IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Natural Compounds For The Treatment Of Hypertension

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Abstract:

Traditional medicine is a catch-all word for centuries-old, culturally-restricted health care methods that persisted before the application of science to medical issues. Cardiovascular disorders, which include heart attacks, cerebrovascular diseases, hypertension, and heart failure, can be caused by conditions of the heart and blood arteries and are treated using medicinal herbs. The risk of a heart attack and stroke is increased by hypertension, which interferes with the heart's ability to pump blood. Although there are several medications available to treat these conditions, most antihypertensive medications have a variety of negative effects. There are a number of pharmacologically active compounds in medicinal herbs that can be utilised to treat and prevent hypertension. An overview of several medicinal plants with hypotensive or antihypertensive characteristics is provided in this paper.

Keywords: Traditional medicine, Hypertension management, Herbal medicine, Persian medicine, Cardiovascular diseases

Introduction:

Cardiovascular diseases (CVDs) are a major contributor to ill health and early mortality and as a result, they are a serious public health concern. As the "silent killer," high blood pressure (BP) is brought on by a variety of reasons; including the interplay of hereditary and environmental variables that disrupts BP control. The leading cause of acute myocardial infarction risk factors, hypertension (HTN), is responsible for roughly 16.5% of fatalities worldwide each year. Additionally, it is the main cause of the morbidity and death that accompanies CVDs. According to the mean of two or more suitable measures of sitting blood pressure, HTN is defined as systolic blood pressure (SBP) 140 mm Hg and diastolic blood pressure (DBP) 90 mm Hg [1]. HTN is treated with a variety of antihypertensive medications, including diuretics, sympatholytics, renin inhibitors, ACE inhibitors, calcium channel blockers, -adrenergic and 1/-adrenergic antagonists, and vasodilators. These medications can cause a variety of adverse effects, such as edoema, impaired vision, skin rashes, vomiting, renal failure, excessive fatigue, and muscular cramps. Traditional medications for the treatment of CVDs have come under scrutiny as the adoption of complementary and alternative therapies and natural products has increased [2].

Due to its superior compatibility with the human body, cheaper cost than modern pharmaceuticals and lack of side effects, herbal medicines are used for basic healthcare by around 75% to 80% of the world's population, who live mostly in impoverished nations. Based on the principle of humours for illness prevention and treatment, Persian medicine is an old and widely recognised traditional system of medicine. Persian medical authorities such as Avicenna and Rhazes documented many illnesses and suggested dietary changes and herbal remedies for pain relief.

Additionally, the therapeutic potential of medicinal plants has been researched. Over 50% of the pharmaceutical medications that are now on the market are produced in part thanks to some of them. The many plants that have antihypertensive properties for usage in the therapy of HTN are reviewed in this review article [3].

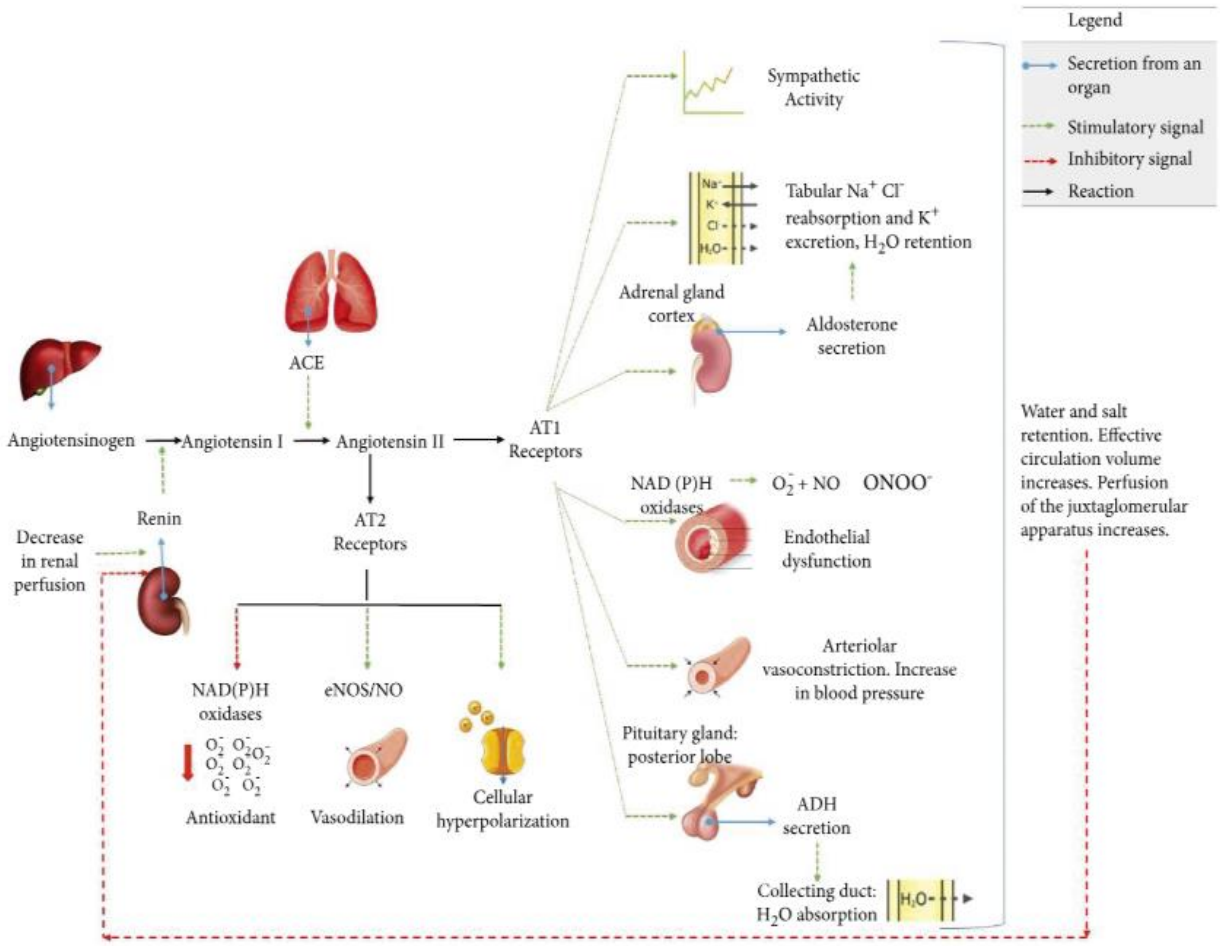

Fig 1: Main mechanisms and signalling pathways involved in blood pressure control

Pathophysiology of Hypertension

The pathophysiological processes associated with the development of HTN include increased vascular resistance, which is primarily defined by reduced vascular diameter as a result of accelerated vascular contraction and arterial remodelling. Increases in the renin-angiotensin-aldosterone system (RAAS), stimulation of the sympathetic nervous system, vasopressin, abnormal G protein-coupled receptor signalling, inflammation, various T-cell functions, and the variety of vasoactive peptides secreted from different endothelial cells and smooth muscle cells are just a few of the factors that have contributed to the pathophysiology of HTN. Vasoconstriction may be enhanced by increased arterial reactivity brought on by pro-oxidant enzyme and endothelial nitric oxide synthase (eNOS) dysregulation, elevated basal and activated calcium levels via calcium channels, and the co-occurrence of vascular smooth muscle cell (VSMC) hyperplasia and hypertrophy. The fact that increased vascular stiffness promotes HTN and associated complications, such atherosclerosis, suggests that therapy should concentrate on vascular stiffness rather than only modifying peripheral vascular resistance [4]. The hormone angiotensin II (Ang

II) can promote cell cycle development. Other potential causes of HTN include hormonal-neurogenic vasoconstriction, genetic disorders of the Na/Ca^{2+} exchange in artery smooth muscles, and hereditary illnesses of the renal sodium secretion.

Herbs and natural remedies with hypotensive and hypertension properties

1. ***Agathosmabetulina***

(Family: Rutaceae; Common name: Buchu). It is a South African medicinal plant that has been used for ages to heal a variety of maladies by the local aboriginal population. It works well as an anti-inflammatory and diuretic. Using buchu, early Dutch immigrants created a brandy tincture that is still used today to cure a variety of ailments [5].

2. ***Allium sativum***

(Family: Alliaceae or Liliaceae; Common name: Garlic). In particular, hyperlipidemia is one cardiovascular ailment for which garlic has been treated for a long time. Additionally, reports of its hypotensive effects exist. It is believed to promote the synthesis of nitric oxide, which relaxes smooth muscles and dilates blood vessels. Allicin is one of the main active components that gives garlic its distinctive smell and many of its therapeutic advantages. Garlic is associated with a reduction in blood pressure in individuals with elevated systolic pressure, rather than in people with normal systolic pressure, according to meta-analysis of literary data that was picked at random. In those with HTN, garlic preparations have been reported to lower BP more effectively than a placebo. After receiving garlic pearls preparation for two months, the antioxidative and antihypertensive effects of garlic were seen in 20 patients with HTN compared to 20 patients with normal blood pressure. The findings showed lowered blood pressure, a significantly lower concentration of 8-hydroxy-2-deoxyguanosin, nitric oxide, and lipid peroxidation, and a higher concentration of antioxidant vitamins C and E [6]. The favourable cardioprotective effects of garlic in essential HTN are highlighted by this study.

3. ***Annona muricata***

(Family: Annonaceae; Common name: Prickly Custard apple). *A. muricata*is a species of the genus Annona, which is well known for its edible fruits, and a member of the Annonaceae family of custard apple trees. The Caribbean and Central America are the tree's natural habitats. According to reports, the plant's leaf extract can decrease high blood pressure by reducing peripheral vascular resistance [7].

4. ***Apiumgraveolens***

(Family: Apiaceae; Common name: Celery). In accordance with Chinese belief, celery is beneficial for treating HTN because it affects the liver, which is linked to one kind of HTN. Celery helped 14 out of 16 patients with HTN in Mainland China. Approximately 8 ounces of the juice were given orally three times each day for up to a week after being combined with an equal amount of honey. Additionally, it is said to lower both systolic and diastolic blood pressure.A. graveolens seeds can be utilised as a safe and effective therapy for high blood pressure since the difference in BP in humans before and after treatment has been proven to be significant ($P<0.05$). You can combine fresh celery juice with vinegar to alleviate HTN-related headaches, shoulder discomfort, and dizziness [8].

5. ***Aristolochiamanshuriensis***

(Family: Aristolochiaceae; Common name: Guan Mu Tong). This Chinese herb is used to treat edoema and rheumatic pain as a diuretic and antiphlogistic. Aristolochic acid, aristoloside, magnoflorine, oleanolic acid,

hederagenin, and tannins are said to be present in the plant's extract. It has been discovered that magnoflorine possesses hypotensive qualities [9].

6. *Artocarpusaltilis*

(Family: Moraceae; Common name: Breadfruit). The Malay Peninsula and western Pacific islands are home to the plant's natural range. According to a research, the plant's leaf extract reduced the tension of isolated, phenylephrine-stimulated guinea pig aorta rings by 15% to 35% [10].

7. *Avenasativa*

(Family: Poaceae/Gramineae; Common names: Dietary Fiber, Green Oat). Whole oats are high in soluble fibre, which can help manage blood pressure and greatly lessen the need for antihypertensive medication. Increased consumption of whole oats may greatly lower the risk of cardiovascular disease when taking into account the changes in cholesterol and glucose levels as well. Oat cereals have been proven to dramatically lower systolic and diastolic blood pressure in HTN patients when added to their regular diet. Whole oats that are high in soluble fibre may be an efficient dietary therapy for HTN prevention and adjuvant treatment [11].

8. *Blond psyllium*

(Family: Plantaginaceae; Common name: Indian plantago). According to preliminary clinical studies, ingesting 15 g of *B. psyllium* (Plantago species) daily will somewhat reduce blood pressure, systolic by roughly 8 mmHg and diastolic by 2 mmHg [12].

9. *Camellia sinensis*

(Family: Theaceae; Common name: Tea). Tea has a variety of possible health advantages. Researchers are quite interested in how tea affects cardiovascular disease. There is conflicting research about tea and HTN. Black tea (fermented tea; *Camellia sinensis*) had no impact on blood pressure in HTN patients, according to research. Consumption of unfermented green tea (*Camellia sinensis*) and partially fermented oolong tea (*Camellia sinensis*) is associated with a lower incidence of HTN, according to population studies [13].

10. *Cappariscartilaginea*

(Family: Capparaceae; Common name: Lasaf). It is a shrub that sprawls or scrambles across rocky terrain, occasionally hanging from cliffs. In rats under anaesthesia, it has been shown that a crude extract of *C. cartilaginea* causes a dose-dependent drop in blood pressure and a mild bradycardia [14].

11. *Carumcopticum*

(Family: Umbelliferae; Common name: Ajwain). Anaesthetized normotensive (NMT) rats experience a decrease in BP and heart rate (HR) in response to the crude extract of *C. copticum* (1–30 mg/kg). The temporary hypotension that is generated quickly recovers to normal. The crude extract generates a minor change in the HR at low doses (up to 1 mg/kg). However, bradycardia has been documented at dosages of 10 to 30 mg/kg [15].

12. *Cassia absus*

(Family: Caesalpiniaceae; Common name: Chaksu). This plant is indigenous to the tropics and may be found all throughout India. According to reports, a crude extract of *C. absus* given intravenously causes a dose-related (1–30 mg/kg) drop in blood pressure, which is accompanied with a decrease in heart rate at the higher dosages (10 and 30 mg/kg). Tachyphylaxis has been observed in patients who received the same dosage of the crude extract several times. Animals under anaesthesia exhibited a persistent drop in blood pressure and a modest antiacetylcholine action [16].

13. *Cassia occidentalis*

(Family: Caesalpiniaceae; Common name: Coffee weed). It is a little tree with a height range of 5 to 8 metres. This plant's leaf is utilised as an antihypertensive in regional traditional medicine. The leaf extract has been proven to have a relaxing effect on the aortic rings in in vitro experiments. According to the investigations, cassia extract may relax smooth muscle and lower blood pressure by preventing Ca2+ influx through voltage-sensitive and receptor-operated Ca2+ channels, demonstrating its nonselectivity on these Ca2+ channels [17].

14. *Castanospermumaustrale*

(Family: Fabaceae; Common name: Black bean). It has been shown that *C. australe* crude extract can lower systolic and diastolic blood pressure in a dose-dependent manner (1-100 mg/kg). The saponin fraction and medicogenic acid glucoside found in the crude extract have been blamed for this drop in blood pressure [18].

15. *Coleus forskohlii*

(Family: Lamiaceae; Common name: Karpurvali). Coleonol, a diterpene derived from *C. forskohlii*, has been studied for its pharmacological characteristics. Due to the relaxation of the vascular smooth muscle, its main impact has been to reduce the blood pressure of anaesthetized cats and rats as well as the spontaneously hypertensive rat. On the isolated rabbit heart and the heart of the cat in vivo, it exerts a favourable inotropic effect in low dosages. Additionally, coleonol has non-specific spasmolytic effects on the smooth muscles of the gastrointestinal system in a variety of species, but not on the guinea pig's bronchial musculature. Coleonol has a depressive effect on the central nervous system when taken in high amounts [19].

16. *Commelinavirginica*

(Family: Commelinaceae; Common name: Virginia dayflower). It belongs to the dayflower family and is a perennial herbaceous plant. It is indigenous to the southeast and middle east of the United States. Whole plant extract has been shown to reduce the tension of isolated guinea pig aorta rings induced by phenylephrine by 15% to 35% [20].

17. *Crataeguspinnatifida*

(Family: Rosaceae; Common name: Chinese Hawthorn). For thousands of years, it was commonly utilised in China as a decoction to treat HTN. It reduces BP, as demonstrated by clinical trials and pharmacological studies. Hawthorn contains powerful antioxidants called flavonoids and oligomeric procyanidins, which together make up the two primary components that contribute to the fruit's positive benefits on the heart. By lowering blood pressure, boosting circulation, and preventing the buildup of arterial plaque and the development of blood clots in the brain, heart, and arteries, the alkaloid rhynchophylline, found in cat's claw, may be helpful in preventing strokes and lowering the risk of heart attack. Intravenous treatment of the extract preparation decreased blood pressure for up to three hours in studies with anaesthetized rabbits [21]. The hypotensive agent was determined to be graeaeic acid. Current hypothesised mechanisms of action for *Crataegus* show that this herb has the potential to have a wide-ranging impact on the cardiovascular system. These side effects include a tonic influence on cardiac myocytes, considerable antioxidant activity, and a hypotensive activity through vasorelaxation brought on by nitrous oxide stimulation [22].

18. Crinum glaucum

(Family: Amaryllidaceae; Common name: River Lily, Swamp Lily). The effects *of C. glaucum,* which is historically used in Western Nigeria to treat asthma, on respiratory and cardiovascular systems, have been studied. Increases in ventilatory rate and depth were accompanied by decreases in both systolic and diastolic pressures as a result of increasing dosages of the aqueous extract [23].

19. Cuscutareflexa

(Family: Cuscutaceae; Common name: Giant dodder). In rats under anaesthesia, *C. reflexa* crude extract has been shown to lower systolic and diastolic blood pressure as well as heart rate. Although the bradycardia and antihypertensive action were shown to be dose-dependent, the drop in HR was only noticed at somewhat higher dosages. Atropine (1 mg/kg) pretreatment had no effect on the cardiovascular reactions to *C. reflexa*[24].

20. Daucuscarota

(Family: Umbelliferae; Common name: Carrot). It has been used to treat HTN in conventional medicine. Two coumarin glycosides with the codes DC-2 and DC-3 were isolated during activity-directed fractionation of *D. carota*'s aerial parts. In rats under NMT anaesthesia, intravenous injection of these substances led to a dose-dependent (1–10 mg/kg) decrease in arterial blood pressure. Both substances had an inhibitory impact on the K+-induced contractions of the rabbit aorta and the spontaneously beating guinea pig atria in the in vitro tests at similar doses (10-200 g/ml). These findings suggest that DC-2 and DC-3 may decrease blood pressure by blocking calcium channels, which may account for the BP-lowering effects of the compounds seen in in vivo investigations [25].Daucuside and daucusol, two novel guaiane-type sesquiterpeneterpenoids with an intriguing epoxy unit, have been discovered from *D. carota* fruits.

21. Desmodiumstyracifolium

(Family: Leguminosae; Common name: Osbeck). Preparations made from the plant's dried leaves and stem that were administered intravenously to dogs under anaesthesia boosted coronary circulation, decreased arterial blood pressure, slowed heart rate, and decreased cardiac oxygen consumption. In 1982, Ho et al. examined the cardiovascular pharmacology of *D. styracifolium* (DSE) and *Clematis chinensis* (CCE) aqueous extracts in rats both in vivo and in vitro. DSE caused two sequential hypotensive effects; the first was brought on by activating cholinergic receptors, while the second was enhanced by blocking the autonomic ganglion and the alpha-adrenoceptor. Unlike DSE, CCE only triggered one hypotensive reaction that was mediated by histaminergic activity. Additionally, both extracts released isolated helical tail artery strips that had been constricted by methoxamine [26]. On isolated atria, CCE similarly had negative chronotropic and inotropic effects, but DSE had a positive chronotropic effect with no discernible impact on the contractile force.

22. Fuchsia magellanica

(Family: Onagraceae; Common name: Hardy Fuchsia, Chiko, Tilco). This plant is indigenous to Chile and Southern Argentina. The leaf extract is infused to lower blood pressure, regulate body temperature, and function as a diuretic. The ethanol/aqueous extracts of this species were studied by Schmeda-Hirschmann et al. in NMT rats, and they discovered a moderate to significant decrease in the mean arterial pressure [27].

23. Glycine max

(Family:Fabaceae Common name: Soybean). It has been discovered that soybean works well to lower blood pressure. One research found a very little drop in blood pressure, while another found no effect [28].

24. Gossypiumbarbadense

(Family: Malvaceae; Common name:Pima cotton). It is a tropical perennial plant with black seeds and yellow blooms. According to a research, the plant's leaf extract reduced the tension of isolated, phenylephrine-stimulated guinea pig aorta rings by 15% to 35%. The plant's leaves are utilised in traditional Surinamese medicine to cure HTN and irregular or delayed menstruation [29].

25. Hibiscus sabdariffa

(Family: Malvaceae; Common name: Roselle). One of the plants with the most in-depth research on its antihypertensive characteristics is this one. Many West African nations have long employed this plant's leaves, calyx, and corolla for both culinary and medicinal uses. This plant extract's antihypertensive impact has been the subject of several studies. In one investigation, the calyx of HS was found to have antihypertensive properties. Adegunloye et al. independently achieved a comparable outcome in Lagos, Nigeria. The BP of experimentally induced hypertensive rats decreased after receiving an intravenous injection of a water extract of dry HS calyx at a dose of 20 mg/kg. The direct vasorelaxant effects of the HS crude extract's antihypertensive effects have been linked to acetylcholine and histamine-like dependent mechanisms [30]. An earlier study shown that the rat aorta smooth muscle was directly relaxed by the petal crude extract of the same plant. In rats with renovascular hypertension, continuous treatment of an aqueous extract of HS has been shown to reverse ventricular hypertrophy.

Reliable proof of the antihypertensive effects of the plant extract in human clinical studies. 39 individuals received a standardised dosage of HS (9.6 mg/day), and the same number of patients received captopril (50 mg/day), and there was no discernible difference in the hypotensive effects, antihypertensive efficacy, or tolerability [31].

26. Lavandulastoechas

(Family: Lamiaceae; Common name: French Lavender). In anaesthetized NMT rats, a crude extract of *L. stoechas* has been shown to cause a decrease in BP and HR. The cardiovascular reactions were eliminated by atropine pretreatment, indicating that both the antihypertensive and bradycardia effects of the crude extract might be controlled by a mechanism or mechanisms like those of acetylcholine [32].

27. Lepidiumlatifolium

(Family: Cruciferae; Common name: Rompepiedra or Stone breaker). In the Canary Islands, this herb has been utilised as a traditional remedy for renal lithiasis. Its diuretic impact in rats has been demonstrated to produce hypotensive effects. The aqueous leaf extracts demonstrated substantial and dose-dependent diuretic and hypotensive effects when administered in dosages of 50 and 100 mg/kg intraperitoneally and orally, respectively. The study went further and used the diuretic properties of furosemide in both situations to extrapolate the rat extract's effects to people [33]. The recommended dosage of *L. latifolium* for men was 3 to 5 g/day in the form of tea, or 43 to 71 mg/kg for a patient weighing 70 kg.

28. Linumusitatissimum

(Family: Linaceae; Common name: Linseed, Flaxseed). It is an annual plant that is said to have come from Egypt.The important fatty acid -linolenic acid, which is abundant in linseed and its oil, looks to be helpful for treating heart disease, inflammatory bowel disease, arthritis, and other health issues. -Linolenic acid is a member of the class of compounds known as omega-3 fatty acids. Numerous studies indicate that diets high in omega-3 fatty acids dramatically reduce blood pressure in those with HTN [34].By lowering blood cholesterol, platelet aggregation, and inflammatory indicators; enhancing glucose tolerance; and acting as an antioxidant, flaxseed may defend against atherosclerotic cardiovascular disease. Without affecting triglyceride or high-density lipoprotein cholesterol levels, daily intake of 15 to 50 g of ground flaxseed can only minimally lower total cholesterol and low-density lipoprotein concentrations. The precise process, nevertheless, is unknown.

29. Lumnitzeraracemosa

(Family: Combretaceae; Common name: Black Mangrove). It is a charming shrub or little tree that may be found along the Indian coast and in the Andaman and Nicobar Islands. The fruits of this plant have been used in folk medicine to cure snake and bug bites as well as skin conditions. The plant's aqueous acetone extract has reportedly been shown to have antihypertensive effects. Eleven hydrolysable tannins found in the leaves of *L. racemosa* have been studied for their potential antihypertensive properties. The three most active ingredients from the screening in spontaneously hypertensive rats were corilagin, castalagin, and chebulinic acid [35].

30. Lycopersiconesculentum

(Family: Solanaceae; Common name: Tomato). Carotenoids included in tomato extract, including lycopene, beta carotene, and vitamin E, are known to be powerful antioxidants that can neutralise free radicals and halt the progression of atherosclerosis. According to a research, tomato extract (Lyc-O-Mato) somewhat lowers blood pressure in those with moderate, untreated HTN. Systolic blood pressure and lycopene concentrations have been found to be significantly correlated. Tomato extract reduced blood pressure by more than 10 mmHg systolic and more than 5 mmHg diastolic pressure in patients receiving low doses of ACE inhibitors, calcium channel blockers, or their combination with low-dose diuretics. There were no negative effects associated with the medication, and compliance with it was quite good [36].

31. Moringaoleifera

(Family: Moringaceae; Common name: Murungai). The crude extract from the leaves of *M. oleifera* reduced systolic, diastolic, and mean blood pressure in a dose-dependent manner in rats under anaesthesia. Within two minutes, the antihypertensive effect vanished and blood pressure returned to normal. Except at high dosages (3 and 10 mg/kg), where a little bradycardia was elicited, HR was not appreciably impacted. It was also determined that the crude extract's thiocarbamate and isothiocyanate fractions were what gave rise to the antihypertensive activity [37].

32. Musangacecropiodes

(Family: Cecropiaceae; Common name: Umbrella tree, Cork Wood). It is a perennial plant with quick growth that is common to tropical rain forests, especially in West Africa. There have been claims that an ethanol extract of the plant's stem bark has antidiarrheal properties. Numerous researchers have established the latex and leaf extract's scientific usefulness as a vasorelaxant and, consequently, a hypotensive agent. It has been shown that the aqueous extract of the stem bark causes a dose-dependent decrease in mean arterial BP, which decreased by 4.51±0.5 mmHg at the dose of 10 mg/kg and 65.23±6.28 mmHg at the dose of 40 mg/kg [38].

33. Ocimumbasilicum

(Family: Lamiaceae; Common name: Basil). A crude extract of *O. basilicum* has been shown to reduce systolic, diastolic, and mean blood pressure in a dose-dependent manner, with a median effective dosage of 30 mg/kg. The transient antihypertensive impact lasts for only two minutes before returning to normal. Eugenol, an ingredient in the extract that works by inhibiting calcium channels, is thought to be responsible for this extract's cardiovascular effects [39].

34. Raphanussativus

(Family: Cruciferae; Common name: Radish): It has been discovered that the plant possesses hypotensive properties. During a 24-hour acute toxicity research on mice, isolated tissue preparations were suspended in tissue baths containing Krebs solution. Rats' BP and HR decreased as a result of the extract in a dose-dependent (0.1-3 mg/kg) manner, which was mediated by an atropine-sensitive route. It demonstrated dose-dependent suppression of contraction force and rate (0.03–3.0 mg/ml) in isolated guinea pig atria. Atropine

eliminated the inhibitory impact in the tissues it was applied to and revealed a heart stimulant action that was impervious to adrenergic and serotonergic receptor blocking. It prevented phenylephrine-induced contractions in the endothelium-intact rat aorta, which atropine prevented.In mice, the extract proved safe up to a dosage of 10 g/kg [40]. The research demonstrated that the plant's cardiovascular inhibitory effects are mediated via muscarinic receptor activation, potentially supporting its usage in HTN.

35. Rauwolfiaserpentina

(Family: Apocynaceae; Common name: Rauwolfia). It is a clever tropical woody plant native to South America, Africa, and Asia. In Hindu medicine, extracts from rauwolfia-related plants and various components of this plant were used to treat a variety of illnesses and complaints, including sleeplessness, mania, and snakebites. This herb is regarded as the most potent hypotensive. The first strong medication used extensively in the long-term treatment of HTN was reserpine, a pure alkaloid of *R. serpentina*. To get benefits and prevent side effects, a tiny amount is all that is necessary [41]. The most frequent adverse effect is nasal congestion. Reserpine was first marketed as Serpasil in 1952 for the management of HTN, tachycardia, and thyrotoxicosis. Reserpine, dihydroergocristine, and a diuretic are still available as a combination (Brinerdin, Crystepin).

36. Sesamumindicum

(Family: Pedaliaceae; Common name: Sesame). In rats under anaesthesia, an alcoholic extract of the seeds (1–30 mg/kg) led to hypotension. A dose-dependent decrease in systolic and diastolic blood pressure was seen. When given somewhat greater dosages (10–30 mg/kg), HR was shown to decline. The cardiovascular reactions were found to be abolished by atropine (2 mg/kg), indicating the existence of an acetylcholine-like chemical in the seeds. The two main phenolic components of sesame oil are sesamin and sesaminol. According to a research on hypertension patients, eating sesame oil significantly lowered oxidative stress while also boosting the activities of glutathione peroxidase, superoxide dismutase, and catalase. These findings provide credence to the idea that consuming sesame oil may strengthen the body's natural antioxidant defences [42]. Sesamin is a helpful preventative medication in HTN and cardiovascular hypertrophy, according to the researchers.

37. Solanum sisymbriifolium

(Family: Solanaceae; Common Name: Sticky Nightshade, Wild Tomato). In Paraguay, a perennial herb called S. *sisymbriifolium*Lam. has been utilised as a traditional medicine with diuretic and antihypertensive characteristics. Both NMT and hypertensive rats were used to study the crude hydroalcoholic root extract's hypotensive effects. When the extract (50 and 100 mg/kg) was administered intravenously to rats with hypertension (adrenal regeneration HTN + deoxycorticosterone acetate), the animals' blood pressure significantly decreased. In conscious hypertensive rats, oral treatment of the extract (10, 50, 100, and 250 mg/kg) similarly had a dose-dependent hypotensive effect. The extract (50 and 100 mg/kg, i.v.) similarly produced dose-dependent hypotension in anaesthetized NMT rats [43]. Last but not least, the extract did not significantly affect blood pressure when it was given orally to conscious NMT rats at doses of 10, 50, 100, 250, 500, and 1000 mg/kg. Nuatigenosido, one of the potential active chemicals, was extracted from the extract in a different investigation. At 100 g/kg and 1 mg/kg intravenously, nuatigenosido decreased blood pressure in rats. At 10^{-6} and 10^{-5} M, it increased the contractile force in a bullfrog's right atrium. At 10^{-7} M, it increased the overshoot amplitude in frog atrial myocytes, shortened action potential durations, increased calcium current, and delayed outward potassium current. The findings showed that nuatigenosido may be crucial to this herb's medicinal properties [44].

38. Theobroma cacao

(Family: Malvaceae; Common names: Chocolate, Cocoa Bean, Cocoa Butter). Cardiovascular disease is avoided by consuming cocoa powder that is high in flavonoid components. Nitric oxide production is stimulated, vasodilation is increased, and endothelial dysfunction is decreased by the flavonoids found in

chocolate. An increasing corpus of clinical evidence demonstrates that daily ingestion of dark or milk chocolate (T. cacao), containing 213 to 500 mg of cocoa polyphenols, can reduce systolic and diastolic blood pressure by around 5 mmHg and 3 mmHg, respectively [45].

39. Uncariarhynchophylla

(Family: Rubiaceae; Common name: Cat's Claw herb). *U. rhynchophylla* has been employed in conventional eastern medicine to decrease blood pressure and treat a variety of neurological problems. The indole alkaloid hirsutine, which has been discovered to function at the Ca2+ channels, has been blamed for the hypotensive activity. Fura-2- Ca2+ fluorescence was used to examine how hirsutine affects the cytosolic Ca2+ level ([Ca2+]cyt) in the smooth muscle of the isolated rat aorta [46]. A persistent rise in [Ca2+]cyt was induced by norepinephrine and a high K+ solution. After noradrenaline and high K+ caused increases in [Ca2+]cyt, hirsutine application markedly lowered [Ca2+]cyt, indicating that hirsutine blocks Ca2+ influx primarily through a voltage-dependent Ca2+ channel.Additionally, the rat aortic contractile responses to caffeine under the Ca2+-free nutritional state were used to study the influence of hirsutine on intracellular Ca2+ stores. Before caffeine therapy, hirsutine was added at 30 μM, and it greatly but only marginally decreased the contraction caused by caffeine. Hirsutine most clearly enhanced the contractile response to caffeine when administered during Ca2+ loading. These findings imply that hirsutine reduces the intracellular Ca2+ level by inhibiting Ca2+ release from the Ca2+ store and increasing Ca2+ absorption into the Ca2+ store. It has been determined that hirsutine affects both the voltage-dependent Ca2+ channel and the Ca2+ storage to lower intracellular Ca2+ levels [47].

40. Viscum album

(Family: Santalaceae; Common name: Mistletoe). The isolated and perfused Langendorff heart model demonstrated considerable coronary vasodilator action in response to the aqueous extracts of V. album leaves. According to the results, the aqueous extract of V. album may include certain physiologically active compounds that can activate the soluble guanylate cyclase/nitric oxide pathway.Underpentobarbitone anaesthesia, albino Wistar rats were used to study the effects of the crude aqueous extract from mistletoe leaves on arterial blood pressure and heart rate [48]. The BP was significantly reduced by the crude extract in the subgroups treated with NMT, renal artery occluded hypertensive (ROH), and sham-induced hypertension (SIH), respectively, by 11.28, 23.98, and 18.80%.In the NMT, ROH, or SIH categories, the extract's depression of the matching HR was not statistically significant. The effects of the extract on BP were inhibited by propranolol. Atropine could not, however, stop the BP drop brought on by the extract. The extract prevented the NMT's BP from rising as a result of noradrenaline. According to the findings, mistletoe extract has an antihypertensive impact without changing HR, probably through sympathetic mechanisms [49,50].

There are several other compounds also they can be amalgamated in nanoparticles in order to deliver against various diseases varying low from dysmenorrhoea to cancer [51-58].

Conclusion

In terms of conservation, medicinal plants have come under extensive scrutiny to see if their traditional usage are backed by real pharmacological benefits or are just based on folklore. Comparing herbal medications to synthetic ones reveals that they are less expensive and have no negative effects. Since ancient times, medicinal plants have been utilised to cure a variety of illnesses, including heart conditions. It is not surprising that they have successfully reduced blood pressure and enhanced cardiac function. All new, little chemical entities that are presented as medicines throughout decays are, in fact, inspired by or created by nature. This may be the cause of why more individuals seek therapy for CVD from herbal medicine than from allopathic medication. In this review, we covered the several plants that are most

frequently used to control and treat hypertension. Additionally, it is advised that patients receive sufficient education on the usage of long-used herbs such black cumin and coriander.

Acknowledgement: The authors are thankful to Department of Pharmacy, Innovative college of Pharmacy, Greater Noida, for providing kind guidance and excellent opportunity as well as necessary facilities for the research.

Conflicts of Interest: The authors confirm that the content of the article has no conflict of interest.

Author's Contribution: Both the authors Raj kumar and ……have contributed equally in the paper.

Data Availability: The original data that support the findings of this study are included in the Article.

Funding: This research paper received no external funding.

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