



INTERNATIONAL JOURNAL
OF
PHYTOPHARMACY RESEARCH
www.phytopharmacyresearch.com

PHYTOCHEMICAL AND PHARMACOLOGICAL REVIEW ON RASONA (*ALLIUM SATIVUM* LINN.): A POTENTIAL HERB

Satyapal Singh^{1*}, Rajendra Prasad², N. P. Rai³

¹Research scholar, ²Associate professor, ³Professor & Head, Department of Kayachikitsa, Faculty of Ayurveda, IMS, BHU, Varanasi, India – 221005.

ABSTRACT

Rasona (*Allium sativum* Linn.) commonly known as 'garlic' has been used safely since ancient time as both food and medicine. It is a rich source of several phytochemicals and recognised to have significant & wide range of biological activities. The active constituent of garlic includes several sulphur containing compounds (principally thiosulfinate) which, are rapidly absorbed, transformed and metabolized. Thiosulfinate, volatile sulphur compound is responsible for its pungent smell and different biological action. Since centuries garlic has been used traditionally for the management of different disorders. In Ayurveda the garlic is considered as 'Rasayana', an important class of drugs reputed to promote health & longevity and therefore, it can be used for the prevention as well as for the management of different disorders. In the United States and Western Europe, garlic is one of the most popular remedies used to reduce various risks associated with cardiovascular disease. Several clinical & experimental studies validated its potential uses in the pathological conditions related to the cardiovascular system, respiratory system, genito-urinary system, gastrointestinal system, hematopoietic system and skin. Garlic can be used in different forms & preparations viz. tablets, capsules, inhalation, beverages, alcohol, macerated in water, fried, cooked in oil, raw, roasted etc.

Keywords: Rasona, Rasayana, Pharmacological action, Life style, Phytochemical.

INTRODUCTION

Rasona is one among the important drugs used in the Ayurvedic system of medicine. It is considered best among the *Vatashamaka* drugs by Acharya Vagbhat [1]. *Rasona* is considered as *Rasayan* in ayurveda. *Rasayan* are very important for promoting health and longevity as described in Ayurveda. Various studies on *Rasayana* drugs validated their action such as immunomodulatory, adaptogenic, antioxidant, nootropic and antistress [2].

Rasona is an annual herb native to Central Asia, but due to its widespread use as a medicine, it is cultivated in almost all continents. Various culture used different variety of garlic depending upon their ecological productivity. There are two common species of garlic namely *Allium sativum* and *Allium tuberosum*. *Sativum* species of garlic is commonly used in most part of India and *tuberosum* species is used commonly in north-east India, south-east Asia and china. The part used is, garlic bulb that contain a wide variety of active ingredients with medicinal properties. The properties are based primarily on the large amount of sulphur compounds.

Properties

As per the traditional use in Ayurveda, *Rasona* has suggested to have following properties [3].

- *Ras* : *Madhur, Lavana, Katu, Tikta* and *Kashaya*.
- *Guna* : *Snigdha, Tikshna, Guru, Pichhila* and *Sar*.
- *Vipaka* : *Katu*
- *Veerya* : *Ushna*.
- *Doshkarma*: *Vata-Kapha Shamak* and *Pitta Prakopak*.

Traditional Use

Traditionally in Ayurveda, *Rasona* has used for promotion of health as well as for the management of wide range of disorders including *Kushtha Roga* (skin disorders), *Vat-Kaphaj Roga*, *Agnimandhya* (impaired digestive power), *Aruchi* (anorexia), *Ajeerna* (indigestion), *Vibandha* (constipation), *Shoola* (as analgesic), *Krimi Roga* (worm infestation), *Jeernakasa* (chronic cough), *Shwas Roga* (*asthma*), *Rajayakshma* (tuberculosis), *Gradhrasi* (sciatica), *Sandhivata* (osteo-arthritis), generalised weakness etc.[3] Acharya Vagbhat mentioned that excess use of *Rasona* *Vitiata Rakta* and *Pitta Dosha*. It

is specially indicated for the management of *Vataja* disorders, *Gulma*, *Kushtha*, *Kilasa* and *Krimiroga* [4,5,6].

The important formulations of *Rasona* include *Lasunadi Vati* & *Rasona Pinda*, which are very common in clinical practice. Acharya Kashyap specially emphasized on different properties and therapeutic uses of *Rasona* and described in detail [7].

Garlic is known as 'da suan' in Chinese traditional medicine. It is considered a warm bitter herb with particular effects on large intestine and spleen. It is used to lower blood pressure, in parasitic infections, in food poisoning and in tumours. It is also used as mild anticoagulant. [8,9]

Arabians has used garlic traditionally to treat abdominal pain, infantile colic, diarrhoea, diabetes mellitus, eye infections, dandruff and tuberculosis. African herbalists used garlic to treat respiratory infections and helminthic infections. Many African families used garlic oil drops to treat childhood ear infection. Several folk traditions recommended garlic to induce abortion. The European scientific cooperative on phytotherapy recommended garlic for the prevention of atherosclerosis, to manage elevated blood lipids, to improve circulation in patients with peripheral arterial vascular disease and to treat upper respiratory tract infections [10].

Onward Second World War, garlic has been reputed as 'Russian penicillin' due to its major use in world war-2 in which antibiotics were shorted in supply. American physicians recommended garlic inhalation for the treatment of tuberculosis in 1800s. Louis Pasteur demonstrated antiseptic activity of garlic in 1858 and Albert Swe has also been used it to treat dysentery in Africa [11].

Chemical Composition (Biochemistry)

Rasona (*Allium sativum*) contains 33 sulphur compound, 17 amino acids, several enzymes and minerals such as selenium etc. It contains higher concentration of sulphur compounds than other *Allium* species. The sulphur compounds are responsible for its pungent odour and therapeutic action. Dried powdered garlic contain at least 1 % alliin (S-allyl cysteine sulfoxide). One of the most biological active compounds, allicin (diallyl thiosulfonates or diallyl disulfide), does not exist in garlic until it is crushed or cut. Injury to the garlic bulb activates the enzyme allinase which metabolise aliin to allicin. Allicin is further metabolized into vinylidithines. This breakdown occurs within hours at room temperature and in minutes during cooking. The first chemical isolated from garlic was Allicin, which is responsible for its antimicrobial effects against many bacteria, viruses, fungi and parasites. Garlic oil, aged garlic and steam distilled garlic do not contain significant amount of alliin or allicin but instead contains various products of allicin transformation. Fresh garlic or garlic powder is considered as most potent than other forms or preparations [12,13,14,15].

Garlic is also a rich source of highly bioavailable selenium, which is thought to responsible for its antioxidant and cancer preventive effect [16-18].

List of potentially active constituents

The active constituents from *Rasona* can be grouped into following [10]

- **Sulphur compounds**

Alliin, allicin, ajoene, allylpropyl disulphide, diallyl trisulfide, S-allylcysteine, vinylidithines, S-allyl mercaptocysteine etc.

- **Enzymes**

Allinase, peroxidase, myrosinase etc.

- **Amino acids**

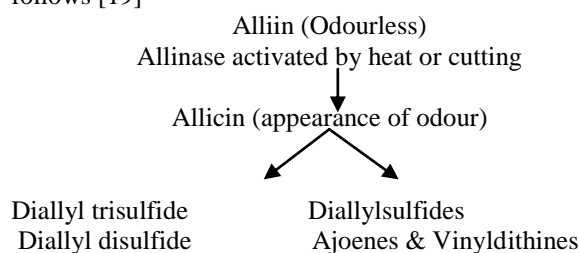
Arginine etc.

- **Minerals**

Selenium, germanium, tellurium and other trace minerals.

Alliin metabolism

The alliin metabolism can be summarized as follows [19]



PHARMACOLOGY

Rasona was reported to enhance the synthesis of nitric oxide, which is responsible for its anti-hypertensive effect. The property is retained in heat treated and aged garlic products [20-23]. Allicin and ajoene were reported to reduce nitrite accumulation in the atherosclerotic plaques and in hypoxic tissues by inhibiting inducible nitric oxide synthase in macrophages [24-26]. In rats, alliin is well absorbed orally and reaches to its peak within 10 minutes and completely excreted within 6 hours. Allicin and vinylidithines are absorbed slowly attaining their maximum concentration within 30 to 120 minutes and persist inside the body upto 6 days [27]. In rats, mice and dogs, S-allyl cystein is well absorbed orally (98-100 %) [28].

Aged garlic extract and its constituent S-allyl cystein have been found to protect vascular endothelial cells from injury caused by oxidised LDL [29]. Some other constituents have been shown to inhibit copper induced oxidative modification of low density lipoprotein [30]. Diallyl disulfide and diallyl trisulfide from *Rasona* are responsible for its lipid lowering effect via inhibition of HMG CoA reductase and or others enzymes [31-34]. Some studies suggested other mechanism which includes increased loss of bile salts in faeces and mobilisation of tissue lipids in circulation, as garlic has profound effect on postprandial hyperlipidaemia [35-36]. Some study demonstrated reduction in vascular tissue lipids, fatty streak formation and atherosclerotic plaque size via the reduction in lipoprotein oxidation [37-42].

PHARMACOLOGICAL ACTION

Several clinical and experimental studies on *Rasona* validated its wide range of action. Some of them are tabulated below.

Table 1. Showing some important pharmacological action of *Rasona* (*Allium sativum*)

S.N.	Pharmacological action	Reference No.
1	Lipid lowering	43-46
2	Cardio-protective	47-50
3	Anti-carcinogenic	51-53
4	Immunomodulatory	54-56
5	Anti-allergic	57-58
6	Anti-hypertensive	59-60
7	Anti-diabetic	61-63
8	Hepatoprotective	64-66
9	Anti-oxidant	67-69
10	Anti-bacterial	70-73
11	Neuroprotective	74-75

DOSAGE

Dose of garlic is determined depending upon part or forms used. Dose of some common forms are as follows [76,77].

- Bolus of *Kand* (Bulb): 3 – 6 gm/day
- Oil of *Kand* (Bulb) : 1 – 2 drops/day
- Enteric coated tablets of garlic powder : 600-800 mg/day

DRUG INTERACTION

Following drug interaction have been reported with garlic [78].

- Garlic may increase the effect of diuretics and may cause excess diuresis.
- Garlic may increase the risk of bleeding/potentiate the effect of warfarin therapy.

CONTRAINDICATIONS

Use of *Rasona* has contraindicated in following conditions [79-81].

- Should not be used by patients on oral anticoagulant and or antiplatelet therapy.
- Breast feeding mother (it can pass into breast milk and cause colic in infants).
- Pregnant women (being *Ushna* and *Tikshna*, it may cause uterine contraction followed by bleeding).
- *Pitta Prakrati* individual.
- Allergic reactions and contact dermatitis.
- Acharya Kashyapa has contraindicated *Rasona* in *Agnimandhya* (impaired digestion), child, *Kamala* (jaundice), *Atisar* (diarrhoea), acute exacerbation of *Shwas Roga* (*asthma*), following *Vaman* (therapeutic emesis), *Virechan* (therapeutic purgation) and *Asthapan Basti* (therapeutic enema).

DISCUSSION

The use of plant based medicines is rapidly increasing as they help in promotion of physical and

mental health and offers no adverse effects. *Rasona* is one among the important herbs has been used in variety of traditional systems specially Ayurvedic system of medicine. In Ayurveda *Rasona* has been used in the prevention as well as in the management of wide range of disorders which include *Vataja* disorders, *Gulma*, *Kushtha*, *Kilasa* and *Krimiroga* etc.

Rasona is a well-known *Rasayana* in Ayurveda. *Rasayana* remedies act essentially on nutrition dynamics and rejuvenate both the body and psyche. Thus, they are reputed to promote physical health, mental health and longevity. In the present era the incidence of diseases like hypertension, diabetes mellitus, psoriasis, etc. is rapidly increasing as a result of disturbed lifestyle. The stress is considered a major culprit in the manifestation and or exacerbation of such type of disorders. Several clinical and experimental studies on *Rasona* validated its wide range of pharmacological effect which includes immunomodulatory, anti-diabetic, anti-hypertensive, anti-oxidant, cardio-protective, anti-stress effect etc. Therefore, *Rasona* plays an important role in the prevention as well as in the management of such type of disorders.

CONCLUSION

In the present era altered immunity and psychosocial stress play an important role in the pathogenesis of lifestyle related disorders. *Rasayanas* as described in Ayurveda nourishes the body, boosts immunity and help to keep the body and mind in best of health. Therefore, being *Rasayana*, *Rasona* is very helpful in the prevention and management of such type of disorders. The present review facilitates to gain necessary information about the enormous pharmacological activities of *Rasona*, which would motivate and provide lead to researchers for further exploration of pharmacological activities.

REFERENCES

1. Vagbhata, Ashtanga Hridaya Sangraha, reprint, Chaukhambha Sanskrita Pratisthan, Varanasi, 2003, 1212.
2. Singh S, Tripathi JS, Rai NP. A Review of Pharmacodynamic Properties of 'Nishadi Vati' - A Herbomineral Ayurvedic Formulation. *IJPRS*, 3(2), 2014, 849-868.
3. P.V. Sharma, dravyaguna vigyan, reprint, Chaukhambha bharti academy, Varanasi, 2003, 72.
4. Agnivesha, Charaka, Dridhabal. Charak Samhita, reprint, Chaukhambha bharti academy, Varanasi, 2005: 546.
5. Sushruta, sushruta samhita, 14th edition, chaukhambha Sanskrit sansthan, Varanasi, 2003, 204.

6. Vagbhata, Ashtanga Hridaya Sangraha, reprint, Chaukhambha Sanskrita Pratisthan, Varanasi, 2003, 110.
7. Kashyapa, Kashyapa Samhita, reprint, Chaukhambha bhaarti academy, Varansi, 2005, 174.
8. Rivlin RS. Historical perspective on the use of garlic. *J Nutr.*, 131(3s), 2001, 951S-954S.
9. Minyi C. Anticancer Medicinal Herbs, Hunan Science and Technology Publishing House, Hunan, 1992, 308.
10. Kathi J. Kemper, MD, MPH. The Longwood Herbal Task Force. Garlic (*Allium sativum*). <http://www.longwoodherbal.org/garlic/garlic.pdf> - assessed on 16/04/2015 & 26/02/2015.
11. Tyler VE. Herbs of choice: the therapeutic use of phytochemicals. 16th ed., Pharmaceutical Products Press, New York, 1994, 209.
12. Block E. The chemistry of garlic and onions. *Sci Am*, 252, 1985, 114-9.
13. Blania G, Spangenberg B. Formation of allicin from dried garlic (*Allium sativum*): a simple HPTLC method for simultaneous determination of allicin and ajoene in dried garlic and garlic preparations. *Planta Med*, 57, 1991, 371-5.
14. Lawson LD, Wang ZJ, Hughes BG. Identification and HPLC quantitation of the sulfides and dialk(en)yl thiosulfinates in commercial garlic products. *Planta Med*, 57, 1991, 363-70.
15. Miething H. HPLC-Analysis of the volatile oil of garlic bulbs. *Phytother Res*, 2, 1988,149-51.
16. Ip C, Lisk DJ. Bioavailability of selenium from selenium-enriched garlic. *Nutr Cancer*, 20, 1993,129-37.
17. Ip C, Lisk DJ. Efficacy of cancer prevention by high-selenium garlic is primarily dependent on the action of selenium. *Carcinogenesis*, 16, 1995, 2649-52.
18. Ip C, Lisk DJ. Modulation of phase I and phase II xenobiotic-metabolizing enzymes by selenium-enriched garlic in rats. *Nutr Cancer*, 28, 1997, 184-8.
19. Robbers JE, Tyler VE. Tyler's Herbs of choice: the therapeutic use of phytochemicals. New York: Haworth Herbal Press. 10, 1999, 287.
20. Das I, Khan NS, Sooranna SR. Potent activation of nitric oxide synthase by garlic: a basis for its therapeutic applications. *Curr Med Res Opin*, 13, 1995, 257-63.
21. Das I, Hirani J, Sooranna S. Arginine is not responsible for the activation of nitric oxide synthase by garlic. *J Ethnopharmacol*, 53, 1996, 5-9.
22. Fallon MB, Abrams GA, Abdel-Razek TT, et al. Garlic prevents hypoxic pulmonary hypertension in rats. *Am J Physiol*, 275, 1998, L283-7.
23. Maslin DJ, Brown CA, Das I, Zhang XH. Nitric oxide--a mediator of the effects of garlic? *Biochem Soc Trans*, 25, 1997, 408S.
24. Dirsch VM, Kiemer AK, Wagner H, Vollmar AM. Effect of allicin and ajoene, two compounds of garlic, on inducible nitric oxide synthase. *Atherosclerosis*, 139, 1998, 333-9.
25. Ide N, Lau BH. Aged garlic extract attenuates intracellular oxidative stress. *Phytomedicine*, 6, 1999, 125-31.
26. Numagami Y, Sato S, Ohnishi ST. Attenuation of rat ischemic brain damage by aged garlic extracts: a possible protecting mechanism as antioxidants. *Neurochem Int*, 29, 1996, 135-43.
27. Lachmann G, Lorenz D, Radeck W, Steiper M. The pharmacokinetics of the S35 labeled garlic constituents alliin, allicin and vinylthiine. *Arzneimittelforschung*, 44, 1994, 734-43.
28. Nagae S, Ushijima M, Hatono S, et al. Pharmacokinetics of the garlic compound S-allylcysteine. *Planta Med*, 60, 1994, 214-7.
29. Ide N, Lau BH. Garlic compounds protect vascular endothelial cells from oxidized low density lipoprotein-induced injury. *J Pharm Pharmacol*, 49(9), 1997, 908-911.
30. Ide N, Nelson AB, Lau BH. Aged garlic extract and its constituents inhibit Cu²⁺-induced oxidative modification of low density lipoprotein. *Planta Med*, 63, 1997, 263-264.
31. Yeh YY, Liu L. Cholesterol-lowering effect of garlic extracts and organosulfur compounds: human and animal studies. *J Nutr*, 131(3s), 2001, 989S-993S.
32. Chi M, Koh ET, Stewart TJ. Effects of garlic on lipid metabolism in rats fed cholesterol or lard. *J Nutr*, 112(2), 1982, 241-248.
33. Yeh YY, Yeh SM. Garlic reduces plasma lipids by inhibiting hepatic cholesterol and triacylglycerol synthesis. *Lipids*, 29(3), 1994, 189-193.
34. Chi MS. Effects of garlic products on lipid metabolism in cholesterol-fed rats (41494). *Proc Soc Exper Biol Med*, 171, 1982, 174-178.
35. Bordia A, Verma SK, Srivastava KC. Effect of garlic (*Allium sativum*) on blood lipids, blood sugar, fibrinogen and fibrinolytic activity in patients with coronary artery disease. *Prostaglandins Leukot Essent Fatty Acids*, 58(4), 1998, 257-263.
36. Bordia A, Bansal HC. Letter: Essential oil of garlic in prevention of atherosclerosis. *Lancet*, 2 (7844), 1973, 1491-1492.
37. Orekhov A, Tertov V. In vitro effect of garlic powder extract on lipid content in normal and atherosclerotic human aortic cells. *Lipids*, 32, 1997, 1055-1060.
38. Kiesewetter H. Long-term effect of garlic powder tablets on the development of plaque formation in the carotid branches of both femoral arteries - a preliminary report. *Eur J Clin Res*, 8, 1996, 34-35.
39. Campbell JH, Efendy JL, Smith NJ, Campbell GR. Molecular basis by which garlic suppresses atherosclerosis. *J Nutr*, 131(3s), 2001, 1006S-1009S.

40. Efendy JL, Simmons DL, Campbell GR, Campbell JH. The effect of the aged garlic extract, 'Kyolic', on the development of experimental atherosclerosis. *Atherosclerosis*, 132(1), 1997, 37-42.
41. Ide N, Nelson AB, and Lau BH. Aged garlic extract and its constituents inhibit Cu²⁺ -induced oxidative modification of low density lipoprotein. *Planta Med*, 63, 1997, 263-264.
42. Phelps S, Harris WS. Garlic supplementation and lipoprotein oxidation susceptibility. *Lipids*, 28 (5), 1993, 475-477.
43. Stevinson C, Pittler MH, Ernst E. Garlic for treating hypercholesterolemia. A meta-analysis of randomized clinical trials. *Ann Intern Med*, 133(6), 2000, 420-429.
44. Van Doorn MB, Espirito Santo SM, Meijer P, et al. Effect of garlic powder on C-reactive protein and plasma lipids in overweight and smoking subjects. *Am J Clin Nutr*, 84(6), 2006, 1324-1329.
45. Yeh YY, Yeh SM. Garlic reduces plasma lipids by inhibiting hepatic cholesterol and triacylglycerol synthesis. *Lipids*, 29(3), 1994, 189-193.
46. Sumioka I, Hayama M, Shimokawa Y, Shiraishi S, Tokunaga A. Lipid-lowering effect of monascus garlic fermented extract (MGFE) in hyperlipidemic subjects. *Hiroshima J Med Sci*, 55(2), 2006, 59-64.
47. Koscielny J, Klussendorf D, Latza R, et al. The antiatherosclerotic effect of *Allium sativum*. *Atherosclerosis*, 144, 1999, 237-249.
48. Budoff, M. J., et al. Inhibiting progression of coronary calcification using Aged Garlic Extract in patients receiving statin therapy: a preliminary study. *Prev Med*, 39(5), 2004, 985-991.
49. Ide N, Lau BH. Garlic compounds protect vascular endothelial cells from oxidized low density lipoprotein-induced injury. *J Pharm Pharmacol*, 49 (9), 1997, 908-911.
50. Durak İ, Öztürk HS, Olcay E, et al. Effects of garlic extract supplementation on blood lipid and antioxidant parameters and atherosclerotic plaque formation process in cholesterol-fed rabbits. *J Herbal Pharmacother*, 2(2), 2002, 19-32.
51. Amagase, H., et al. Aged Garlic Extract may inhibit the proliferation of Breast Cancer cells. *Carcinogenesis*, 14, 1993, 1627-1631.
52. Matsuura, N., et al. Aged garlic extract inhibits angiogenesis and proliferation of colorectal carcinoma cells. *Journal of Nutrition*, 136(3), 2006, 842S-846S.
53. Arunkumar, A., et al. Growth suppressing effect of garlic compound diallyl disulfide on prostate cancer cell line (PC-3) in vitro. *Biol Pharm Bull*, 28(4), 2005, 740-743.
54. Kyo E, Uda N, Kasuga S, Itakura Y. Immunomodulatory effects of aged garlic extract. *J Nutr*, 131(3s), 2001, 1075S-9S.
55. Chandrashekar PM, Prashanth KV, Venkatesh YP. Isolation, structural elucidation and immunomodulatory activity of fructans from aged garlic extract. *Phytochemistry*, 72(2-3), 2011, 255-64.
56. Hassan ZM, Yaraee R, Zare N, Ghazanfari T, Sarraf Nejad AH, Nazori B. Immunomodulatory effect of R10 fraction of garlic extract on natural killer activity. *Int Immunopharmacol*, 3(10-11), 2003, 1483-9.
57. Zare, A., et al. Purified aged garlic extract modulates allergic airway inflammation in BALB/c mice. *Iran J Allergy Asthma Immunol*, 7(3), 2008, 133-141.
58. Ghazanfari T, Hassan ZM, Ebrahimi M. Immunomodulatory activity of a protein isolated from garlic extract on delayed type hypersensitivity. *Int Immunopharmacol.*, 2(11), 2002, 1541-9.
59. Harauma, A., et al. Aged garlic extract improves blood pressure in spontaneously hypertensive rats more safely than raw garlic. *Journal of Nutrition*, 136(3 Supplement), 2006, 769S-773S.
60. Pantoja CV, Chiang LC, Norris BC, Concha JB. Diuretic, natriuretic and hypotensive effects produced by *Allium sativum* (garlic) in anaesthetized dogs. *J Ethnopharmacol.*, 31, 1991, 325-31.
61. Yelmar Yogesh Dhondiram et. al. Upshayatmaka effect of Rasona (*Allium sativum* Linn.) in Madhumeha with special reference to blood sugar level. *Int. J. Res. Ayurveda Pharm*, 4(2), 2013, 212-215.
62. Thomson, M., et al. Including garlic in the diet may help lower blood glucose, cholesterol, and triglycerides. *Journal of Nutrition*, 136(3), 2006, 800S-802S.
63. Ahmad MS, Ahmed N. Antiglycation properties of aged garlic extract: possible role in prevention of diabetic complications. *J Nutr.*, 136(3 Suppl), 2006, 796S-799S.
64. L. N. Ebenyi, U. A. Ibiyam, P. M. Aja. Effects of alliums sativum extract on paracetamol induced hepatotoxicity in albino rats. *Int. Res. J. Biochem. Bioinform*, 2(5), 2012, 93-97.
65. Wang BH, Zuzel KA, Rahman K, Billington D. Treatment with aged garlic extract protects against bromobenzene toxicity to precision cut rat liver slices. *Toxicology*, 132, 1999, 215-25.
66. Wang EJ, Li Y, Lin M, et al. Protective effects of garlic and related organosulfur compounds on acetaminophen-induced hepatotoxicity in mice. *Toxicol Appl Pharmacol*, 136, 1996, 146-54.
67. Benkeblia N. Free-radical scavenging capacity and antioxidant properties of some selected onions (*Allium cepa* L.) and garlic (*Allium sativum* L.) extracts. *Brazilian Archives of Biology and Technology*, 48, 2005, 753-759.
68. Rojas P, Serrano-García N, Medina-Campos ON, Pedraza-Chaverri J, Maldonado PD, Ruiz-Sánchez E. S-Allylcysteine, a garlic compound, protects against oxidative stress in 1-methyl-4-phenylpyridinium induced parkinsonism in mice. *J Nutr Biochem*, 22(10), 2011, 937-44.
69. Borek C. Antioxidant health effects of aged garlic extract. *J Nutr*, 131, 2001, 1010-5S.

70. EL Mahmood Muhammad Abubakar. Efficacy of crude extracts of garlic (*Allium sativum* Linn.) against nosocomial *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Pseudomonas aeruginosa*. *Journal of Medicinal Plants Research*, 3(4), 2009, 179-185.
71. Benkeblia N. Antimicrobial activity of essential oil extracts of various onions (*Allium cepa*) and garlic (*Allium sativum*). *Lebensmittel-Wissenschaft und-Technologie*, 37, 2004, 263-268.
72. Cañizares P, Gracia I, Gómez LA, Martín de Argila C, Boixeda D, García A, de Rafael L. Allyl-thiosulfinates, the bacteriostatic compounds of garlic against *Helicobacter pylori*. *Biotechnology Progress*, 20, 2004, 397-401.
73. Adebolu, T. T., Adeoye, O. O. and Oyetayo, V. O. Effect of garlic (*Allium sativum*) on *Salmonella typhi* infection, gastrointestinal flora and hematological parameters of albino rats. *African Journal of Biotechnology*, 10(35), 2011, 6804-6808.
74. Peng, Q., et al. Neuroprotective effect of garlic compounds in amyloid- β peptide-induced apoptosis in vitro. *Med Sci Monit*, 8(8), 2002, BR328-337.
75. Dua JS, Prasad DN, Tripathi AC and Gupta R. Role of traditional medicine in Neuropsychopharmacology. *Asian J Pharm Clin Res*, 2(2), 2009, 72-76.
76. P.V. Sharma, dravyaguna vigyan, Chaukhambha bharti academy, Varanasi, 2003, 77.
77. Ashraf R, Aamir K, Shaikh AR, Ahmed T. Effects of garlic on dyslipidemia in patients with type 2 diabetes mellitus. *J Ayub Med Coll Abbottabad*, 17 (3), 2005, 60-64.
78. Ernst E. Cardiovascular effects of garlic (*Allium sativum*): a review. *Pharmatherapeutica*, 5, 1987, 83-9.
79. Asero R, Mistrello G, Roncarolo D, Antoniotti PL, Falagiani P. A case of garlic allergy. *J Allergy Clin Immunol*, 101, 1998, 427-8.
80. Lembo G, Balato N, Patruno C, Auricchio L, Ayala F. Allergic contact dermatitis due to garlic (*Allium sativum*). *Contact Dermatitis*, 25, 1991, 330-1.
81. Sharma PV. Dravyaguna vigyan, reprint, Chaukhambha bharti academy, Varanasi, 2003, 74.