Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 10, December 2021: 6529 - 6539

Use Of Traditional Herbs Garlic, Ginger and Onion as Cardio Protectants

Loveneet Kaur[1]

Abstract

Medicinal plants have been used in patients with systolic hypertension, congestive heart failure, angina pectoris, cerebral insufficiency, atherosclerosis, venous insufficiency and arrhythmia since centuries. Natural products have revived interest in traditional remedies that have been used for the treatment of cardiovascular diseases. The purpose of this review is to provide information on the traditional uses of some herbal medicines that affect the cardiovascular system. Systematic literature searches were carried out and the available information on various medicinal plants traditionally used for cardiovascular disorders was collected. This review highlights the cardiovascular effects of three potent herbs i.e. Garlic (*Allim sativum*), Ginger (*Zingiber officinale)* and Onion *(Allium cepa)*. Although these plants are used for the treatment of heart disease since centuries, current research methods show that they can be utilized effectively in the treatment of cardiovascular diseases including congestive heart failure, arrhythmias, ischemic heart disease and hypertension.

Keywords: Cardiovascular, Hypertension, Herbs, Heart Diseases, Medicinal.

Introduction

Globally, the leading cause of mortality is cardiovascular diseases. India is also struggling to manage Cardiovascular Diseases (CVD) along with burden of obesity, type II diabetes and hypertension (Devasagayam et al., 2004). In India, the heart disease occurred 10 to 15 years earlier that in west. $1/5^{th}$ of the total deaths are caused due to coronary heart diseases. These diseases are more prevalent in urban areas than in rural area. In Indians, lower selenium and low vitamin C level is the important reason for increase in risk of CVD. Level of vitamin C lowers due to destruction during prolonged cooking (Hughes & Ong, 1998)

CVD are associated with the development of arthrosclerosis and is related to an inflammatory response. The response is provoked by bad diet habits, obesity, sedentary lifestyle and stress (Arcusa et al., 2021) The word “neutraceuticals” is used for any ingredients or food with a health benefit beyond the traditional nutritional effects; further, it has an effective impact on health, physical or cognitive state (Ma et al., 2021). In this paper, three plants are discussed that are used to prevent and cure cardiovascular diseases. These are Garlic, Ginger and Onion.

[1] Department of Botany & Environment Science, Mata Gujri College, Fatehgarh Sahib,

loveneet.bhangu@gmail.com

Ginger (*Zingiber officinale*) is a medicinal plant with beneficial health effects that has been widely used in food and pharmaceutical products. Crude extract of ginger is cardioprotective due to its antiplatelet, antihypertensive, and cardiotonic effects (Fakhri et al., 2021).
Garlic is reported to inhibit the pathogenesis of cardiovascular disease, to prevent cancer and other chronic diseases that are caused due to aging (Rahman, 2003)
The study by Galeone et al. (2009), suggested that a diet rich in onions have a favourable effect on the risk of acute myocardial infection; therefore, these vegetables could be useful in a CVD- diet that is cardioprotectant (Galeone et al., 2009)

1. *Allium sativum*

Common Name : Lasun (A. Singh et al., 2018)]

Classification

Kingdom: Plantae
Division: Tracheophyta
Class : Magnoliopsida
Order: Asparagales
Family: Amaryllidaceae
Genus: *Allium*
Species: *sativum*

Part used: Root (Ray & Saini, 2021)

Botanical Description of the plant

According to Stearn, 1992, *Allium* has estimated 750 species but according to (Friesen et al., 2006) the genus *Allium* have approximately 780 species (Stavělíková, 2008) The genus has 6 subgenera. Garlic is a plant with long, flat, grass like leaves and a papery hood around the flowers. The greenish white or pink flowers are found grouped together at the end of a long stalk. The stalk arises directly from the flowers bulb, which is the part of the plant used as food and medicine. The root is used for the treatment of cardiovascular diseases.

Role of Garlic

The risk of cardiovascular diseases is growing at a very fast rate throughout the world (Gersh et al., 2010; Qidwai & Ashfaq, 2013). CVD is recognised as a leading cause of mortality in the world. It cause more than 80% of death in low and middle-income countries. Garlic has played an important role in the diet and the medicines in the human history (Qidwai & Ashfaq, 2013). For more than 5000 years, Allium sativum has been recognised as a potential plant. The many products of garlic are consumed as food and spices by the various cultures for centuries (Gómez-Arbeláez et al., 2013; Qidwai & Ashfaq, 2013). Garlic has a history of use in Egypt as a medical treatment for a variety of ailments. (Gómez-Arbeláez et al., 2013; Qidwai & Ashfaq, 2013; Sterling & Eagling, 1997).
The garlic is also known for its beneficial effects to prevent the various aspects of cardiovascular diseases that include hypertension and dyslipidemia (Qidwai & Ashfaq, 2013; Steiner & Li, 2001)

Fig. 1Garlic

Composition of Garlic

Many forms of garlic are available. Among them raw garlic and aqueous extract preparation are most commonly used.

Polysaccharide present in Garlic

Garlic contains 33 sulphur compound, 17 amino acids, enzymes and minerals such as selenin (Londhe et al., 2011). The principal bioactive compound of garlic is Allicin. Sulphur is the main constituent of Allicin. On the breakdown it gives odour to the garlic. It is produced on chopping or crushing the raw garlic. The enzyme allinase activates on chopping or crushing the garlic .

The garlic powder is produced by dehydration. Composition of raw garlic and garlic powder is the same. The enzyme allinase is inactivated when the temperature exceed 60°C. The other sulphur containing compounds are allyl methyl thiosulfonate, 1-propenyl allyl thiosulphonate a, diallyl sulfide, diallyl disulphide, diallyl trisulfide. Garlic contain approximate 0.9% g-glutamystein and up to 1.8% Alliin [W. Qidwai et al.,2013; Lawson 1998].

Chemical composition of garlic bulb (Grela & Klebaniuk, 2007)

s.no.	Chemical components	Value g/kg
1.	Dry matter	312.4
2.	Crude protein	61.43
3.	Crude ash	14.82
4.	Ether extract	6.53
5.	Allin	11.12
6.	Allicin	4.91
7.	Crude fiber	8.61

Garlic and cardiovascular disease prevention

The leading global cause of mortality and morbidity is cardiovascular disease. The use of garlic to prevent cardiovascular disease has received attention recently (Ray & Saini, 2021).

The garlic is the centre of attraction in the last few years due to its potential role in the prevention of various cardiovascular disease (Bakhsh & Chughtai, 1984; Mader, 1990; Qidwai & Ashfaq, 2013).

The evidences from various studies suggest that garlic works through various mechanisms such as decreasing blood pressure and serum cholesterol levels, preventing platelet aggregation, and boosting fibrinolytic antioxidant activity to achieve the favourable results. Majority of the reported studies have positive response. However some of the contradictory studies (Arora et al., 1981; Khoo & Aziz, 2009; Qidwai & Ashfaq, 2013) have made a question mark on the role of garlic in prevention of cardiovascular diseases.

Dyslipidaemia is regarded as a major risk factor that is responsible for the development of atherosclerosis and cardiovascular diseases (Qidwai & Ashfaq, 2013), low high density lipoprotein cholesterol (HDL-C) and high triglycerides.

The cholesterol that is present in the beta-lipoprotein (LDL) and pre- beta-lipoprotein gets deposited into the blood vessels. While alpha lipoprotein (HDL) plays an important role to reduce the serum cholesterol (Qidwai & Ashfaq, 2013; D. K. Singh & Singh, 2008).

From the literature, the considerable evidences support the invaluable role of garlic to treat the hypercholesterolemia by the inhibition of cholesterol biosynthesis in the liver and through the inhibition of oxidation of low density lipoprotein (Qidwai & Ashfaq, 2013; Sumiyoshi, 1997).

Hypertension is an another risk factor for cardiovascular diseases. At present, it affects almost 1 billion people in the world and it is expected to increase the number to 1.6 billions by 2025 (Kearney et al., 2005; Qidwai & Ashfaq, 2013) .

The regular consumption of garlic has shown some association with the control of blood pressure as the blood pressure is the major cause of heart attacks and strokes. The blood pressure control properties of garlic that are related to the production of hydrogen sulphide (Benavides et al., 2007; Qidwai & Ashfaq, 2013) and the content of allicin that is liberated from allin and enzyme allinase (Banerjee et al., 2003; Qidwai & Ashfaq, 2013) that is thought to have vasodilation and inhibitory effects on angiotensin II. Many people utilise garlic as a remedy for the control of blood pressure in the world.

According to a survey, in the world, about 29 % of the people use garlic to control their blood pressure (Osamor & Owumi, 2010). The higher level of cholesterol enhances the formation of atherosclerotic plaques. These plaques are the risk factors for the heart attacks and strokes (Borek, 2006). The "Aged Garlic Extract" (Rahman) is a product of garlic. It is used to reduce blood pressure, inhibit the production of prostaglandin that is involved in inflammation and lower homocysteine (Borek, 2006).

Use

Experimental and clinical studies proved that *Allium sativum* produced the hypotensive effects. It induced significant decrease in systolic and diastolic blood pressure (Al-Qattan et al., 1999; Al-Snafi, 2017; Ali et al., 2000; Aqel et al., 1991; Fallon et al., 1998; Silagy & Neil, 1994).

2. *Zingiber officinale*

Common name: Ginger

Classification (Mohammad & Hamed, 2012)

Kingdom: Plantae
Class: Magnoliopsida
Order: Zingiberales
Family: Zingiberaceae
Genus: *Zingiber*
species: *Z. officinale*

Part used: Root, Whole plant

Botanical description

Ginger is a species of family Zingiberaceae. Ginger posses perennial tuberous or rhizomatous roots. The plant has pseudo-stem. It is 60 to 90 cm tall. The leaves are dark green in colour (Mohammad & Hamed, 2012). The stalks of ginger are covered with flat sheaths. They may be taken off stalk. The stem also bears 8 to 12 distinct leaves. The leaves are alternative, long or flat stalkless blades are also present. Leaves are 10 to 21 cm in length and 2 to 2.5cm wide. The flowers are small and colour of flowers is pale- yellow. The anthers are coronate, long and horn shaped (Mohammad & Hamed, 2012). A three celled ovary is present that is oval shaped. The plant is cultivated all over India, Taiwan, Bangladesh, Jamaica and Nigeria. The plant grows in warm climates (Mohammad & Hamed, 2012; Schauenberg & Paris, 1977).

Fig. 2. Ginger

Chemical composition of ginger

S.no.	Components	Value
1.	Zingiberene	163.2
2.	Curcumene	124.2
3.	Susquiphellandrene	114.0
4.	Famesene	65.1
5.	Beta-phellandrene	60.1
6.	Beta-bisabolene	42.3
7.	Eucalyptol	24.8

8.	Acoradiene	30.0
9.	Camphene	29.2

In ginger, the active ingredients are thought to be present in volatile oil. It comprises almost 1 to 3 % of its weight. The major ingredients of ginger oil are sesquiterpenes like zingiberene, bisapolene, and zingiberol (Connell & Sutherland, 1969; Mohammad & Hamed, 2012; Yoshikawa et al., 1993). The odour and flavour is caused by the mixture of shogaols, zingerone and gingerols. The main pungent principle is [6]-Gingerol (1-[4'-hydroxy-3,-methoxyphenyl]-5-hydroxy-3-decanone). Some amount of other sesquiterpenes such as bisabolene, beta-sesquiphellandrene and farnesene and monoterpenoids fraction such as cineol, beta-phelladrene and citral have been identified (Mohammad & Hamed, 2012).

Role of *Zingiber officinale* in prevention of cardiovascular diseases

A series of studies show that the bioactive components present in ginger like gingerol and shogaol protect against the cardiovascular diseases (Capewell et al., 2010; Nethravathi R. et al., 2021). As hypertention is a risk factor for cardiovascular diseases, it can be prevented by antihypertensive medications, through herbal therapy such as ginger (Gong et al., 1989; Nethravathi R. et al., 2021).

Uses

Ethanolic extract at a dose of 0.1g/kg body wt /day for 75 day results in decreased serum cholesterol & infarct size & grade atherosclerotic lesion (Nethravathi R. et al., 2021).

3. *Allium cepa*

Common name: Onion

Classification

Kingdom: Plantae

Division: Magnoliophyta

Class: Liliopsida

Order: Asparagales

Family: Amaryllidaceae

Genus: Allium

Species: cepa

Part used: Onion bulb

Botanical description

Onion is a member of family Amaryllidaceae. The plant of onion is either biannual or perennial. The plants has tubular leaves, bulb and shallow adventitious fibrous roots (Pareek et al., 2017; Ranjitkar, 2003). The length of stem is 100 to 200 cm. , inflorescence is of umbel type. The bulb of onion is flat, globular, oblong in shape. There are usually three colours of onion bulbs: white, red and yellow (Fritsch, 2005; Pareek et al., 2017). The diameter of edible bulb is upto 10 cm (Pareek et al., 2017).

Fig. 3. Onion

Chemical composition of *Allium cepa*

The onion bulb is a good source of (+)-S-alk(en)yl-L-cysteine sulfoxide and gamma-glutamyl peptide. They both accounts for above 70% of total sulphur present in onion (L. D. Lawson, 1998; Pareek et al., 2017). The three non- volatile and odorless alk(en)yl cysteine sulfoxides are S-methyl cysteine sulfoxide (methiin), S-trans-prop-1-enyl cysteine sulfoxide (isoalliin) and S-propyl cysteine sulfoxide (propiin). Other than these the proximates, vitamins, minerals, lipids, amino acids are also present in onion.

Peroximates present in onion

S.no.	Components	Mean Value per g/kg
1.	Water	891.1g
2.	Protein	11g
3.	Ash	3.5g
4.	Fiber	17g
5.	Carbohydrates	3.4g
6.	Sugar total	42.4g
7.	Dextrose	19.7g
8.	Sucrose	9.9g
9.	Fructose	12.9g
10.	Energy	40 kcal
11.	lipids	1g

Role of *Allium cepa* in prevention of cardiovascular diseases

The major factors of cardiovascular diseases are elevated blood cholesterol and triglycerides levels that includes LDL cholesterol, increased platelet activity, diabetes, hypertension and obesity (Corzo-Martínez & Villamiel, 2012). According to the study of Galeone et al., 2009, *Allium cepa* has been described to have hypoglycemic, hypolipidemic and antithrombotic effects. Therefore, it could be helpful in diet used to prevent cardiovascular diseases (Corzo-Martínez & Villamiel, 2012).

Uses

In (Babu & Srinivasan, 1999) observed that the dietary intake of onion for 8 weeks produced a remarkable hypolipidemic effect besides hypoglycemic influence in diabetic rats. It has been reported that the long-term absorption of natural flavonoids, like, quercetin, is very useful in prevention of advanced glycation of collagens, which cause the development of cardiovascular complications in patients with diabetes (Pareek et al., 2017).

Discussion and Conclusion

This review highlights the cardiovascular effects of three potent traditional botanicals viz. Garlic, Onion and Ginger. Although these plants have been used in the treatment of cardiac disease for hundreds of years, present research methods show that how these can be utilized effectively in the treatment of Cardiovascular Diseases including ischaemic heart disease, arrhythmias, congestive heart failure and hypertension. The unique chemical constituents present in these plants provide beneficial effects by different modes of action.

Suggestions

The effects of these botanicals have proved to be effective in animal trails. In order to establish a cause and effect relationship between molecular characteristics and the role of Garlic, Ginger and Onion, active ingredients in the prevention and treatment of CVD, the proposed in vitro, in vivo, and animal models need be further validated in human investigations, so that these herbs can be used more effectively in the treatment of Cardiovascular diseases.

References

1. Al-Qattan, K., Alnaqeeb, M., & Ali, M. (1999). The antihypertensive effect of garlic (Allium sativum) in the rat two-kidney–one-clip Goldblatt model. *Journal of ethnopharmacology, 66*(2), 217-222.
2. Al-Snafi, A. E. (2017). Medicinal plants for prevention and treatment of cardiovascular diseases-A review. *Respiration, 23*, 25.
3. Ali, M., Al-Qattan, K., Al-Enezi, F., Khanafer, R., & Mustafa, T. (2000). Effect of allicin from garlic powder on serum lipids and blood pressure in rats fed with a high cholesterol diet. *Prostaglandins, Leukotrienes Essential Fatty Acids 62*(4), 253-259.
4. Aqel, M., Gharaibah, M., & Salhab, A. (1991). Direct relaxant effects of garlic juice on smooth and cardiac muscles. *Journal of ethnopharmacology, 33*(1-2), 13-19.
5. Arcusa, R., Carrillo, J. Á., Xandri-Martínez, R., Cerdá, B., Villaño, D., Marhuenda, J., & Zafrilla, M. P. (2021). Effects of a fruit and vegetable-based nutraceutical on biomarkers of inflammation and oxidative status in the plasma of a healthy population: a placebo-controlled, double-blind, and randomized clinical trial. *Molecules, 26*(12), 3604.
6. Arora, R. C., Arora, S., & Gupta, R. K. (1981). The long-term use of garlic in ischemic heart disease An appraisal. *Atherosclerosis, 40*(2), 175-179.
7. Babu, P. S., & Srinivasan, K. (1999). Renal lesions in streptozotocin-induced diabetic rats maintained on onion and capsaicin containing diets. *The Journal of nutritional biochemistry, 10*(8), 477-483.

8. Bakhsh, R., & Chughtai, M. (1984). Influence of garlic on serum cholesterol, serum triglycerides, serum total lipids and serum glucose in human subjects. *Food/Nahrung, 28*(2), 159-163.
9. Banerjee, S., Mukherjee, P. K., & Maulik, S. (2003). Garlic as an antioxidant: the good, the bad and the ugly. *Phytotherapy Research: An International Journal Devoted to Pharmacological Toxicological Evaluation of Natural Product Derivatives 17*(2), 97-106.
10. Benavides, G. A., Squadrito, G. L., Mills, R. W., Patel, H. D., Isbell, T. S., Patel, R. P., . . . Kraus, D. W. (2007). Hydrogen sulfide mediates the vasoactivity of garlic. *Proceedings of the National Academy of Sciences, 104*(46), 17977-17982.
11. Borek, C. (2006). Garlic reduces dementia and heart-disease risk. *The Journal of nutrition, 136*(3), 810S-812S.
12. Capewell, S., Ford, E. S., Croft, J. B., Critchley, J. A., Greenlund, K. J., & Labarthe, D. R. (2010). Cardiovascular risk factor trends and potential for reducing coronary heart disease mortality in the United States of America. *Bulletin of the World Health Organization, 88*, 120-130.
13. Connell, D., & Sutherland, M. (1969). A re-examination of gingerol, shogaol, and zingerone, the pungent principles of ginger (Zingiber officinale Roscoe). *Australian journal of chemistry, 22*(5), 1033-1043.
14. Corzo-Martínez, M., & Villamiel, M. (2012). An overview on bioactivity of onion. *Onion Consumption Health. 1ª Ed. Nueva York: Nova Science Publishers, Inc* 1-48.
15. Devasagayam, T., Tilak, J., Boloor, K., Sane, K. S., Ghaskadbi, S. S., & Lele, R. (2004). Free radicals and antioxidants in human health: current status and future prospects. *Japi, 52*(794804), 4.
16. Fakhri, S., Patra, J. K., Das, S. K., Das, G., Majnooni, M. B., & Farzaei, M. H. (2021). Ginger and heart health: from mechanisms to therapeutics. *Current Molecular Pharmacology, 14*(6), 943-959.
17. Fallon, M. B., Abrams, G. A., Abdel-Razek, T. T., Dai, J., Chen, S.-J., Chen, Y.-F., . . . Ku, D. D. (1998). Garlic prevents hypoxic pulmonary hypertension in rats. *American Journal of Physiology-Lung Cellular and Molecular Physiology 275*(2), L283-L287.
18. Friesen, N., Fritsch, R. M., & Blattner, F. R. (2006). Phylogeny and new intrageneric classification of Allium (Alliaceae) based on nuclear ribosomal DNA ITS sequences. *Aliso: A Journal of Systematic Floristic Botany 22*(1), 372-395.
19. Fritsch, R. M. (2005). Herkunft, taxonomie und geschichte von Allium. In *Zwiebelanbau, Handbuchfür Praxis und Wissenschaft* (Vol. 10, pp. 15-37): Agrimedia.
20. Galeone, C., Tavani, A., Pelucchi, C., Negri, E., & La Vecchia, C. (2009). Allium vegetable intake and risk of acute myocardial infarction in Italy. *European journal of nutrition, 48*(2), 120-123.
21. Gersh, B. J., Sliwa, K., Mayosi, B. M., & Yusuf, S. (2010). Novel therapeutic concepts the epidemic of cardiovascular disease in the developing world: global implications. *European heart journal, 31*(6), 642-648.
22. Gómez-Arbeláez, D., Lahera, V., Oubiña, P., Valero-Muñoz, M., De las Heras, N., Rodríguez, Y., . . . López-Jaramillo, P. (2013). Aged garlic extract improves adiponectin

levels in subjects with metabolic syndrome: a double-blind, placebo-controlled, randomized, crossover study. *Mediators of inflammation, 2013*.

23. Gong, Q., Wang, S., Gan, C., & Zhong. (1989). A clinical study on the treatment of acute upper digestive tract hemorrhage with wen-she decoction. *Chinese Journal of Modern Developments in Traditional Medicine, 9*(5), 272-273, 260.
24. Grela, E. R., & Klebaniuk, R. (2007). Chemical composition of garlic preparation and its utilization in piglet diets. *Medycyna Weterynaryjna, 63*(7), 792-795.
25. Hughes, K., & Ong, C.-N. (1998). Vitamins, selenium, iron, and coronary heart disease risk in Indians, Malays, and Chinese in Singapore. *Journal of Epidemiology Community Health 52*(3), 181-185.
26. Kearney, P. M., Whelton, M., Reynolds, K., Muntner, P., Whelton, P. K., & He, J. (2005). Global burden of hypertension: analysis of worldwide data. *The lancet, 365*(9455), 217-223.
27. Khoo, Y., & Aziz, Z. (2009). Garlic supplementation and serum cholesterol: a meta-analysis. *Journal of clinical pharmacy therapeutics 34*(2), 133-145.
28. Lawson, L. (1996). The composition and chemistry of garlic cloves and processed garlic. *Garlic: The science and therapeutic applications of Allium sativum L. and related species*, 37-109.
29. Lawson, L. D. (1998). Garlic: a review of its medicinal effects and indicated active compounds. *Blood, 179*, 62.
30. Ma, R.-H., Ni, Z.-J., Zhu, Y.-Y., Thakur, K., Zhang, F., Zhang, Y.-Y., . . . Wei, Z.-J. (2021). A recent update on the multifaceted health benefits associated with ginger and its bioactive components. *Food Function 12*(2), 519-542.
31. Mader, F. (1990). Treatment of hyperlipidaemia with garlic-powder tablets. Evidence from the German Association of General Practitioners' multicentric placebo-controlled double-blind study. *Arzneimittel-Forschung, 40*(10), 1111-1116.
32. Mohammad, S. M., & Hamed, H. K. (2012). Ginger (Zingiber officinale): A review. *Journal of Medicinal Plants Research, 6*(26), 4255-4258.
33. Nethravathi R., Manasa R., Rajeshwari J., Shekhara Naik R., & Shivananjappa, M. (2021). Cardioprotective effects of ginger (Zingiber officinale). *Southeast Asian Journal of Health Professional, 4*(1), 1-5.
34. Osamor, P. E., & Owumi, B. E. (2010). Complementary and alternative medicine in the management of hypertension in an urban Nigerian community. *BMC complementary alternative medicine 10*(1), 1-9.
35. Pareek, S., Sagar, N. A., Sharma, S., & Kumar, V. (2017). Onion (Allium cepa L.). *Fruit and vegetable phytochemicals: Chemistry human health 2*, 1145-1162.
36. Qidwai, W., & Ashfaq, T. (2013). Role of garlic usage in cardiovascular disease prevention: an evidence-based approach. *Evidence-Based Complementary Alternative Medicine 2013*.
37. Rahman, K. (2003). Garlic and aging: new insights into an old remedy. *Ageing research reviewss, 2*(1), 39-56.
38. Ranjitkar, H. D. (2003). Onion (Allium cepa L.). In A. Kumar (Ed.), *A Handbook of Practical Botany*. Kathmandu.

39. Ray, S., & Saini, M. K. (2021). Cure and prevention of cardiovascular diseases: herbs for heart. *Clinical Phytoscience, 7*(1), 1-10.
40. Schauenberg, P., & Paris, F. (1977). *Guide to medicinal plants*: Keats Pub.
41. Silagy, C. A., & Neil, H. (1994). A meta-analysis of the effect of garlic on blood pressure. *Journal of hypertensions, 12*(4), 463-468.
42. Singh, A., Rani, R., & Sharma, M. (2018). *Medicinal herbs of Punjab (India).* Paper presented at the Biol. Forum.
43. Singh, D. K., & Singh, V. K. (2008). Pharmacological Effects of Allium Sativum L.(Garlic. *Annual Review of Biomedical Sciences, 10*, 6-26.
44. Stavělíková, H. (2008). Morphological characteristics of garlic (Allium sativum L.) genetic resources collection–Information. *European heart journal, 123*(116,220), 114,040.
45. Steiner, M., & Li, W. (2001). Aged garlic extract, a modulator of cardiovascular risk factors: a dose-finding study on the effects of AGE on platelet functions. *The Journal of nutrition, 131*(3), 980S-984S.
46. Sterling, S. J., & Eagling, D. R. (1997). *Agronomics and allicin yield of Australian grown garlic (Allium sativum).* Paper presented at the II International Symposium on Edible Alliaceae 555.
47. Sumiyoshi, H. (1997). New pharmacological activities of garlic and its constituents. *Nihon yakurigaku zasshi. Folia pharmacologica Japonica, 110*, 93P-97P.
48. Yoshikawa, M., Hatakeyama, S., Chatani, N., Nishino, Y., & Yamahara, J. (1993). Qualitative and quantitative analysis of bioactive principles in Zingiberis Rhizoma by means of high performance liquid chromatography and gas liquid chromatography. On the evaluation of Zingiberis Rhizoma and chemical change of constituents during Zingiberis Rhizoma processing. *Yakugaku Zasshi: Journal of the Pharmaceutical Society of Japan, 113*(4), 307-315.