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SHORT REVIEW

An Overview of the Benefits of Indian Spices for High Blood Pressure

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Abstract

The utilization of herbs, spices, and other plant components has a rich historical background in Indian medicine. In ancient and medieval economies, spices were among the most demanded resources. Although herbalists and alternative medicine practitioners have relied on plants for health and healing for decades, it is only in the last few decades that scientists have begun to investigate the medicinal properties of ordinary herbs and spices. Spices' anti-hypertensive, anti-hypercholesterolemia, anti-diabetic, and anti-inflammatory characteristics are of utmost relevance in the modern world because of the prevalence of illnesses like diabetes, cardiovascular disease, arthritis, and cancer. Throughout the Middle Ages, people employed herbs and spices for cooking, food preservation, and even medicine. In developing nations like India, where poverty and malnutrition are widespread, a better understanding of plant-derived compounds and spices' antioxidants and therapeutic effects could lower healthcare expenses. It has been postulated that food significantly impacts the onset of various human diseases, including cardiovascular disease. This manuscript looks at the research on how certain spices, such as garlic, ginger, cardamom, and cinnamon, can affect health problems like hypertension.

Keywords: Anti-inflammatory, Antioxidant, Cardiovascular Diseases, High Blood Pressure, Spices

1. Introduction

About 1.5 billion people have hypertension, making it the most common chronic and non-communicable disease worldwide. Its influence is growing rapidly, especially in nations with low per capita income. Hypertension is still poorly recognized and treated, resulting in unacceptably low rates of blood pressure management, even in wealthy countries. There has been a disappointing lack of revolutionary research in recent years, despite the many clinical investigations and trials that have been undertaken over the past four decades[1-3]. Research into alternate methods of treating hypertension and an examination of the factors underlying hypertension have seen a considerable drop. Considering this, this review looks at several herbal remedies that have shown promise in treating hypertension. Primary hypertension, which accounts for 90-95 % of all cases, is characterized by the lack of an obvious contributor to the development of hypertension. Conditions affecting the kidneys, arteries, heart, or endocrine system are the primary causes of secondary hypertension (5-10%).

Having a Systolic Blood Pressure (SBP) that is at least 140 mmHg and a Diastolic Blood Pressure (DBP) that is at least 90 mmHg (140/90 mmHg) is hypertensive. The leading cause of cardiovascular illness, arterial hypertension affects almost a quarter of the adult population worldwide. More than half of persons who have hypertension are unaware that they have it, even though the World Health Organization reports that it is the greatest cause of mortality globally owing to cardiovascular disorders. Stroke, heart attack, brain shrinkage, blindness, and renal disease are only a few of the devastating outcomes of uncontrolled high blood pressure[4,5]. Hypertension is known as a "silent killer" since most people who suffer from it do not realize they have it. More activity, weight loss, and dietary alterations, including nutritional supplements, are all important components of hypertension management.

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Obesity, insulin resistance, high alcohol intake, high salt intake, ageing, stress, sedentary lifestyle, low potassium intake and low calcium intake are the risk factors for hypertension. This review highlights a few Indian spices that could be useful in hypertension.

The management of hypertension requires a multifaceted approach, including exercise, weight loss and dietary changes that may include supplementation. Obesity, insulin resistance, excessive alcohol consumption, excessive salt consumption, ageing, stress, a sedentary lifestyle, insufficient potassium intake, and insufficient calcium intake are all risk factors for hypertension. The focus of this review is to shed light on specific Indian spices that have potential benefits in hypertension management. Compared to modern urban medicines and therapies, natural therapy is significantly more cost-effective. Natural and traditional medicines, which incorporate spices, herbs, vegetables, and fruits, are devoid of undesirable or unintended side effects, unlike allopathic treatments. These natural treatments are considered general daily health supplements that not only contribute to the cure of the primary illness but also provide soothing effects to other bodily systems. Rejuvenating and reviving the human body is one of the many benefits that holistic treatments offer. Herbal and natural therapies target the underlying problem rather than focusing solely on the indications and symptoms of the condition. Thus, helps in terminating health ailments permanently[6-9].

2. Current Scenario

Dry cough, impotence, dizziness, swollen ankles, fatigue, feeling depressed, sleeplessness, impotence, palpitations, bradycardia, constipation, loss of taste, and headaches are just some of the unwanted side effects of current antihypertensive drugs. Even though modern medicine tends to centre on allopathic treatments, many cultures still place a high value on the usage of spices and herbs. Unfortunately, not enough research has been done on the safety and efficacy of these natural therapies[10,11].

Various spices and their constituents have been shown to alleviate hypertension symptoms in traditional medical practices. Depending on the severity of the ailment, treatment may require using a single herb or a mix of herbs. Clinical studies have shown promising results in lowering blood pressure and improving heart, artery, and cardiovascular system function when specific herbal medications are used[12-14].

3. Indian Spices for Treatment of High Blood Pressure

3.1 Ajwain

Ajwain, sometimes called carom or carom seed, is a common ingredient in Indian cuisine. There is a strong aroma, and it appears to be a hybrid between fennel and cumin seeds. India and Iran are the primary producers of Ajwain seeds. Carom seeds, also known as Ajwain, are always boiled before being added to a recipe. There is evidence that thymol, a compound found in abundance in carom seeds, can block calcium channels. Ca^{2+} entry blockers cause blood artery relaxation and dilation, which reduces blood pressure by limiting calcium's ability to stimulate the contraction of heart muscle cells. The book 'Healing Spices' by Dr. Bharat mentioned that Ajwain, a spice, exhibited similar effects to the calcium channel blocker verapamil in reducing blood pressure in laboratory animals[18-22]. Furthermore, in a study conducted on rabbits, carom seed powder was found to decrease total cholesterol, LDL (bad) cholesterol, and triglyceride levels. Similarly, in a rat study, it was observed that the levels of total cholesterol, triglycerides, and LDL (bad) cholesterol were reduced, while the levels of HDL (good) cholesterol were increased[15-17]. Ajwain's image is depicted in Figure 1[18].

Figure 1. Ajwain.

3.2 Black Cumin

Nigella sativa L., more often known as black cumin seeds, have a long history of use as both a spice and

a medicinal herb in the countries of Bangladesh and India. Herbalists have variously referred to it as a miracle herb, a miraculous seed, and even "The plant from heaven". Black cumin is considered "Prophetic medicine" in Islamic belief since Prophet Mohammed (PBUH) said it could cure anything other than death[19]. There has been encouraging research into the effectiveness of black cumin seeds for treating hypertension. Black cumin seeds were reported to normalize hypertension in an angiotensin II-induced hypertensive rat model by blocking the vascular effects of angiotensin II. Additionally, 300 mg of black cumin seed extract twice daily for 28 days resulted in a minor but statistically significant reduction in blood pressure in a randomized controlled clinical trial involving elderly persons with hypertension[20,21] *Nigella Sativa* extract at a concentration of 30 mg/ml has been shown to have vasorelaxant properties, which enhance the relaxation of blood vessels. This demonstrates that the vasodilatory effects of *Nigella Sativa* extract are comparable to those of nitrite oxidant and prostacyclin.

Black cumin and thymoquinone essential oils have been shown to reduce blood pressure and heart rate through serotoninergic and muscarinic receptor pathways, respectively, according to previous research. Black cumin and thymoquinone, its active component, decreased oxidative stress by blocking calcium channels and boosting urine output, which may have contributed to a drop in blood pressure. In a study on mouse aortas, Peixoto *et al.,* also showed that thymol, another component of black cumin, had a sedative effect on mice aortas. Additionally, black cumin extract (*Nigella sativa*) has been studied for its potential to reduce preeclampsia-related increases in mean diastolic blood pressure. Previous research has shown that the essential oils of black cumin and its active component, thymoquinone, can significantly reduce blood pressure and heart rate by acting on the serotonergic and muscarinic receptor pathways. These oils have been found to lower blood pressure by lowering oxidative stress, which they do by blocking calcium channels and increasing urine production[22-26]. The black cumin image is depicted in Figure 2[27].

3.3 Cardamom

Elettaria cardamom, more often known as cardamom, is a perennial herbaceous plant that spreads via

Figure 2. Black cumin.

underground rhizomes. It is a member of the ginger family, Zingiberaceae. In addition to its culinary uses, this popular spice has also been put to good use as a medicinal herb. Essential oils and other bioactive compounds found in cardamom have been shown to have a protective effect against Cardiovascular Disease (CVD) by lowering blood pressure. Mean Arterial Blood Pressure (MAP), systolic blood pressure, and diastolic blood pressure are all reduced in pre-hypertensive (Stage 1) participants when taken as a powder (3 g). The most significant advantage of cardamom, sometimes known as the "Queen of Spices," is that it contains antioxidant characteristics that are beneficial to heart health. Cardamom is rich in fibre, which has been shown to improve cardiovascular health by reducing cholesterol levels[28-30].

Cardamom was shown to have alkaloids, flavonoids, sterols, saponins, and tannins in a phytochemical study. 1,8-cineole, terpinyl acetate, limonene, terpinolene and myrcene are only a few of the essential oils and bioactive phytochemicals found in cardamom[31]. Due to its high bioactive component content[32]. Due to cardamom's antioxidant properties, can prevent these structural modifications from occurring, resulting in reduced hypertension. Cardamom lowers aortic pressure by inhibiting Ca^{++} influx via calcium channels in the heart muscle. Indirectly suppressing the high K^{+}-induced contraction and directly blocking the Ca^{+2} channel is the way cardamom achieves this effect. Due to its diuretic properties, cardamom facilitates increased salt and potassium excretion via urination. Cardamom's cholinomimetic activity, via its action on the M_3 receptor, causes vasodilation and a reduction in blood pressure. The diuretic effect is the result of an increase

Figure 3. Cardamom.

Figure 4. Cinnamon.

in urine volume and an increase in the excretion of potassium and sodium[28-33]. The cardamom image is depicted in Figure 3[29].

3.4 Cinnamon

Most people keep cinnamon in their kitchen since it is a common native spice. Mostly employed for its flavouring properties, it has been an integral part of our diet for a long time. Cinnamon belongs to the genus *Cinnamomum*, family Lauraceae. The leaves and bark of cinnamon trees are valuable for their aromatic and flavourful properties and are often employed as a culinary spice or to produce essential oils[34].

For decades, it has been utilized in alternative medicine as a remedy for cardiovascular issues like high blood pressure. *C. cassia* was tested for its effect on ischemic heart disease in a rat model using Sprague Dawley rats. Vasorelaxant nitric oxide generation is thought to be responsible for the cardioprotective effects of cinnamaldehyde and cinnamic acid, the active components. Cinnamaldehyde, a component of cinnamon, has been linked to a vasorelaxation effect via blocking L-type calcium channels. However, the hypothesis that its impact on KATP channels in the vascular smooth muscles was responsible for the BP drop was supported by an *in vivo* trial. Although cinnamon's influence on diabetes has been studied extensively, its involvement in the management of BP has received very little attention. It lowers blood pressure because of peripheral vasodilation in dogs and guinea pigs. While the exact mechanism by which cinnamon lowers blood pressure is still unknown, a meta-analysis of three studies indicated that it considerably lowered both systolic and diastolic blood pressure readings. Cinnamon supplementation in the diet has been shown to significantly reduce systolic blood pressure in another trial with 59 participants. Consuming cinnamon as part of one's diet has been shown to boost the secretion of bile components such as cholesterol and phospholipids, without altering the bile's overall composition. In a study using rats, Sharma *et al.* discovered that a single dose (250 mg/kg body weight) of cinnamon alcoholic extract (50%) considerably reduced serum triglyceride levels and had an anti-hypercholesterolemic effect. Another study utilizing triton WR- 1339-induced hypolipidemic rats found that levels of total serum cholesterol, triglycerides, phospholipids, and low-density lipoprotein were reduced[35-39]. Figure 4 is of cinnamon[27].

3.5 Coriander

High blood pressure is a common side effect of eating too much salt. Those with high blood pressure are also cautioned to avoid spicy foods for the same reason. Spices, if used properly, may also aid in the control of blood pressure. Furthermore, many people find that by consuming strong herbs and spices like coriander, they can decrease their salt intake, which may have positive effects on heart health. Coriander, or *Coriandrum sativum* L., is a popular herb in a wide variety of culinary, medicinal, and industrial contexts. Plants are grown for their seeds (fruits) because of the essential oil, fatty acids, coumarins, flavonoids, and polyphenols they contain. Petroselinic acid and the essential oil linalool both have promising medical applications[40].

Coriander is used for stomach and heart problems in traditional medicine. Antioxidant properties have been demonstrated. The aqueous methanolic extract of the seeds (1-30 g/ml) lowers systolic, diastolic, and mean arterial blood pressure, most likely because of

Figure 5. Coriander.

Figure 6. Garlic.

the Ca^{2+} antagonist. There is evidence that coriander extract can help the body get rid of excess sodium and water by acting as a diuretic. If your blood pressure is high, this could help. Coriander has been linked in certain studies to a reduction in cholesterol levels. In a research study, rats given coriander seeds had their LDL (bad) cholesterol significantly reduced and their HDL (good) cholesterol significantly increased. Furthermore, in rat models of general anaesthesia, a crude extract of Coriandrum sativum was found to have antihypertensive effects, leading to a reduction in blood pressure due to the relaxation of arterial contractions[41-45]. Coriander is shown in a symbolic context below[27](Figure 5).

3.6 Garlic

Garlic, or *Allium sativum*, is a plant in the family Alliaceae. Throughout ancient times, people in several different cultures have used garlic (*Allium sativum*) for both its culinary and therapeutic properties. Garlic, which is already one of the most well-known natural medications, is steadily becoming more popular in the field of complementary and alternative medicine. Throughout the course of human history, garlic has been an essential component of the culinary and medical practices of a wide variety of cultures. Garlic consumption has been linked to improvements in blood pressure, cholesterol, and other cardiovascular indicators. Garlic also has antimicrobial properties[46].

Garlic contains a variety of compounds, but thiosulfinates, often known as allicin, are regarded to be the most significant active component. Garlic is one of the most popular supplements because of its capacity to combat bacteria and free radicals. This is due to the high quantities of the compound allicin that garlic contains. Garlic is one of the complementary therapies that is used the most frequently for the regulation of blood pressure, with estimates indicating that between 50 and 75 per cent of individuals who have hypertension make use of it[47-49]. Garlic's blood-pressure-lowering effects have been connected to its active sulfur components. To accomplish this, Nitric Oxide (NO) and Hydrogen Sulphide (H_2S) production is enhanced[47]. However, the most important feature is garlic's ability to block the action of the Angiotensin Converting Enzyme (ACE)[47-50]. The bulb of garlic is seen in the photograph that can be found below[51] (Figure 6).

3.7 Ginger

Ginger, also known as *Zingiber officinale* (ZO), is an herb that is consumed on a regular basis and has several medicinal applications. Both high blood pressure and heart rate can be lowered by consuming ginger due to the high potassium content of the spice. When given orally (70–140 mg/kg) or intravenously (1.75–3.5 mg/kg). The bioactive components (6)-gingerol and (6)-shogoal in ginger elicit tri-phasic blood pressure profiles, which are characterized by a rapid drop in blood pressure, an intermediate rise, and a prolonged reduction in blood pressure. A new angiotensin II type 1 receptor antagonist, (6)-gingerol, has just been identified. There is evidence that ginger can lower lipid levels, including cholesterol, triglycerides, LDL, and VLDL (VLDL). In addition to this, it blocks the activity of angiotensin-converting enzyme-1[52,53].

The plant *Zingiber officinale* includes several different cations and anions, some of which are essential for bone formation, muscular contraction, and nerve transmission. These elements include calcium, magnesium, and phosphorus. Ginger reduces blood pressure by reducing the electrical currents which go along calcium channels. These currents cause organ and artery smooth muscle tissue to become compressed. By relaxing the arterial walls, which reduces the amount

Figure 7. Ginger.

of smooth muscle contraction, blood flow is increased, and blood pressure is lowered. Ginger reduces salt intake and blood pressure[54-58]. Figure 7 depicts a ginger[59].

3.8 Fenugreek Seed (FG)

Trigonella foenum-graecum (FG) was originally from Asia and Eastern Europe, it is now widely farmed all around the world. Leaves are used as a leafy vegetable, while the seeds are used as a spice. Fenugreekine, diosgenin, neogitogenin, homoorientin, saponaretin, neogigogenin, tigogenin, fibres, flavonoids, polysaccharides, fixed oils, and the recognized alkaloids carpaine, gentianine, trigonelline, and choline are just a few of the many bioactive chemicals found in a mature FG seed. The dietary fibre content of fenugreek seeds is around 48. When consumed, dietary fibre produces a thick gel in the digestive tract, which slows down the absorption of carbohydrates and fats. 5-HT2 subtype receptors have a serotonergic antagonistic feature that has been linked to a significant reduction in hypertension in rats. Studies have indicated that persons who regularly take fenugreek had reduced cholesterol levels and, thus, lower risks of heart attack, supporting the herb's reputation for cardiovascular health advantages. Inhibiting the production of Low-Density Lipoprotein (LDL), the protein responsible for the absorption of cholesterol and triglycerides, is how fenugreek reduces total and bad cholesterol levels. Triglycerides, which are fatty deposits in the blood, are mostly to blame for cardiovascular issues, and their levels can be regulated efficiently with this supplement. The galactomannan in fenugreek is responsible for the

Figure 8. Fenugreek seed.

herb's beneficial effects on cardiovascular health. Its high potassium level might counterbalance the effects of the salt, helping you maintain a healthy heart rate and blood pressure[60-64]. Figure 8 is of fenugreek[65].

3.9 Sesame Seed

Sesamum indicum L., more commonly referred to as sesame, is the most economically significant and nutrient-rich crop in the world, according to research found[66]. It belongs to the family Pedaliaceae. Tocopherol, sesamin, sesamolin, and sesamol are some of the non-fat fatty acids and antioxidants that make up this mixture. Many pharmacological effects have been attributed to sesamin and sesaminol, the two primary phenolic components of sesame oil. Animal models of hypertension have shown that sesamin and its active metabolites can reduce blood pressure. Sesamin was suggested as an effective preventative treatment for hypertrophy and hypertension in the cardiovascular system. Saturated fat makes up 15% of a serving of sesame seeds, whereas polyunsaturated fat accounts for 41% and monounsaturated fat makes up 39%. There is some evidence that reducing cholesterol and protecting against heart disease can be accomplished by consuming more polyunsaturated and monounsaturated fats and less saturated fat. In addition, the plant compounds lignans and phytosterols found in sesame seeds may also help

Figure 9. Sesame seed.

reduce cholesterol levels. For two-month clinical trial, 38 patients with high blood lipids reduced their "bad" LDL cholesterol by 10% and their triglycerides by 8% by eating 5 tablespoons (40 grams) of hulled sesame seeds every day. Hypertension significantly raises the risk of developing cardiovascular disease, myocardial infarction, stroke, and kidney failure. Sesame seeds may be beneficial to lowering Blood Pressure (BP) since they are rich in polyunsaturated fatty acids, fibre, phytosterols, and lignans. Prospective cohort studies have linked inadequate magnesium consumption to an increased risk of developing hypertension. Additionally, recent trials show that magnesium supplementation can aid in lowering blood pressure. The high magnesium content of sesame seeds has been associated with lower blood pressure. In addition to their potential benefits for blood pressure regulation, the lignans, vitamin E, and other antioxidants found in sesame seeds may help reduce arterial plaque accumulation[66-75]. The sesame seed image is shown in Figure 9[76].

3.10 Tea

The *Camellia sinensis* plant, specifically its leaves and buds, is traditionally used to make tea. It fights infections, inflammation, cancer, diabetes, and high blood pressure. Regular tea drinking was found to considerably reduce both systolic and diastolic blood pressure, with green tea's hypotensive effect being more pronounced than that of black tea. Patients with obesity and hypertension who took 379 mg of green tea extract daily for 12 weeks saw a substantial decrease in systolic and diastolic blood pressure in a double-blind, placebo-controlled study. The catechins in tea are the primary flavonoids, and they come in four main forms: epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC), and epigallocatechin-3-gallate (EGCG). Catechins stimulate a protein channel to form in the artery-lining smooth muscle cells' membranes. Hence, the exit of potassium ions, which are positively charged, from the cells is made possible. The voltage across the membranes of nerve and muscle cells is maintained by channels that selectively allow to stay or let out negative and positive ions. These switches open and close in response to fluctuations in voltage, earning them the name "voltage gated". Catechins in green tea stimulate KCNQ5 potassium ion channels. The new study used computational modelling and modified channel protein to demonstrate that the two catechins bind to a voltage-sensing area. This binding facilitates channel opening and accelerates cellular excitation. This should reduce muscle cell "excitability" and contracting. Relaxing lowers blood pressure and dilates blood vessels. Researchers from the University of Denmark, led by Professor Abbott, measured tension in the arteries of rats to test this hypothesis. Researchers discovered that the two catechins in tea activate the KCNQ5 ion channel, causing blood vessels to dilate and relax. Some of the same researchers have found evidence that a specific protein channel is responsible for the antihypertensive effects of some herbs traditionally used in traditional medicine. Human body temperature is roughly 37 degrees Celsius, so whether you drink your tea hot or cold, you'll end up there. Consequently, the favourable antihypertensive effects of tea are activated only through consumption[77-81]. The image of green tea is shown in Figure 10[82].

Figure 10. Tea leaves.

4. Conclusion

Considering the wide variety of climates and landscapes across India, it seems to reason that the country would also have a rich variety of spices. In the ancient and medieval worlds, spices were often considered to be among the most valuable commodities available for trade. Traditional healers and herbalists have been using plant medicines for generations, but only recently have scientists started looking into the potential health benefits of spices and herbs that are more often utilized. Current conditions highlight the importance of spices' anti-proliferative, anti-hypercholesterolemic, anti-diabetic, and anti-inflammatory properties. This is because the leading causes of death in the world today are non-communicable diseases such as diabetes, heart disease, arthritis, and cancer. Spices and the active compounds that they contain could be used as potential medications for treating or preventing the health conditions in concern. Garlic, coriander, ginger, cinnamon, ajwain, black cumin, and tea are all typical spices found in Indian specialities. Within the context of this review, researchers illustrated the possible antihypertensive effects of these spices by demonstrating their ability to reduce ACE activity, block the Ca channel, and modulate the endothelium relaxing factor. This article discusses the potential significance of some spices commonly used in Indian cooking for flavour and taste in promoting cardiovascular health.

5. Discussion

Given the great range of climates and topographies of India, it makes expected that the country would stock a wide variety of spices. In ancient and medieval economies, spices were highly prized for their economic worth. For decades, doctors and herbalists have relied on plant treatments, but only recently have scientists begun looking into the potential health benefits of spices and herbs. These chemicals are widely used because of their low price, low toxicity, and lack of resistance. The antihypertensive properties of the phytochemicals discovered in the spices and their derivatives have been the subject of extensive research. The typical Indian spices of garlic, cinnamon, ginger, cardamom, coriander, fenugreek, and sesame seed all help to lower blood pressure.

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