



PROBABLE MECHANISM OF ACTION OF *SHUNTHI* (*ZINGIBER OFFICINALE*) ON HYPERTENSION W.R.T. VARIOUS CARDIO-VASCULAR CONDITIONS: A LITERARY REVIEW.

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ABSTRACT

Hypertension i.e., increased blood pressure is itself a cause of various cardiac and other vascular diseases like CHF, IHD, CHD, Stroke, renal failure etc. According to Ayurveda patho-physiology of Hypertension can correlated with *naantamaja kapha vhyadhi* i.e., *dhamanipratichaya*. There are many single herbal medicines that have direct action on heart and various abnormal cardiac conditions. *Shunti* (*Zingiber officinale*) is one of the herbal medicinal plant mentioned as '*Hridya*' i.e., action on heart (useful in various cardiac conditions) by *Acharya Charak* and *Sushruta*. *Shunthi* by its medicinal properties improves functions of heart and maintain elasticity of walls of blood vessels, so it is useful to maintain and cure hypertension.

Keywords: Hypertension, *Shunthi* (*Zingiber officinale*), *Dhamanipratichaya*, Cardiac conditions.

1. INTRODUCTION

Hypertension i.e., increased blood pressure is a serious medical condition that significantly increases the risk of heart, brain, kidney and other vascular diseases.¹ It is also a major cause of early death in all over world¹ and is a life-threatening condition of today's era. Blood pressure is the force exerted by circulating blood against the major blood vessels wall in the body.¹ It is written as two numbers- systolic pressure / diastolic pressure. i.e., 120/80.¹ Systolic pressure means pressure in the blood vessels during contraction of heart and diastolic blood pressure is pressure in the vessels when heart is in relaxed stage between two beats. Hypertension is diagnosed when systolic pressure is more than 140 mmHg and diastolic blood pressure is more than 90 mmHg on two different days¹. In the earlier stage, most of the patients are asymptomatic and unaware about

problem hence it also called a "silent killer." Today's sedentary life style, obesity, unhealthy diet and food, lack of exercise, stressful jobs, night shifts and consumption of tobacco, alcohol are increasing prevalence of hypertension day by day. Hypertension gradually develops in body due to various abnormal cardiovascular conditions and it is itself a cause of various cardiac and other vascular diseases like CHF, IHD, CHD, Stroke, renal failure etc.

According to Ayurveda patho-physiology of gradually developing hypertension can correlated with *naantamaja kapha vhyadhi* i.e., *dhamanipratichaya*.² Blood vessels i.e., *Sira* and *Dhmani* are made up from *Mansa*³ and *Meda*⁴ *dhatu*, and blood flowing through these vessels is a mixture of *Rasa-Rakta dhatu*⁵ along with *prakrut Kapha* and *Piita dosha*, and this flow of blood is due to force exerted by *Vyan vayu*.⁶ Abnormal increase in *Mansa* and

Meda dhatu, increases thickness of inner vessel wall, which decreases lumen of blood vessels and becomes thick and narrow which resist flow of blood (*Ras-Rakta dhatu* and *Vyan Vayu*) and increases blood pressure. Further, if this obstruction of *dhatu* and *Vata* persist longer, then *Ruksha guna* of *Vata* dries *Kapha dosha* and *Rasa-Rakta dhatu* which decreases elasticity of blood vessels and leads to atherosclerosis / hardening of blood vessels i.e., *Dhamani paratichaya*. In Ayurvedic texts and *brihatrayee*, there are many medicinal plants are mentioned as '*Hridya*' i.e., action on heart (useful in various cardiac conditions). *Shunthi* (*Zingiber officinale*) is one of the medicinal plants mentioned as '*Hridya*' by *Acharya Charak* and *Sushruta*. *Shunthi* by its medicinal properties improves functions of heart and maintain elasticity of walls of blood vessels, so it is useful to maintain and cure hypertension.

In this article various clinical and animal trials of *Shunthi* extracts on hypertension and cardiovascular conditions are reviewed. Also, chemical constituents, active principles and ayurvedic medicinal properties of *Shunthi* in terms of *Rasa*, *Veerya*, *Vipaka*, *Guna* and *Karma* are reviewed. After reviewing its ayurvedic medicinal properties and scientific clinical trials, probable mode of action of *Shunthi* on hypertension with different cardiovascular conditions is explained by Ayurvedic and modern prospective.

2. METHODS

References from Ayurvedic texts and *brihatrayees* which shows usefulness of *Shunthi* in cardiovascular conditions were collected. Medicinal properties of *Shunthi* in terms of *Rasa*, *Veerya*, *Vipaka*, *Guna* and *Karma* were reviewed. Chemical constituents and active principles of *Shunthi* were reviewed from scientific journals. Various animal and clinical trials of different extracts of *Shunthi* were reviewed from scientific journals and articles. Probable mode of action of *Shunthi* on different cardiovascular conditions is explained by both Ayurvedic and modern prospective.

3. RESULTS

3.1. Ayurvedic medicinal properties of *Shunthi*

Acharya Charak has mentioned *hridya* and *vata-shleshm vibandhahar* property of ginger (*Shunthi*) in *annapanvidhi adhyaya* of *sutrasthana*^{7,8} *Acharya Sushruta* also mentioned *Shunthi* as *hridya* in *annapanvidhi adhyaya* of *sutrasthana*.^{9,10} *Raj nighantu* and *Bhavapraksha nighantu* mentioned *vibandhahar* property of *Shunthi*.^{11,12} i.e., release obstruction in the way of *dosha* and *dhatu* viz. *rasa-rakta dhatu* and *vyana vayu* etc. *Bhavamishra* explained pharmacological properties of *Shunthi* in *Haritakyadi varga* of *Bhavaprakasha Nighantu*. He stated that *Shunthi* possess *katu-madhur rasa* (taste), *madhur vipaka* (taste after digestion) and *ushna virya*. Also, *snighdha* and *sukshma guna*. Due to these medicinal properties, *Shunthi* acts as *hridya* i.e., useful in various cardiovascular conditions and release *vibandha* (obstruction) in the ways of blood vessels.

3.2. Chemical constituents and active principles

Active ingredients present in *Shunthi* are terpenes and oleoresin called ginger oil, phenolic compounds i.e., gingerol, shogaol and lipophilic rhizome extracts are major components from terpene.^{13,14} Potentially active gingerols can be converted to shogaols, zingerone, and paradol¹³ Ginger and its all constituents- gingerol, shogaol, zingerone, paradol, flavanoids show antioxidant activity and prevent damage of macromolecules caused by the free radicals or oxidative stress. Gingerol, shogaol, zingerone also shows anti-inflammatory activity. Chief active principle gingerol shows cardio tonic activity- potent positive inotropic effect on guinea pigs isolated left atria.¹⁵

3.3. Animal and clinical trials of different extracts of *Shunthi*

Shown in Table No. 1.

4. DISCUSSION

From various animal studies, evidences



shows that *Shunthi* extract exert effects on blood pressure and heart rate directly and indirectly.¹⁶ In Guinea pig paired atria model, crude extract of *Shunthi* shows cardio-depressant effect on the rate and force of spontaneous contractions.¹⁷ In thoracic aorta model of rabbit, *Shunthi* extract relaxes vascular contraction induced by phenylephrine.¹⁷ As like to the effect of verapamil, the crude extract of *Shunthi* shows shifting of Ca^{2+} dose-response curves to the right, which confirmed Ca^{2+} channel- blocking activity of *shunthi*.¹⁷ Also, *Shunthi* extract acts on both types of calcium channels i.e. membrane-bound and the intracellular Ca^{2+} , as it shows inhibition of the phenylephrine control peaks in normal Ca^{2+} plus and Ca^{2+} free solutions.¹⁷ All these studies indicate that the *Shunthi* lowers blood pressure through blockade of voltage dependent calcium channels. In another paper, *Shunthi* extract by its PPAR agonist action, attenuate PAAC induced increase in CK-MB and LDH levelson (PAAC) model of rat.¹⁸

The probable mechanism of action of *Shunthi* can be stated from above mentioned animal and clinical trials. Calcium channel blocker action Zingiber Officinale inhibits influx of calcium ion into cell membrane which causes relaxation of blood vessels and ultimately reduces blood pressure. Inhibited entry of Ca^{+2} ions into smooth muscle walls of blood vessels causes vasodilatation and decreases blood pressure Peroxisome proliferator activated receptor (PPAR α) is expressed in tissues like the liver, kidney intestine skeletal muscles and heart^{20,21} and is primarily involved in fatty acid oxidation.²¹ Activation of these PPAR α inhibits pro-inflammatory responses of vascular smooth muscle and attenuating the development of atherosclerosis.²¹ Zingiber Officinale activates PPAR (Peroxisome proliferator activated receptor) on myocytes and vascular smooth muscles which increase oxidation of fatty acid and reduce chances of atherosclerosis and reverse cardiac hypertrophy, decreases oxidative stress.

According to Ayurveda blood vessels i.e., *Sira* and *Dhmani* are made up from

*Mansadharakala*³ and *mrudupaka* of *Meda dhatu*.⁴ RBC, WBC, Platelets, Plasma these components of blood can be correlated with *rasa* and *rakta dhatu*.⁵ This mixture *rasa* and *rakta dhatu* along with *prakrut kaph* and *pitta dosha* is continuously flowing through *sira* and *dhamani*.²² This flow of blood (*rasa-rakta dhatu*) through vessels is due to force exerted by *vyana vayu*.⁶ Abnormal increase in *mansa* and *meda dhatu* increases thickness of inner wall of blood vessel called as *dhamani upalepa*² which decreases lumen of blood vessel i.e., *dhamani atipuran*² and become thick and narrow which resist flow of blood (*rasa-rakta dhatu* and *vyana vayu*) and increases blood pressure. Further, if this obstruction persists longer, the *ruksha guna* of *vata* dries *kapha dosha* and oiliness of *mansa dhatu* (*vasa*), which decreases elasticity of blood vessels and leads to hardening of blood vessels called atherosclerosis i.e., *Dhamaniparatichaya*.

Shunthi by its *vibandhahar* property, destroy obstruction in the ways of blood and also due to its *snigdha* (unctuous) *guna* decreases *rukshata* (dryness) of *vata* and maintain elasticity of blood vessels which results in decrease in blood pressure. *Acharya Charaka* and *Sushruta* mentioned that *Shunthi* possess *Hridya* property i.e., Action on heart. *Charaka* also mentioned, *Shunthi* is useful in *vatashleshma vibandha* i.e., obstruction caused by *Kapha* and *Vata dosha*. This *vibandha* (obstruction) may occurs anywhere in the body e.g., obstruction in blood vessels, lymphatic channels, intestinal lumen etc. This obstruction further causes *vata* and *kapha* disorders. Increased blood pressure in hypertension is one of the *vata-kapha* disorders. Increased *kapha dosha* in blood causes vitiation of *rasa rakta dhatus* and obstruction in the way of blood. Dryness of *vata dosha* causes hardening of blood vessels which results in increased blood pressure. *Shunthi* by its hot potency liquefy the *kapha dosha* and its *snigdha guna* pacify dryness of *vata*, which may help to remove obstruction in the way of blood/lumen. *Snigdha guna* of *Shunthi* also improves elasticity of blood vessels which further improve endo-



thelial function and reduces hypertension.

5. CONCLUSION

- ♦ *Shunthi* reduces blood pressure and cardiac hypertrophy by activating PPAR receptors on heart and blood vessels.
- ♦ *Shunthi* reduces blood pressure by inhibiting entry of Calcium ions in to the cell. (CCB action)
- ♦ *Shunthi* reduces blood pressure by reducing obstruction of flow of blood through its *vibandha har* property.
- ♦ *Shunthi* reduces blood pressure by reducing dryness of *vata* and maintain elasticity of blood vessels though its unctuous (*snigdha*) property.

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TABLE

Table No. 1. Animal and clinical trials of different extracts of *Shunthi*

Anti-hypertensive Activity	Model	Extract / formulation	
Animal Trial	Anesthetized rats ¹⁶	Crude extract	Dose-dependent (0.3–3 mg/kg) fall in the arterial blood pressure.
	Guinea pig paired ¹⁷ atria	Crude extract	Cardio-depressant activity on the rate and force of spontaneous contractions.
	Rabbit thoracic aorta preparation ¹⁷	Crude extract	Relaxed the phenylephrine induced vascular contraction at a dose 10 times higher than that required against K-induced contraction.
			shifted the Ca ²⁺ dose-response curves to the right, similar to the effect of verapamil, confirm Ca ²⁺ channel-blocking activity.
			inhibited the phenylephrine control peaks in normal Ca ²⁺ -plus and Ca ²⁺ -free solutions, indicating that it acts at both the membrane-bound and the intracellular Ca ²⁺ channels.
	Partial abdominal aortic constriction (PAAC) model of rat ¹⁸		vasodilator effect
			significantly attenuated PAAC-induced increase in LVW/BW, LVWT, LV protein content, LV RNA concentration and collagen deposition in a dose-dependent manner
			attenuated PAAC induced increase in CK-MB and LDH levels perhaps due to PPAR agonist action
Human Trial	Healthy Humans ¹⁹	Extract	Decreases MABP induced by cardiac hypertrophy due to PAAC
			shows dose-dependent blood pressure lowering effect

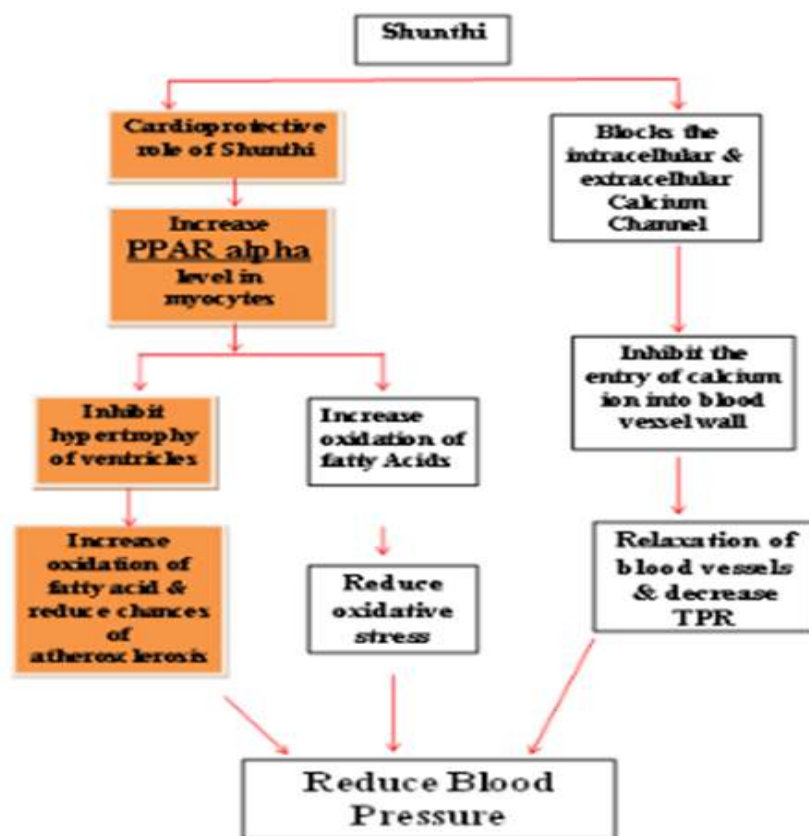


Figure No. 1. Probable mode of Action of *Shunthi*

PPAR = Peroxisome proliferator activated receptor

PPAR α is expressed predominantly in the liver, kidney and heart, and is primarily involved in fatty acid oxidation.

PPAR α activation inhibits vascular smooth muscle pro-inflammatory responses, attenuating the development of atherosclerosis.

PPAR activators are capable of reducing blood pressure and cardiac hypertrophy

Figure No. 2. Probable mode of Action of *Shunthi*

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