers exhibited an antihypertensive action through the activation of ACE2-Ang-(1-7)-Mas-9 pathways in spontaneously hypertensive rats<sup>4</sup>.

#### **Persea americana:**

*Persea americana* Family : Lauraceae is one of the emerging plants of interest in the management of hypertension. It is commonly known as the avocado pear tree and is widely distributed in tropical countries. The edible fruit pulp contains up to 33% oil rich in monounsaturated fatty acids, which are believed to modify the fatty acid contents in cardiac and renal membranes and enhance the absorption of alpha and beta-carotene and lutein. Other parts of the plant have been

reported to have medicinal properties. The aqueous leaf extract, for example, has shown analgesic and anti-inflammatory, anticonvulsant, hyperglycemic and hypo cholesterolaemic, vasorelaxant and blood pressure-reducing activities in animal studies. While studies on the antihypertensive properties of the plant have focused on the leaf extracts. However, herbalists in Nigeria have confirmed through oral communication that the aqueous seed extract is equally effective in the treatment of hypertension. We therefore designed the present study in order to investigate the effect of the aqueous seed extract on the blood pressure of normotensive Sprague-Dawley rats.

The aqueous leaf extract has antihypertensive properties, possibly by causing relaxation of blood vessels. The results of this study indicate that the aqueous seed extract of *P. americana* possesses blood pressure-lowering properties in normotensive Sprague-Dawley rats. The effect of the extract may be due to reduction in heart rate. The results from the study, justify the use of the extract for the management of hypertension by herbalists in Nigeria<sup>5</sup>.

#### **Selaginella vogelii:**

*Selaginella vogelii* belongs to the family of Selaginellaceae and is widely used in traditional medicine to treat hepatitis, cancer, cardiovascular, renal and inflammatory diseases. The present study was undertaken. The aqueous extract of *S. vogelii* was evaluated for anti hypertensive and nephroprotective. Reverse phase high-performance liquid chromatography (RP-HPLC) was used to analyze the chromatographic fingerprint and identify various components of the plant extract. The antihypertensive activity of the aqueous extract of *Selaginella vogelii* (100, 200 and 400mg/kg of body weight) was evaluated in an L-NAME-induced hypertension model in rats. After body weight measurement, the CODA non-invasive blood pressure system was used to record cardiovascular parameters such as blood pressure and heart rate. Biochemical and histological analysis were performed to demonstrate the protective effect of the aqueous extract of *Selaginella vogelii* in the gentamicin (i.p.)-induced nephrotoxicity model. The phytochemical analysis indicated the presence of phenolic acids, flavonoids and saponins. The aqueous extract of *Selaginella vogelii* significantly prevented ( $P < 0.1$ ) the increase in mean blood

pressure, with a maximum of 47.64% at the dose of 400mg/kg during the 4 weeks of treatment. The *Seleginella vogelii* aqueous extract significantly reduced ALAT (60.88), ASAT (38.84%) and creatinine (52.81%) concentrations. In the nephroprotective assay, the plant extract (400mg/kg) significantly decreased ( $P<0.01$ ) kidney weight (39.66%). Urea and creatinine rates were reduced in both tissue and serum. Histological analysis showed that *S.vogelii* extract (400mg/kg) restored renal disorders induced by the administration of gentamicin. The aqueous extract of *Seleginella vogelii* possesses antihypertensive and nephroprotective effects with an effective dose of 400mg/kg. This study indicates that the aqueous extract prevented the increase in mean blood pressure and the nephroprotective effect may be attributed to the decrease in creatinine and urea levels in the kidneys. The findings justify the traditional use of *Seleginella vogelii*<sup>6</sup>.

#### **Erythrina senegalensis:**

*Erythrina senegalensis* (*E. senegalensis*) Family: Fabaceae, used in the present study is a spiny shrub or tree with an open crown; the bole has a thick, corky, dark gray bark armed with stout prickles slightly recurved from a woody. The plant is found in west-tropical Africa, from Senegal to northern Cameroon. Because the raw seeds are poisonous, *E. senegalensis* is used in traditional medicine in the treatment of many pathologies, including arterial hypertension and diabetes. The stem bark is febrifuge; the decoction is taken in the treatment of yellow fever, malaria, bronchitis, rachitis, liver and gallbladder problems, amenorrhea and women's sterility. The bark and the roots are commonly used in the treatment of gastrointestinal disorders such as leprosy and hemorrhoids, as an anti-abortion and as a general tonic. The wood is chewed as an aphrodisiac. Most of these effects result from its actions on smooth muscle and antimicrobial activity. In addition, some extracts of *E.senegalensis* have revealed cardiovascular, hypoglycaemic and antioxidant activities. Moreover, many flavonoids isolated from the stem bark extract have been shown to affect diacylglycerol acyltransferase (DGAT) activity and are therefore good targets in the treatment of diabetes. However, the curative effects of the plant on any model of hypertension and/or diabetes have yet to be studied. Therefore, the present study was designed to evaluate the activity of the aqueous

extract of *E.senegalensis* stem bark on diabetic hypertensive rats and some of its complications. The results of the phytochemical screening of the aqueous extract stem bark of *E.senegalensis* revealed that the extract contains alkaloids, flavonoids, saponins, tannins, triterpenes, steroids, polyphenols and anthraquinones. Glucosides and anthocyanins were not present. Qualitative determination of compound contents in *E. senegalensis* using HPLC-DAD-HRESI-MS. *E.senegalensis* crude extract sample was analyzed by HPLC coupled to both diode array and mass spectrometry detectors. The latter was used with an electrospray ionization source in positive ion mode. A representative base peak. The purpose of this study was to evaluate the antihypertensive and antidiabetic activity of the aqueous extract of the stem bark of *E.senegalensis* on a diabetic hypertensive rat model. The results show that administration of sucrose at 15% (1.5 g/kg) and ethanol at 40% (5g/kg/day) for four weeks resulted in a significant increase in arterial blood pressure (ABP) and heart rate (HR). The installation of this arterial hypertension (HTA) might involve a complex variety of mechanisms. The aqueous extract of the bark of *E.senegalensis* significantly reversed the hyperglycemia, hypotension, dyslipidemia, weight loss, liver dysfunction, kidney dysfunction and oxidative stress induced in hypertensive diabetic rat models. The improvement of these parameters may be due at least in part to the presence of erysenegalensein (D,O,N,E), warangalone, senegalensin and 6,8-diprenylgenistein identified in the extract. The possible modes of action include antioxidant, hepatoprotective<sup>7</sup>.

#### **Morinda lucida:**

*Morinda lucida* Family: Rubiaceae is a medium-sized tree with short, crooked branches. Although it is very bitter, the whole plant, stem bark and roots are known to have medicinal properties. It is readily available throughout the year in southwestern Nigeria. It is a rich source of two powerful antioxidants, vitamin A and E, which could be effective in combating degenerative diseases like atherosclerosis; vitamin K; and different secondary metabolites responsible for the ethnomedicinal properties of the plant: alkaloides, tannins, saponins, flavonoids and phenols. The leaf and stem bark are reported to possess anticancer, hepatoprotective, cytotoxic and genotoxic, anti-spermatogenic, hypoglycemic and anti-diabetic



activities. In some cases, the plants are used to treat hypertension. The aim of this study was to evaluate the possible antihypertensive effect of a common locally available plant, *Morinda lucida*, against L-nitrogen Arginine-Methyl-Ester (L-NAME)-induced hypertension in male Wister rats. Forty-eight rats were used for the experiment. They were divided into six groups labeled A–F, each containing eight animals. The animals were dosed for six weeks, with group A being the control group (normotensive) given feed and water group B animals were administered L-NAME only, 40mg/kg (hypertensive); groups C, D, and E were simultaneously treated with L-NAME (40mg/kg) and *Morinda lucida* extract in increasing doses of 100mg/kg, 200mg/kg and 400mg/kg, respectively; and group F was given lisinopril at 20mg/kg for a period of 6 weeks. From the result, there was a significant increase in systolic, diastolic and mean arterial blood pressure in the hypertensive group compared to the normotensive group and hypertensive-treated groups. Hypertension caused significant ( $p < 0.05$ ) increases in oxidative stress markers, including malondialdehyde (MDA), protein carbonyl (PC), and hydrogen peroxide ( $H_2O_2$ ), while reducing the activities of superoxide dismutase (SOD) and serum nitric oxide (NO) levels. Also, serum myeloperoxidase (MPO), blood urea nitrogen and creatinine were increased with high expression of cardiac injury biomarkers such as cardiac troponin and angiotensin II type 1 receptor. These indicated oxidative stress and cardiac damage because of hypertension, most especially in the untreated hypertensive group. The co-treatment of hypertensive rats with *Morinda lucida* extract caused a reduction in markers of oxidative stress and inflammation and normalized blood pressure parameters. The findings from this study suggest the possibility of *Morinda lucida* extract as a novel antihypertensive agent<sup>8</sup>.

#### **Calpurnia aurea:**

*Calpurnia aurea* (Ait.) Benth. subsp. *aurea* (CASA) Family: Fabaceae seeds are used to treat hypertension in Ethiopian folklore medicine, particularly by Shinasha, Agew-awi and Amhara people in northwest Ethiopia. The study was conducted to evaluate the antihypertensive activity of an 80% methanol extract of CASA in an animal model of hypertension, as well as its vasorelaxant effect and possible underlying mechanisms in the isolated guinea pig aorta. Hypotensive and

hypertensive effects of CASA extract were determined in vivo through the intravenous (i.v) route in normotensive and hypertensive anesthetized rats using a 2-kidney-1-clip 2 (K1C) rat model. Ex vivo, guinea pig thoracic aortic rings were isolated and suspended in an organ bath and the vasodepressor effect as well as the mechanism of action of the extract were studied by means of isometric tension recording experiments. The blood pressure fell dose-dependently and significantly in renal hypertensive and normotensive rats following i.v. administration, suggesting that the hydroalcoholic extract possesses hypotensive and antihypertensive effects. The extract also caused a dose-dependent relaxation of the aorta pre-contracted with KCl at a concentration of 5-250mg/L, with a maximum relaxation of 92.1% achieved at 250mg/L. The relaxation mechanisms were found to be independent of the muscarinic receptors, histamine receptors, ATP-dependent  $K^+$  channels, cyclooxygenase enzymes, cGMP/NO pathway and endothelium system. The extract caused a rightward shift of the  $Ca^{++}$  dose-response curves, similar to that caused by verapamil, indicating that it produced vasorelaxation by inhibiting extracellular  $Ca^{2+}$  influx<sup>9</sup>.

#### **Pleurospermum lindleyanum:**

*Pleurospermum lindleyanum* (Lipsky) Family: Apiaceae B. Fedtsch is a perennial herb classified in the genus *Pleurospermum*, that is native to the Taxkorgan, Xinjiang and China. In the Xingjiang Province, it is a well-known ethnic traditional herb, often addressed by its tribal name, kurumuti. It grows in harsh conditions over 4000m above sea level, such as the Pamirs plateau. It is rich in flavonoids, coumarins, terpenoids and essential oils and have been widely used in the prevention and treatment of hypertension, diabetes, coronary heart disease and cerebral thrombosis by local Tajik residents. A total of 30 compounds were identified in PLAE. PLAE significantly attenuated the SBP of SHR. The effects began after 3 weeks of administration and then became steady and long-lasting. Its potential mechanism may be associated with the protective effects on renal and cardiac injury caused by hypertension: the decrease of plasma vasoconstrictors, such as ACE, ALD, Ang2 and ET-1 levels; the maintenance of NO/ET balance; the increase in plasma NO levels and SOD activity; thereby reducing oxidative stress. *Pleurospermum lindleyanum* can be suggested as a

novel antihypertensive ethnic traditional herb, which lays the foundation for research into safe and effective antihypertensive herbal medicines<sup>10</sup>.

### III. CONCLUSION:

In conclusion, this review mainly focused on the antihypertensive activity exerted by the various easily available plant parts. In this study, we reviewed the research works, which showed promising results given by the samples (especially the extracts obtained from leaves, bark) is taken as a base for various research works to overcome the emerging resistance shown by conventional antihypertensive activity.

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