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Role of Traditional Anti-Hypertensive Food Plants in Sustainable Dietary Approaches to Hypertension: Evidence-Based Review

Usha Sree Anandas¹, Vishnu Priya Bairi², Trisha R³

¹ Assistant Professor; ^{2,3} Postgraduate Students, Department of Nutrition and Dietetics,
St. Pious X Degree and PG College for Women, Hyderabad, India

ABSTRACT

Hypertension, or high blood pressure, is a big risk for heart and kidney problems and is still a big issue for public health. Even though medicines are important for treating hypertension, keeping blood pressure under control over time also needs good eating habits and lifestyle choices. Many traditional foods from India have gained attention because they are often eaten there and contain active compounds that may be good for heart health. This review looks at recent research on some traditional Indian foods and how they might help manage blood pressure. The foods studied are garlic, hibiscus, fenugreek, pomegranate, turmeric, cardamom, moringa, and amla. Recent reviews and studies suggest that garlic, hibiscus, pomegranate, fenugreek, and turmeric might help lower blood pressure a little, but the results are not always the same and may depend on things like how the food is used, how much is taken, how long it's used, initial blood pressure levels, and who is in the study. For moringa and amla, most of the research focuses on their benefits for the heart, metabolism, and other health aspects rather than clearly showing they lower blood pressure. Some possible reasons for this include better blood vessel function, more nitric oxide activity, and less damage from free radicals and inflammation. Overall, these traditional foods might help as part of a healthy diet, but they should not be used instead of prescribed blood pressure medicines. More research is needed to study these foods in the ways they are usually eaten, especially in diets that match local culture. Future studies should also look at long-term use, safety, how well people stick to the foods, and any effects they might have with other medicines. This research could help understand better how these traditional foods can be used in managing hypertension through diet.

Keywords: Hypertension; traditional food plants; dietary approaches; garlic; hibiscus; pomegranate; functional foods; cardiovascular health

INTRODUCTION

Hypertension is a common long-term health condition and a major risk factor for cardiovascular disease, stroke, and chronic kidney disease. Its importance as a public-health issue is not only related to how many people have the condition. Problems such as late detection, inadequate treatment, and poor long-term blood-pressure control also contribute to preventable illness. For this reason, managing hypertension involves more than prescribing medicines. A healthy diet, regular physical activity, maintaining a healthy body weight, avoiding tobacco, and other lifestyle changes are all important parts of prevention and treatment. The International Society of Hypertension recommends healthy eating, regular physical activity, and other practical lifestyle changes as part of overall blood-pressure management. Diet is especially important because eating habits affect health over many years. Plant foods are of interest in this area because some contain phytochemicals that may affect blood-vessel function, oxidative stress, and other processes involved in blood-pressure regulation. India is a useful setting for considering these foods because plants and spices have traditionally been part of everyday meals as well as traditional health practices. Ingredients such as garlic, turmeric, fenugreek, cardamom, hibiscus, pomegranate, moringa, and amla have attracted scientific attention because of their possible cardiovascular benefits. However, traditional use alone does not prove that a food can lower blood pressure. Claims about these plants need to be considered alongside evidence from clinical and scientific studies. The quality of the evidence also differs from one plant to another, so it is important to look at randomized trials and systematic reviews wherever they are available.

TRADITIONAL FOOD PLANTS WITH ANTIHYPERTENSIVE POTENTIAL

Garlic (*Allium sativum*)

Garlic is one of the commonly used culinary plants for which there is a relatively large amount of clinical research. Studies have suggested that garlic may have a useful role as an addition to a diet aimed at managing blood pressure, although evidence from studies of aged garlic preparations needs to be interpreted carefully. Compounds in garlic, particularly allicin and other sulphur-containing substances, have been studied for their possible effects on nitric oxide availability, endothelial function, and oxidative stress (Sleiman et al., 2024). It is important, however, to distinguish between eating garlic as a normal food and taking concentrated garlic preparations. Findings from supplement studies cannot automatically be applied to the amounts of garlic normally used in cooking.

Hibiscus (*Hibiscus sabdariffa*)

Hibiscus is traditionally consumed in India and in several other regions as a sour-tasting drink or infusion. In recent years, it has received attention for its possible effect on blood pressure. A systematic review and meta-analysis of clinical trials found that consuming *Hibiscus sabdariffa* was associated with a reduction in systolic blood pressure. The effect appeared to be more noticeable among people who had higher blood-pressure levels at

the beginning of the studies (Ellis et al., 2022). Although these results are encouraging, the studies did not all use the same preparation, amount, or treatment duration. Because of these differences, there is not enough evidence to recommend one standard therapeutic dose. Hibiscus contains anthocyanins and other polyphenols that may support vascular function through antioxidant and vasodilatory effects. From a dietary point of view, hibiscus could be used as a low-sugar beverage as part of a balanced diet. Its use should still be considered in the context of a person's overall dietary and clinical needs.

Fenugreek (*Trigonella foenum-graecum*)

Fenugreek seeds are widely used in Indian cooking and have a long history of use in traditional dietary practices. Compared with garlic and hibiscus, there have been fewer clinical studies specifically looking at its effect on blood pressure. A systematic review and meta-analysis of six randomized controlled trials involving 373 participants found a significant reduction in systolic blood pressure, while the overall change in diastolic blood pressure was not significant (Amini et al., 2023). Some subgroup analyses suggested that larger amounts of fenugreek and shorter intervention periods were associated with greater reductions in blood pressure. These findings are interesting, but they are not strong enough to establish a specific amount for routine dietary use. Fenugreek also contains dietary fibre and several phytochemicals, which may contribute to its wider metabolic effects. More research using the forms and quantities normally eaten as food would help clarify how much fenugreek contributes to blood-pressure management.

Pomegranate (*Punica granatum*)

Pomegranate is commonly eaten as a fruit or consumed as juice and provides a good source of polyphenolic compounds. Its possible effects on cardiovascular health have been examined in a number of clinical studies. A systematic review and meta-analysis of 14 clinical trials found that pomegranate juice was associated with a reduction in systolic blood pressure, although the results for diastolic blood pressure were less consistent (Ghaemi et al., 2023). A later systematic review and meta-analysis of 22 randomized controlled trials reported significant reductions in both systolic and diastolic blood pressure. However, the studies differed considerably from one another, which makes it difficult to apply the results equally to every form of pomegranate consumption (Bahari et al., 2024). Pomegranate can therefore be included in a diet that supports cardiovascular health. It is worth remembering that whole fruit and juice are not nutritionally identical. Whole pomegranate provides dietary fibre and retains the natural structure of the fruit, while juice generally contains less fibre. The form and amount consumed should therefore be considered when applying the research findings to everyday dietary practice.

Turmeric and Curcumin (*Curcuma longa*)

Turmeric is a familiar ingredient in Indian cooking and is regularly used in a wide range of dishes. Curcumin, one of its main bioactive compounds, has been studied extensively because of its possible cardiovascular effects. A GRADE-assessed systematic review and dose-response meta-analysis of 35 randomized controlled trials reported modest reductions in both systolic and diastolic blood pressure following curcumin or turmeric

supplementation. The review also found improvements in some measures of endothelial function (**Dehzad et al., 2024**). These findings are promising, but there is an important limitation. Most of the studies used concentrated turmeric or curcumin supplements rather than the small amounts of turmeric normally added to food. Therefore, the results cannot be used to estimate the effect of ordinary culinary use. Curcumin has also been investigated for antioxidant and anti-inflammatory properties, and improved endothelial function may be one possible pathway through which it could influence blood-pressure regulation. At present, turmeric is best considered a useful part of a varied diet rather than a treatment for hypertension. It should not replace established medical care.

Cardamom (*Elettaria cardamomum*)

Cardamom is a commonly used spice and has also been investigated for its possible effects on cardiometabolic health. Some clinical studies have looked at green cardamom supplementation in relation to blood pressure and inflammatory markers, particularly in people with metabolic health concerns. However, the clinical evidence for cardamom is much smaller than the evidence available for garlic, hibiscus, or pomegranate. Its practical value may also be broader than any direct effect on blood pressure. Because cardamom adds flavour without adding sodium, it can be useful when preparing meals with less salt. Herbs and spices used in this way may make a reduced-sodium diet easier to follow without sacrificing taste. Whether cardamom itself produces a meaningful reduction in blood pressure is still uncertain, and further research is needed before a direct antihypertensive effect can be established (**Heydarian et al, 2023**).

Moringa (*Moringa oleifera*)

Moringa leaves are widely used in Indian diets and can be eaten fresh or in powdered form. The plant has attracted considerable attention because its leaves and other parts contain a range of nutrients and bioactive compounds. A comprehensive review published in 2023 described antioxidant, anti-inflammatory, and possible cardioprotective properties of *Moringa oleifera*. However, much of the existing evidence comes from laboratory and animal studies, while research in humans remains limited (**Pareek et al., 2023**). Because of this, there is currently not enough evidence to consider moringa an established food-based treatment for hypertension. For now, moringa may be better considered for its nutritional contribution and its possible role in improving overall diet quality. Well-designed human studies using clearly defined food preparations and realistic amounts are still needed to determine whether regular consumption has a meaningful effect on blood pressure.

Amla (*Emblica officinalis* / *Phyllanthus emblica*)

Amla has been part of Indian dietary and traditional health practices for a long time. It contains a variety of nutrients and bioactive compounds and has been studied for its possible cardiovascular benefits. A systematic review and meta-analysis of nine randomized controlled trials involving 535 participants reported improvements in several cardiovascular risk markers, including LDL cholesterol, triglycerides, and high-sensitivity C-reactive protein (**Brown et al., 2023**). However, the available evidence does not show a consistent blood-pressure-lowering effect, and differences among the studies

make the findings less certain. Amla may therefore be useful as part of a nutrient-rich dietary pattern, particularly because of its possible effects on broader cardiovascular risk factors. These findings should not, however, be taken as proof that amla directly treats hypertension. More clinical research is needed to understand its specific role in blood-pressure management.

The plants discussed contain a wide range of bioactive compounds that can affect different functions in the body. Their possible influence on blood pressure is therefore likely to involve several biological processes acting together rather than a single mechanism. These processes may include improving the functioning of blood vessels, supporting nitric oxide activity, reducing oxidative stress and inflammation, and influencing the vascular and renal systems involved in blood-pressure regulation. Bioactive compounds such as the sulphur-containing compounds present in garlic, polyphenols found in hibiscus and pomegranate, and curcuminoids from turmeric have been investigated for their possible involvement in these mechanisms.

These mechanisms provide a possible explanation for how traditional food plants may contribute to blood-pressure control, but laboratory findings alone cannot establish their effectiveness in everyday human diets. Results obtained from laboratory and animal experiments should therefore be interpreted carefully, since the quantities of plant compounds used in such studies are often much greater than the amounts normally obtained from food. Similarly, results obtained using concentrated extracts may not accurately represent the effects of consuming these plants as part of traditional meals. Further research should therefore examine these foods in the forms and quantities in which they are normally consumed.

Traditional food plants may contribute to better nutrition because they can be incorporated into familiar dietary practices without requiring major changes in eating habits. Garlic, fenugreek, turmeric and cardamom are already widely used in cooking, while pomegranate, amla, hibiscus and moringa can be incorporated into a variety of foods and beverages. Since these foods are already familiar to many communities, their inclusion in healthy dietary patterns may be more practical than introducing unfamiliar foods. This familiarity may also make it easier for individuals to adopt healthier eating practices.

Dietary management of high blood pressure, however, should not depend on identifying a small number of foods as being specifically antihypertensive. Greater importance should be given to the overall quality of the diet. A healthy dietary pattern should include adequate fruits and vegetables, whole grains and legumes while limiting excessive sodium intake. Herbs and spices can be used to enhance flavour and may help reduce dependence on salt during food preparation. Fruits and vegetables can also contribute potassium, dietary fibre and other beneficial plant nutrients. In general, diets based on commonly available foods are likely to be more practical and sustainable than relying on high-dose supplements containing several plant extracts. Factors such as affordability, availability, seasonal variation, traditional cooking practices and individual food preferences should also be considered when developing dietary approaches. These

considerations are particularly relevant when planning nutrition programmes for communities. Research conducted in India should further investigate practical ways of incorporating traditional foods into local diets while maintaining both nutritional quality and cultural acceptability.

Consuming a plant as part of the normal diet is different from taking it in the form of a concentrated supplement. Many of the plants discussed are commonly eaten as foods or used as culinary spices, whereas concentrated preparations can provide substantially higher amounts of their active compounds. This difference is important when considering safety and possible interactions with medicines used to control blood pressure or other medications. Such concerns may be particularly relevant for individuals who use several supplements or herbal preparations. Traditional food plants should therefore be considered as components of a healthy dietary pattern rather than replacements for medical treatment. Individuals taking medication for hypertension should not discontinue their prescribed medicines and replace them with foods, herbs or herbal products.

The amount of safety information available also differs among the plants considered. In the case of moringa, for example, human clinical evidence remains limited. Existing reviews have highlighted the need for further research to establish appropriate doses, suitable methods of preparation and potential adverse effects before wider health recommendations can be made. Future clinical studies should also provide information on side effects and the use of other medications while assessing changes in blood pressure. Such information would help provide a clearer understanding of the safety of these dietary approaches.

The available evidence also has several limitations, including relatively small study populations, short intervention periods and differences in plant preparation, dosage and research methodology. Future studies should involve longer periods of observation and should investigate plants in the forms and quantities that are realistically consumed as foods. Research should also include diverse Indian populations so that differences in preparation practices, absorption of bioactive compounds, safety and long-term adherence to dietary interventions can be better understood.

Overall, traditional Indian foods may have a supportive role in the dietary management of high blood pressure, although the strength of evidence differs considerably between individual plants. Garlic and hibiscus currently have comparatively stronger evidence, while pomegranate, fenugreek and turmeric have produced encouraging findings. Evidence for moringa, amla and cardamom remains insufficient to establish a clear blood-pressure-lowering effect. These foods can nevertheless be included as part of a balanced dietary pattern alongside established measures such as reducing salt intake, consuming adequate fruits and vegetables and maintaining regular physical activity. They should not be regarded as alternatives to professional medical advice or prescribed treatment.

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