



## Review Article

### A CRITICAL REVIEW ON ANTI-HYPERTENSIVE ACTION OF *ALLIUM SATIVUM*

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**KEYWORDS:** Garlic, *Lashoon*, HTN, Lifestyle disorder.

#### ABSTRACT

In twenty first century we are living in an age of revolution which has significantly changed our lifestyle. Due to the rapid modernization, people are leading towards more stressful life. As a consequence, human race is suffering from various problems grouped under a common umbrella of 'Lifestyle disorders'. Hypertension is one of the widespread lifestyle disorders. About 26.4% of the world adult population in 2000 had hypertension and 29.2% were expected to have this condition by 2025. India is considered as global capital of hypertension.

Increased blood pressure i.e., hypertension has been globally acknowledged as most prevailing risk factor for life threatening cardiovascular diseases. Ayurveda is a science of life and oldest medical science as well. The principle focus of Ayurveda is on maintaining good health and adopting a healthy way of life. In spite of number of available antihypertensive drugs in modern medicine; overall percentage of patients suffering from hypertension is rising sharply. Almost 25 centuries ago, Hippocrates, the father of medicine, stated "Let food be thy medicine and let medicine be thy food".

In this article we have collected data from various researches carried out at national and International institutions on *Allium sativum* and its antihypertensive property. This review emphasizes on antihypertensive action of worldwide most commonly used food item with medicinal properties *Allium sativum* i.e., Garlic, its appropriate doses, contraindication, untoward effects and probable mode of action. From the above review we can say that appropriate use of *Allium sativum* can control hypertension up to certain extent.

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#### INTRODUCTION

Hypertension has been globally considered as most prevailing risk factor for life threatening diseases. It is also known as a silent killer. It is a major risk factor for the development of coronary artery diseases, congestive heart failure, stroke and renal disorders.<sup>1</sup> About 26.4% of the world adult population in 2000 had hypertension and 29.2% were projected to have this condition by 2025. India is labelled as global capital of hypertension.<sup>2</sup>

Hence it is need of hour to find a natural and sustaining way to deal with hypertension.

#### Aims and objectives

In spite of number of available anti-hypertensive drugs in modern medicinal science; overall percentage of patients suffering from hypertension is rising sharply. Almost 25 centuries ago, Hippocrates, the father of medicine, stated "Let food be thy medicine and let medicine be thy food".<sup>3</sup> In that context this review is a sincere attempt to put forth efficacy of *Allium sativum* in HTN. This paper also describes appropriate doses, contraindications, untoward effects and probable mode of action of *Allium sativum*.

## Material and Methods

Firstly a brief account of hypertension and *Allium sativum* is discussed in this paper. Further we have collected data from various researches carried out at national and International institutions on *Allium sativum* and its anti-hypertensive property. Probable mode of action of *Allium sativum* is also discussed based on scientific evidences.

## Literature Review

### Hypertension

Hypertension results from a variety of reasons like stress, obesity, genetic factors, over use of the salt in the diet and ageing. As we all know, hypertension is termed as a silent killer because it rarely exhibits symptoms before it damages the heart, brain or kidney.<sup>4</sup>

At present hypertension has been globally recognized as most prevalent cardiovascular disorders. It is a medical condition in which the blood pressure of the subject is elevated above 140/90 mm Hg. More than 90% of cases of hypertension are regarded as "primary hypertension" which means high blood pressure with no apparent basic medical cause.<sup>5</sup> WHO has rated hypertension as one of the most important cause of premature deaths worldwide.<sup>6</sup>

In India hypertension is accountable for the 57% of stroke deaths and also 24% of all CHD deaths.<sup>7</sup> According to an analysis of worldwide data for the global burden of hypertension, 20.6% of Indian men and 20.9% of Indian women were suffering from hypertension in 2005. The rates for hypertension are projected to go up to 22.9 and 23.6 for Indian men and women, respectively by 2025.<sup>8</sup>

A reduction of 5 mmHg in systolic B.P has been associated with a 7% reduction in all-cause mortality. This fact reveals the importance of controlling blood pressure for a disease free life.<sup>9</sup>

### Types of Hypertension

There are mainly two types of hypertension.

1. Primary (essential) hypertension (97-98%). It has no clear primary cause but appears to be the result of interplay of complex genomic and environmental factors.
2. Secondary hypertension (2-3%) is caused by a specific underlying mechanism frequently involving kidneys or endocrine system.

### Factors Affecting Blood Pressure

These include 1.Vessel Elasticity 2. Blood Volume 3.Cardiac Output and 4.Peripheral Resistance. Peripheral resistance depends upon

blood viscosity, vessel diameter and vessel length. Some other factors and conditions plays a role in development of hypertension such as smoking, overweight or obesity, lack of physical activity, excessive salt intake, alcohol consumption, stress and family history of high blood pressure.<sup>10</sup>

### Importance of controlling hypertension

Hypertension means transitory or sustained elevation of systemic arterial blood pressure to a level which is likely to cause cardiovascular damage or other adverse consequences. A reduction of 5 mmHg in systolic B.P has been associated with a 7% reduction in all-cause mortality. This fact reveals the importance of controlling blood pressure for a disease free life.<sup>11</sup>

### *Allium Sativum*

The name "*Allium sativum*" is derived from the Celtic word "all", meaning burning or stinging, and the Latin "*sativum*" means planted or cultivated. The English word garlic is derived from the Anglo-Saxon "gar-leac" or spear plant, mentioning to its flowering stalk.<sup>12</sup>In olden days in Greece, they used garlic as a diuretic, which was recorded by Hippocrates.<sup>13</sup>

It is a perennial rhizome, thought to be indigenous to Central Asia, Siberia and West of the Himalayas and has been grown in England from before 1540. It is now widely cultivated all over the world.<sup>14</sup>

*Allium sativum* i.e., garlic is a member of the *Liliaceae* family. It one of the oldest cultivated food; highly regarded all over the world.<sup>15</sup>

**Species:** *Allium sativum*

**Family:** *Liliaceae/Alliaceae/ Amaryllidaceae*

**Common Names** (Synonyms): Garlic (Eng.), *Lasun* (Hindi), *Rasonam* and *Lahsuna* (Sanskrit).<sup>16</sup>

### Composition

The composition of raw garlic is 59% water, 33% carbohydrates, 6% protein, 2% dietary fibre, and less than 1% fat.<sup>17</sup> It contains carbohydrates (arabinose, galactose), vitamins (folic acid, niacin, thiamine, Vit. C), amino acids (arginine, asparagic acid, methionine), enzymes (allinase), volatile compounds (allyl alcohol, allylthiol, allylpropyl disulphide), prostaglandins A2, D2, F2, and E2. Mn= 23.5%, Vit. B6= 17.5, Vit. C= 14.7, tryptohan= 6.2%, selenium=7.5%, calcium= 5.1%. Phosphorus= 4.5%, Cu= 4% and protein= 3.6% .<sup>18</sup>

### Dosage and dosage form

*Allium sativum* i.e., garlic supplement preparations are available in oil, extract, powder, capsules and tablet forms. It is observed that chemical composition of these preparations may

not reflect the composition of fresh garlic clove. Hence it is always desirable to take daily dose equivalent to 4g of fresh garlic cloves, which is about the size of one usual garlic clove.<sup>19</sup> Average daily dosage: fully-dried powder, 400-1200mg; fresh (air-dried) bulb, 2-5 g; garlic oil, 2-5 mg. Fully-dried powder, 400-1200mg, fresh (air-dried) bulb, 2-5 g; garlic oil, 2-5mg.<sup>20</sup>

### **Rasona in Ayurveda**

The word *Rasona* is formed by two words; *Rasa* and *Oona* i.e., 'devoid of one *Rasa Amla Rasa*' (sour).<sup>21</sup> In *Kashyapa Samhita* there is a chapter called *Lashoona Kalpa Aadhyaya*, which contains many references and systematic explanation on the origin, method of administration, benefits etc. of *Lashoona*.<sup>22</sup> In *Charaka Samhita* and in *Sushruta Samhita*, *Lashoona* is mainly advocated in *Vataja* disorders in the form of *Rasayana*.<sup>23</sup>

**Types:** According to *Kashyapa Samhita* there are two types of garlic depending upon the distribution. The one which grows in the hills i.e., is *Girija* is like a nectar used by the gods, *Vaidyas* and *Brahmins* for various accomplishments and other which grows in the plains is called as *Ksetraja*.<sup>24</sup>

### **Adverse drug reaction**<sup>25-28</sup>

Apart from the valuable medicinal properties, *Allium sativum* may also exhibit toxic effects when overdosed. Repeated and/or excessive garlic consumption may produce toxic effects. Some people are allergic to sulphur based compounds found in it. There were several reported allergic reactions to garlic; namely, contact dermatitis, asthma, rhinitis, conjunctivitis, urticarial rash, anaphylaxis and angioedema. Adverse effects may be seen when garlic is used either internally or externally.

**Internally:** It may present with upset stomach, bloating, bad breath, body odour, headache, and fatigue. In some cases loss of appetite, vertigo and allergic bronchospasm is also recorded. Due to its blood-thinning properties, people with bleeding disorders such as, Haemophilia and other platelet disorders should not use it frequently.

Too much use of *Allium sativum* can increase risk for bleeding during or after delivering a baby or while undergoing any surgical procedure.

**Externally:** A cutting sensation on the skin may occur from handling too much fresh or dried garlic. Blistering, contact dermatitis (skin rash) is also seen if applied on a delicate skin.

### **Probable mode of action**

Disorders of the heart and CVS claims more lives than any other diseases. Obstruction or clogging of the coronary arteries causes more

deaths than any other factors. The arteries, which supply the heart with blood and oxygen, become increasingly narrower as plaque builds up over time. When blood supply becomes restricted in the coronary artery that portion of the heart is deprived of oxygen and leads to heart attack. The two greatest means of heart disease are high blood pressure and high blood serum cholesterol levels; which are directly impacted by the therapeutic action of garlic. The relevant role of *Allium sativum* in coronary heart disease was observed on rabbits and found that even pre-existing atherosclerotic deposits and lesions could actually be reversed if garlic was consistently consumed.<sup>29</sup> Garlic has probably been most popularized as a complementary therapy for blood pressure control.<sup>30</sup> Red blood cells take sulphur containing molecule in *Allium sativum* called polysulphide and use them to produce hydrogen sulphide. This hydrogen sulphide in turn helps blood vessels to expand and keep our blood pressure in check.<sup>31</sup> Various mechanisms for antihypertensive effect of *Allium sativum* have been reported to include vasorelaxation through H<sub>2</sub>S production<sup>32</sup>, inhibition of angiotensin-converting enzyme in vitro<sup>33</sup>, endothelium-derived relaxing and constricting factors<sup>34</sup> and beta-adrenoceptor blocking action.<sup>35</sup>

However, there is a possibility that *Allium sativum* may act through other mechanisms especially the inhibition of the renin-angiotensin system which plays a significant role in 2K1C renovascular hypertension. Garlic has been shown to exert some blood pressure lowering effect by reduction in angiotensin converting enzyme activity and generally increasing the effects of vasodilators at same time decreasing those of the constrictors.<sup>36</sup>

### **Current research**

Modern science is trying to clear many dogmas of ancient cultures regarding garlic, defining mechanisms of action and discovering garlic's potential for disease prevention and treatment. A recent in vitro study has confirmed that, the vasoactive ability of garlic sulphur compounds whereby red blood cells convert garlic organic polysulfide into hydrogen sulphide, a known endogenous cardio-protective vascular cell signalling molecule.<sup>37</sup> A study has demonstrated that use of 2400 mg garlic tablet containing 31.2 mg alliin has high dose reduced diastolic pressure by 16 mmHg after 5 hours of administration.<sup>38</sup> Also one meta-analysis made on pooled data from 415 patients showed reduction of 7.7 mmHg diastolic pressure.<sup>39</sup>

One recent research has been conducted by C. R. Nwokocha et al, at department of basic medical

sciences, University of the West Indies, Mona campus, Kingston entitled, 'Antihypertensive properties of *Allium sativum* (garlic) on normotensive and two kidney one clip hypertensive rats'. In this study, they investigated the cardiovascular effects of aqueous garlic extracts (AGE) on normotensive and hypertensive rats using the two-kidney one-clip (2K1C) model. Mean arterial blood pressure (MAP) and heart rate (HR) were measured in normotensive and 2K1C rat models. The jugular vein was cannulated for administration of drugs. Intravenous injection of AGE (5-20 mg/kg) caused a significant ( $p < 0.05$ ) decrease in both MAP and HR in both the normotensive and 2K1C models, with more effects on normotensive than 2K1C rat model.

Dose of 20mg/kg of AGE had significantly ( $p < 0.05$ ) reduced systolic ( $16.7 \pm 2.0\%$ ), diastolic ( $26.7 \pm 5.2\%$ ), MAP ( $23.1 \pm 3.6\%$ ) and HR ( $38.4 \pm 4.3\%$ ) in normotensive rats. In 2K1C group, it has significantly ( $p < 0.05$ ) reduced systolic ( $22.2 \pm 2.1\%$ ), diastolic ( $30.6 \pm 3.2\%$ ), MAP ( $28.2 \pm 3.1\%$ ) and HR ( $45.2 \pm 3.5\%$ ) from basal levels.

These results shows that garlic at higher doses (15 and 20mg/kg) induced marked hypotension and bradycardia when injected intravenously whereas at a lower doses (5 and 10 mg/kg) it produced only a slight fall in MAP.<sup>40</sup>

## CONCLUSION

Natural products of animals and plants origin have been used by mankind for thousands of years either in the pure forms or crude extracts to treat many diseases. For health issues and issues related with life style disorders sensible use of natural products is gaining popularity. So as to deal with various pathological threats including cardiovascular complexities modern society is selecting use of natural products over synthetically prepared chemicals. Today mankind is looking towards Ayurveda in a search of an ideal and safe way to deal with hypertension. This review emphasizes on antihypertensive action of *Allium sativum*; the worldwide most commonly used food material having medicinal properties. From the above review we can say that proper use of *Allium sativum* can control hypertension up to certain extend if used judiciously.

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