A REVIEW ON HERBS WITH ANTIHYPERTENSIVE AND DIURETIC PROPERTIES

Nidhi Agarwal* and Sheel Sharma

* UGC - senior research fellow, Food Science and Nutrition, Banasthali University, p.o. – Banasthali Vidyapith, Rajasthan-304022, India
Professor and Head, Food Science and Nutrition, Banasthali University, p.o. – Banasthali Vidyapith, Rajasthan-304022, India

ABSTRACT
Hypertension is one of the leading causes of disability and death, due to stroke, heart attack, and kidney failure. It is a major health problem that challenges not only health care professionals but also the pharmaceutical industry and drug regulatory agencies. Synthetic drugs cause side effects, even leading to an increase in blood pressure. Therefore, herbal drugs are much sought after now a days due to being side effect free and cost effective also. Herbal drugs have been used since the dawn of civilization and organized existence. The present review is aimed at summarizing information on clinical trials of various medicinal plants used in managing hypertension.

Keywords: Herbal drugs, Pharmaceutical industry, Hypertension, Medicinal plants, Health problem.

INTRODUCTION
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INTRODUCTION

Hypertension is the leading member of the so called “non communicable diseases” (NCD group) and a leading contributory cause of death worldwide. [1] A large number of population surveys from different parts of the world have all along demonstrated hypertension to be a ubiquitous disease that affect all ethnic groups and engulf all geographic regions. [2]

In countries with old civilizations and heritages like India, the ancient wisdom, folklore and alternate medicinal systems just as Ayurveda, have always promoted the concept of food and herbs based prevention and management of diseases like cardiovascular, hypertension and diabetes mellitus. It is surprising that modern medicine with a glare of newer health gadgets and technologies has made us lopsidedly reliant on
them. It is high time; we recapitulate perspective and give the natural herbal bounty with wealth of potential a real chance.

Hypertension is considered to be a predisposing factor for stroke, coronary heart disease, peripheral vascular disease, heart failure and end-state renal disease.\[^{3, 4}\] It is estimated that hypertension contributes about 57% towards all deaths from strokes and 24 percent towards all deaths from coronary artery disease in India.\[^{5}\] Nearly one billion people are affected by hypertension worldwide, and this figure is predicted to increase to 1.5 billion by 2025.\[^{6}\] Each year, two million new cases of hypertension are diagnosed. It is estimated that 43 million people in the United States, almost 24% of the adult population are afflicted with hypertension and taking antihypertensive medication.\[^{7}\] The risk of hypertension increases with age in both men and women.\[^{8}\] Before age 55, more men than women are hypertensive; but the reverse is true for those over the age of 55. As a matter of fact, it is a chronic medical condition in which the blood pressure stays elevated, mostly for no ostensible reason. It is also referred to as high blood pressure or shortened to HT, HTN or HPN. The word "hypertension", by itself, normally refers to systemic, arterial.\[^{9}\]

**Medication for Hypertension:**

Common clinical strategies to achieve a lowering of blood pressure include the use of angiotensin converting enzyme (ACE) inhibitors, beta blockers, calcium channel blockers (or CCB’s) and diuretics.\[^{3, 10}\] For simplistic reasons, these agents work by reducing arterial resistance and/or decreasing cardiac output. Indeed, ACE inhibitors work by interrupting the conversion of angiotension-I to angiotension-II and therefore attenuating the arterial constrictor effects of angiotensin-II.\[^{11}\] Beta receptor blockers act to counter the stimulatory effects of vascular and cardiac noradrenergic receptors.\[^{12}\] CCB’s inhibit calcium entry thus decreasing the tone of vascular smooth muscle and promoting vasodilatation.\[^{4}\] Diuretics work by promoting the expulsion of urine, measured as the urinary volume (UV) excreted, and urinary sodium (UNa) from the body and this helps reduce the volume of blood circulating through the cardiovascular system.\[^{13, 3, 10}\]

**Role of Plant Products in the Management of Hypertension:**
Since time immemorial, people have used plants in treating various diseases without any side effect. Their use has been safe and they are cost effective also. One well documented use of plant products is their use as antihypertensive and hypotensive agents. Hence, there is an ever increasing need for safe antihypertensive and hypotensive agents.

**Antihypertensive / Hypotensive Herbs**

Herbal based therapeutics for hypertension has been in use since Vedic era and now a days, it has been used and practisized due to lack of its adverse side effective property, and efficacy in curing hypertension and cost effectiveness. Some herbs are not being used in pharmacological preparations in the industry because of non availability of clinical studies on them. Their safe amount of use is questioned till now along with efficacy. However, the use of natural herbs for curing hypertension is well documented in different traditional medicine systems since Ayurveda to Chinese and European traditional system. In this modern era, use of herb is being more popular day by day due to evidenced by clinical trials, safety, efficacy and cost effectiveness. A large no. of plants has been supported by evidences to treat hypertension. Therefore, plant based drugs should be developed to make the use of drugs safe and effective. This review aims at summarizing data on clinical trials of various medicinal plants, useful in curing hypertension.

**Achillea wilhelmsii (Common name - Yarrow)**

Alcoholic extract of *Achillea wilhelmsii* C. Koch (Asteraceae) was evaluated in men and women aged 40-60 years. At a dose of 15-20 drops, the alcoholic extract significantly (p<0.05) decreased the diastolic and systolic blood pressure after two and six months, respectively. [14]

**Spergularia purpurea (Common name - Sand spurrey)**

Water extract of *Spergularia purpurea*, furosemide (10 mg kg\(^{-1}\)) was administered to study the hypotensive effect in rats. There was a significant increase in UV with *Spergularia purpurea* (~23 ml 24 h\(^{-1}\) with 400 mg kg\(^{-1}\) of *Spergularia purpurea*). After 4 weeks of treatment, responses seemed to be dose-dependent (16.9 and 19.3 ml 24 h\(^{-1}\) with doses of 100 and 200 mg kg\(^{-1}\) of *Spergularia purpurea*, respectively), were similar to those of furosemide (~23 ml 24 h\(^{-1}\)) and were significantly greater than placebo (~10 ml 24 h\(^{-1}\)). Changes in urinary electrolytes (sodium, potassium
and chloride) mirrored those of UV, with the highest dose increasing UNa to \(~4\) mEq kg\(^{-1}\) as compared with placebo (\(~1.5\) mEq kg\(^{-1}\)). Again, this change was not too dissimilar to that achieved with furosemide (\(~3\) mEq kg\(^{-1}\)). There was no change in plasma electrolyte in \textit{Spergularia purpurea}. At the lowest and highest doses (100 and 400 mg kg\(^{-1}\)) glomerular filtration increased relative to placebo, but was unchanged by the intermediate dose.\(^{[15]}\)

In the second study the protective effect of flavonoid extract of \textit{Spergularia purpurea} (5 mg kg\(^{-1}\)) was evaluated. The extract was administered daily to normotensive and hypertensive rats, and compared with placebo and furosemide (10 mg kg\(^{-1}\)). In both animal models furosemide and \textit{Spergularia purpurea} flavonoids decreased blood pressure to a similar magnitude but did not differ significantly from placebo. These flavonoids also interfered with the tubular absorption of electrolytes as shown by significant increases in UNa, potassium and chloride. Indeed, UV and UNa increased to \(~60\) ml kg\(^{-1}\) 24 h\(^{-1}\) and \(~10–15\) mEq kg\(^{-1}\) 24 h\(^{-1}\), respectively, in those receiving flavonoids. These effects were roughly double those seen in the placebo group (\(~30\) ml kg\(^{-1}\) 24 h\(^{-1}\) and \(~7.5\) mEq kg\(^{-1}\) 24 h\(^{-1}\)) and were similar to responses seen with furosemide.\(^{[16]}\)

\textbf{Allium sativum (Common name - Garlic)}

A garlic preparation containing 1.3 % allicin at a large dose (2400 mg) was evaluated in an open-label study in nine severely hypertensive patients (diastolic blood pressure 115 mm Hg or greater). Approximately five hours after taking the garlic, the systolic blood pressure fell an average of 7 mm Hg while diastolic BP dropped an average of 16 mm Hg. A significant decrease in diastolic blood pressure lasted from 5-14 hours after the dose and no significant side effects were reported.\(^{[17]}\)

In another study, the effects of two garlic sources on systolic blood pressure (SBP) were studied using spontaneously hypertensive rats (SHRs). Beginning at 12 wk of age, male SHRs were fed diets containing either aged garlic extract (AGE) or raw garlic (RG) powder for 10 wk. Both AGE and RG reduced the increase of SBP compared with the control group from 4 wk after beginning the experimental diets. The effect of AGE was accompanied by a decrease of pulse pressure (PP), suggesting an improvement of the pliability of the artery, although RG did not affect PP. However, harmful effects were
observed in the RG group, including a decrease in erythrocytes, an increase in reticulocytes, and generation of papilloma in the forestomach. This study revealed that AGE might safely improve several factors related to blood vessel physiology and circulatory disease unlike RG. [18]

**Cinnamomum verum (Common name - Cinnamon)**

The protective effect of *Cinnamomum verum* and its aqueous extract was evaluated in spontaneous hypertensive rats (SHR). Addition to diets of cinnamon (8% w/w) reduced the serum blood pressure (SBP) of rats eating sucrose containing diets to virtually the same levels as SHR consuming non sucrose containing (only starch) diets. The presence of cinnamon in the diet also decreased the SBP of SHR consuming a non sucrose-containing diet. This finding suggested that cinnamon reduced more than just sucrose-induced SBP elevations perhaps a genetic component(s) of the elevated BP as well. The effects of cinnamon on SBP tended to be dose-dependent. Aqueous extracts of cinnamon also decreased SBP. [19]

**Lepidium sativum (Common name - Garden cress)**

Aqueous and methanol extracts of *L. sativum* seeds were administered to experimental rats orally at doses of 50 and 100 mg/kg p.o. Hydrochlorothiazide (10 mg/kg) was used as positive control in study. The diuretic effect of the extracts was evaluated by measuring urine volume, sodium and potassium content, conductivity and pH. Urine volume was significantly increased by the two doses of aqueous and methanol extracts in comparison to control group. While the excretion of sodium was also increased by both extracts, potassium excretion was only increased by the aqueous extract at a dose of 100 mg/kg. There was no significant change in the conductivity and pH of urine after administration of the *L. sativum* extracts. The diuretic effect of the extracts was comparable to that of the reference standard (hydrochlorothiazide) and the methanol had the additional advantage of a potassium-conserving effect. [20]

**Terminalia arjuna (Common name - Arjuna)**

The extract of *Terminalia arjuna* was evaluated for antihypertensive properties. The extract of *T. arjuna* (dissolved in propylene glycol) in the dose range of 5 to 15 mg/kg were administered intravenously in a pilot study and the dose (6 mg/kg). Intravenous administration of *T. arjuna* produced dose-dependent hypotension in
anaesthetized dogs. The hypotension produced by 6 mg/kg dose of the extract was blocked by propranolol but not by atropine or mepyramine maleate. This indicates that muscarinic or histaminergic mechanisms were not likely to be involved in the hypotension produced by the extract. The blockade by propranolol of the hypotension produced by T. arjuna indicated that the extract might contain active compound(s) possessing adrenergic β2-receptor agonist action and/or that act directly on the heart muscle. This indicated the likely involvement of peripheral mechanism for hypotension produced by the 70% alcoholic extract of Terminalia arjuna.\[21\]

In another study, 12 subjects with refractory chronic congestive heart failure (idiopathic dilated cardiomyopathy (n=10); previous myocardial infarction (n=1), or peripartum cardiomyopathy (n=1)), received Terminalia arjuna, at a dose of 500 mg every eight hours, or placebo for two weeks, each treatment protocol separated by a two-week washout period, as an adjuvant to conventional therapy. Terminalia, compared to placebo, was associated with decrease in echo-left ventricular end diastolic and end systolic volume indices, increase in left ventricular stroke volume index, and increase in left ventricular ejection fractions.\[22\]

Olea africana and Olea europea (Common name - Olive)

Aqueous extract of Olea europaea was evaluated in two groups of hypertensive patients, 12 patients consulting for the first time, and 18 patients on conventional antihypertensive treatment. An aqueous extract was given for three months, after 15 days of placebo supplementation. There was a statistically significant decrease of blood pressure (p<0.001) for all patients, without side effects.\[23\] This antihypertensive potential of Olea europea might possibly due to its phytochemicals including 20 % oleuropein, a complex structure of flavonoids, esters and multiple iridoid glycosides and its antioxidant properties.\[24, 25\] One of olive leaf’s mechanisms of action was vasodilation. In another study, a decoction of olive leaf caused relaxation of isolated rat aorta endothelium. The relaxant activity was independent of the integrity of the vascular endothelium. Oleuropeoside was found to be a component responsible for vasodilator activity.\[26\]

A study looked at 20 sets of identical twins with "borderline" hypertension -- blood pressure that was above the optimal level of 120/80, but below the cut off of 140/90 used to diagnose high blood pressure. One member of each twin pair was given
tablets containing olive leaf extract, while the other received no supplements but did get lifestyle advice on lowering blood pressure. After eight weeks, supplement users taking 1,000 mg of olive leaf extract per day showed a substantial dip in their blood pressure overall. The twins who received no supplements showed no significant change in their blood pressure. [27]

In this study, hypotensive effect of olive leaf extract (OLE) was evaluated in 30 patients with essential hypertension. [23] OLE was given every four hours for three months after 15 days’ treatment with a placebo. Active treatment resulted in a statistically significant decrease of blood pressure (P<0.001) in all patients and was considered well tolerated. [28]

**Viscum album (Common name - Mistletoe)**

Aqueous extract of *Viscum album* leaves was administered in albino wistar rats under pentobarbitone anesthesia. The extract (150 mg/kg) was administered via the oral route, once daily for six weeks. Propranolol (0.5 mg/kg i.v.), atropine (1.5 mg/kg i.v.) and noradrenaline (1.0 mg/kg i.v.) were also administered to elucidate the probable mechanism of action of the extract. The results showed that the control aterial blood pressure (BP) and heart rate (HR) in the normotensives were 97.50±3.20 mmHg and 440.00±12.60 beats/min, respectively. The crude extract produced a significant decrease in BP i.e., 11.28, 23.98 and 18.80% in the normotensives (NMT), renal artery-occluded hypertensives (ROH) and salt-induced hypertensives (SIH) treated subgroups. The depression produced by the extract on the corresponding HR was not significant in the NMT, ROH or SIH subgroups. Propranolol blocked the action of the extract on BP. However, atropine did not prevent the extract-induced depression of BP. The extract blocked noradrenaline-induced increase in BP in the NMT. [29] In another study, its pharmacological effects, including diuretic and hypotensive activity, were studied using an alcohol extract of Japanese and European mistletoe. Both extracts showed blood pressure lowering effects when administered intravenously and orally to cats. [30]

**Nigella sativa (Common name - Black seed)**

*Nigella sativa* (Family; Ranunculaceae) has a long history of use in folk medicine as a diuretic and hypotensive agent. In a study, an oral dose of either *Nigella sativa* extract (0.6 mL/kg/day) or furosemide (5 mg/ kg/day) significantly increased diuresis by
potential of being a potent, centrally acting antihypertensive agent. In the same rat study, a comparison between Nigella sativa and nifedipine found mean arterial pressure decreased by 22- and 18 percent in the Nigella sativa and nifedipine treated rats, respectively.\[31\]

**Plectranthus barbatus (Common name - Coleus)**

Coleus forskohlii has been used in Ayurvedic medicine for its hypotensive property. In a study with isolated heart tissue, forskolin activated membrane-bound adenylatecyclase and cytoplasmic cAMP-dependent protein kinase. The researchers postulated the positive inotropic effect was via an enhanced calcium uptake by the heart muscle cell.\[32\] Another constituent from Coleus, ditermene coleonol, was reported to lower blood pressure in both rat and cat models.\[33\]

**Vacinum arctostaphylus (Common name - Qare qat)**

The effect of aqueous extract of Vaccinium arctostaphylus was evaluated on blood pressure in rats. Rats were subjected to sham operation or the placement of plexiglass clips on left renal arteries. Four weeks later, renal artery clipped rats were given intravenous injection of normal saline or the extract at 10, 25, 75 or 100 mg/kg, and mean blood pressure and heart rate were measured before and 20, 40 and 60 minutes after drug administration. Compared to sham group, renal artery clipped groups had a significantly higher mean blood pressure, heart and right kidney weights, lower left kidney weights and significantly indifferent heart rate. Compared to vehicle treatment, the extract at 75 and 100 mg/kg, but not at 10 or 25 mg/kg, did significantly reduce mean blood pressure at 20, 40 and 60 minutes after administration without changing the heart rate.\[34\]

**Rauwolfia serpentine (Common name - Sarapgandha)**

Powder of Rauwolfia serpentina was administered in 389 subjects, aged 21-55 years, with diastolic blood pressures 90-115 mm Hg. Subjects were randomly assigned to either a combination of a diuretic and Rauwolfia serpentina, or an identical placebo. Diastolic blood pressure was reduced an average of 10 mm Hg and systolic by 16 mm Hg in the active treatment group, with no change in the placebo group.\[35\] The decrease in blood pressure might be due to the Rauwolfia constituent ajmaline.

In another study, ajmaloon - a preparation from Rauwolfia serpentina was evaluated by determining the serum cadmium levels as 43 percent higher and serum zinc
levels 28 percent lower than normotensive control. Significant decrease was reported along with decrease in elevated serum cadmium levels.\cite{36}

*Linum Usitatissimum* (Common name - Flax seed/Linseed)

Three strains of *Linum Usitatissimum* (Family : Linaceae) : Flanders (low in lignan and high in - linolenic acid), Linola 989 (high in lignan and low in - linolenic acid) and AC Linora (intermediate in both lignan and - linolenic acid) were used to study the hypotensive effects in women. All three strains of flax significantly reduced blood pressure during mental stress induced by a frustrating cognitive task (Stroop color-word interference task) (\(p < 0.004\)). Linola 989, the strain highest in lignan and lowest in -linolenic acid, was associated with the least increase in peripheral resistance during stress, the greatest reduction in plasma cortisol during stress and the smallest increase in plasma fibrinogen during mental stress.\cite{37}

*Fraxinus excelsior* (Common name - Ash)

The hypotensive effect of an aqueous extract of *Fraxinus excelsior* L. was investigated in both normotensive (WKY) and spontaneously hypertensive rats (SHR). Daily oral administration of *Fraxinus excelsior* (20 mg/kg) aqueous extract for 3 weeks produced a significant decrease in systolic blood pressure (SBP) with variation coefficient (\(\%\)) of 13.5% in SHR (\(p < 0.01\)) and 9% in WKY rats (\(p < 0.05\)). The aqueous extract of *Fraxinus excelsior* significantly enhanced the urination in both SHR (\(p < 0.05\) compared to control) and WKY (\(p < 0.05\) compared to control). Irbesartan (Avapro\textsuperscript{®}), an angiotension II antagonist, was used as reference drug. Furthermore, oral administration of aqueous *Fraxinus excelsior* extract at a dose of 20 mg/kg produced a significant increase in urinary excretion of sodium (\(p < 0.01\) compared to control), potassium (\(p < 0.001\) compared to control) and chlorides (\(p < 0.01\)) in SHR rats. In normal rats, the aqueous *Fraxinus excelsior* extract administration induced a significant increase of the urinary elimination of sodium (\(p < 0.05\) compared to control), chlorides (\(p < 0.01\) compared to control) and potassium (\(p < 0.01\) versus control). While there were no significant changes in heart rate (HR) after *Fraxinus excelsior* treatment in both SHR and WKY rats, glomerular filtration rate (GFR) showed a significant increase in SH rats (\(p < 0.001\)) after *Fraxinus excelsior* treatment.\cite{38}

*Camellia sinensis* (Common name - Tea)
The effect of polyphenol in black and green tea was investigated in spontaneously hypertensive rats (SHRSP). The rats were divided into three groups: the control group consumed tap water (30 mL/d); the black tea polyphenol group (BTP) consumed water containing 3.5 g/L thearubigins, 0.6 g/L theaflavins, 0.5 g/L flavonols and 0.4 g/L catechins; and the green tea polyphenol group (GTP) consumed water containing 3.5 g/L catechins, 0.5 g/L flavonols and 1 g/L polymetric flavonoids. During the day time, systolic and diastolic BP were significantly lower in the BTP and GTP groups than in the controls. GTP significantly increased catalase expression, and BTP and GTP significantly decreased MLC-p expression in the aorta. Study demonstrated that both black and green tea polyphenols attenuated blood pressure that reincreases through their antioxidant properties in SHRSP. Furthermore, because the amounts of polyphenols used in this experiment correspond to those in _1 L of tea, the regular consumption of black and green tea might also provide some protection against hypertension in humans. [39]

Azadirachta indica (Common name - Neem)

The effect of concurrent administration of Azadirachta indica leaf extract with DOCA-salt was investigated in the development of hypertension. Over 5-6 week old, inbred male wistar rats with a starting weight of 190 g were given either: (1) twice weekly subcutaneous (s.c.) injections of vehicle (soyabean oil, 0.25 mL per animal) for the first 2 weeks, plus normal drinking water (controls); (2) twice weekly (s.c.) injections (weeks 1 and 2 only) of 15 mg/kg DOCA dissolved in vehicle, plus drinking water containing 1.0% NaCl and 0.03% KCl (DOCA-salt group); or (3) 20 mg/kg of aqueous neem extract daily, in addition to the DOCA-salt treatment (DOCA-salt-neem group). All groups (8-12 animals) received normal rat pellets ad libitum and their BP was measured weekly. Terminally, the animals were anaesthetized and ECGs recorded using s.c. pins in a lead II configuration. The mean arterial pressure was significantly lower (p < 0.05) in the control (97 +/- 3.7 mmHg) and DOCA-salt-neem (87 +/- 3.4 mm Hg) groups than in the DOCA-salt group (115 +/- 7.1 mm Hg). PR and RR intervals and the duration of the QRS complex were shorter (p < 0.05) in the DOCA-salt group than in the control and DOCA-salt-neem groups. Amplitude of the QRS complex was increased (p < 0.05) in the DOCA-salt group compared with both the DOCA-salt-neem and the control groups. Daily administration of 20 mg/kg neem-leaf extract concurrently with DOCA-salt for 5
weeks prevented the development of hypertension and the accompanying alterations in the ECG patterns seen in DOCA-salt treated rats.\textsuperscript{[40]}

\textbf{Hibiscus sabdariffa} (Common name - Roselle)

Aqueous \textit{Hibiscus sabdariffa} petal extract was administered in renovascular hypertensive rats. Blood pressure in the hypertensive rats receiving \textit{Hibiscus sabdariffa} and sham-operated rats was similar (mean arterial pressures were 109 and 107 mmHg [\textit{Hibiscus sabdariffa} and sham-operated rats]), but lower than the pressure in those rats ingesting placebo (147 mmHg). No difference in heart rate was seen between these groups.\textsuperscript{[41]}

\textbf{Urtica dioica} (Common name - Stinging nettle)

\textit{Urtica dioica} was infused for 60 min at doses of 4 and 24 mg$^{-1}$ kg$^{-1}$ in anaesthetised rats and decreased arterial blood pressure by 17 and 43 mmHg, respectively (from 114 mmHg). The change at the highest dose being not too dissimilar to that achieved with 2 mg$^{-1}$ kg$^{-1}$ of furosemide (−31 mmHg). Concurrent increases in urinary flow and UNa were also documented. Again, the highest dose producing similar increases in urinary flow (9.1 l min$^{-1}$ versus 9.6 l min$^{-1}$ from a baseline of 1 l min$^{-1}$) and sodium excretion (+1.0 and 1.1 Eq min$^{-1}$) to that of furosemide. Increases in both parameters were seen at the lowest dose, but they were less marked (+1.2 l min$^{-1}$ and 0.2 Eq min$^{-1}$, respectively). This data would suggest that \textit{Urtica dioica}, when directly infused, has dilatatory effects on arterial tone and acts as a diuretic and natriuretic.\textsuperscript{[42]}

\textbf{Petroselinum sativum} (Common name - Parsley)

Oral administration with aqueous extract of seeds of parsley 20\% (AE) was administered in 19 anaesthetized rats. Urine was collected three times (30 minutes each) and then this material was used for sodium and potassium determinations, to evaluate the amount excreted of these ions. Blood pressure was measured by mercury manometer for 9 times. Control group did not show any differences; but AE group showed an increased of urinary flow and sodium and potassium amount excreted, and also decreased arterial pressure.\textsuperscript{[43]}

\textbf{Foeniculum vulgare} (Common name - Fennel)
The vascular effects of aqueous extracts of *Foeniculum vulgare* leaves were tested using pentobarbital-anaesthetized rats. An intravenous administration of the lyophilized boiled water extract of leaves produced a significant dose-related reduction in arterial blood pressure, without affecting the heart rate or respiratory rate. In contrast the non-boiled aqueous extract showed very little hypotensive activity. The hypotensive effect of the boiling water extract appeared not to be mediated via adrenergic, muscarinic, ganglionic or serotonergic receptors; however, histamine antagonists inhibited the hypotensive effect in a dose-related manner.\[44\]

*Cecropia pachystachya* (Common name - *Yagrumo*)

Administration of *Cecropia pachystachya* showed a lowering of steady state blood pressure with extracts obtained from neotropical and temperate regions. However, the mechanism for this lowering was not via diuresis as UV and UNa and potassium after 3 h was unchanged by *Cecropia pachystachya*.\[45\]

*Momordica charantia* (Common name - *Bittergourd*)

Aqueous extract of *Momordica charantia* was used to study the hypotensive effects in rat experimental paradigms. Acute intravenous administrations of the bitter melon extract produced dose-dependent, significant reductions in systemic arterial blood pressure and heart rates of normal and hypertensive Dahl salt-sensitive rats. The findings of this experimental animal study revealed that bitter melon extract possessed hypotensive properties and, therefore, lend pharmacological credence to folkloric, ethnomedical uses of the plant in the management and/or control hypertension in some rural African communities.\[46\]

DISCUSSION:

Medicinal plants have come to occupy a singular position in the modern medicinal system as the pharmaceutical industry is evincing special interest in using natural substances extracted from the plants or going for their synthesis. At least 7,000 medical compounds in the modern pharmacopoeia are derived from plants. This revival of interest in plant-derived drugs is mainly due to the current widespread belief that ‘Green Medicine’ is safe and more dependable than the costly synthetic drugs, many of which have adverse side effects.
Despite the increased popularity of herbal treatments, the safety and effectiveness of alternative medicines have not been scientifically proven and remain largely in the realm of unknown. Many herbs have shown positive results in-vitro, animal models or small-scale clinical trials, whereas most of the studies have proved efficacious without many side effects. The quality of the trials on herbal remedies is highly variable and many involving herbal interventions have been found wanting in quality, with many trials remaining ritualistic lacking in will to undertake exhaustive studies. Proper double-blind clinical trials are needed to determine the safety and efficacy of each plant product before they can be recommended for medical use.

CONCLUSION

Hypertension is a considered a predisposing factor for stroke, coronary heart disease, peripheral arterial disease, heart failure and end-state renal disease. Nearly one billion people are affected by hypertension worldwide and India contributes a substantial proportion to this global hypertensive population. Drugs used in the treatment cause adverse effects to health along with being costly. Greater than 26,000 times more people die from preventable medical misadventure and lack of properly regulated, prescribed and used drugs than those from dietary supplements. While treatment of hypertension with plants is cost effective, it can also prove efficacious and side effect free. This review is aimed at appraising clinical data on various medicinal plants useful for health professionals, researchers and scientists to develop plant based medicines and dietary supplements through controlled research studies, in a bid to provide succour to hypertension afflicted world community. India, China and some other countries who have the old civilizations with traditional medicinal systems, need to come forward to enlighten the world on this front so that the potential of plants in the preventive and remediing of hypertension can be fully realized.

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For Correspondence:
Nidhi Agarwal, UGC - SRF,
Food Science and Nutrition,
R.N. 158, Shanta Nikunj,
Banasthali University,
Rajasthan - 304022,
India
E-mail: agarwalnidhi86@gmail.com