

# GARLIC EFFECTS ON GASTRIC ACID AND PEPSIN SECRETIONS IN RAT

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## ABSTRACT

**Introduction:** Garlic (*Allium Satiyum*) is a plant widely used in traditional medicine. Its anti-hypertensive, lipid lowering, oxidative activities, anti-viral, anti-bacterial, anti-fungal properties have been proven. It has a tonic effects on stomach but its effects on gastric secretion is not known.

**Propose of study:** To investigate the effect of garlic extract on basal and pentagastrin stimulated gastric acid and secretions in rats.

**Hypothesis:** Garlic extract stimulates gastric gland causing increased production/release of basal acid and pepsin level. Garlic acid mask pentagastrin stimulatory response and causes decrease in acid and pepsin secretary level.

**Method of Testing:** Two group of wistar rats (12 in each group) weighing 200-250gm were used. The first group was considered as study group and received garlic extract, the second group was considered as control. Animal were anesthetized with an intraperitoneal injection of sodium thiopental (50mg/kg) and after tracheotomy and ligation of cervical esophagus, laparotomy was done. A cannula was placed in stomach through duodenum and 1ml of normal saline was injected in to stomach in each group. After 30 minutes their stomach were emptied. Next in study group 1ml garlic extract (100mg/kg) and in control group 1ml normal saline were introduced into stomach. After 15 min 1ml normal saline was injected in both groups and immediately all gastric contents were collected in both groups by wash out technique and basal secretions of acid and pepsin were measured. In order to measure pentagastrin effect on gastric secretions, 25 micro gram/kg pentagastrin was used in both groups.

**Result:** Basal acid secretion in study group showed a significant increase in comparison to control group with P value <0.001 ( $15.6 \pm 1.63$  micro mol/15 min in case group vs  $4.1 \pm 0.36$  micro mol/15min). Basal pepsin secretion in study group showed a significant increase in comparison to control group with P value <0.001 ( $7.27 \pm 0.15$  micro gm/15min in case group vs  $5.62 \pm 0.12$  micro gm/15min). On pentagastrin stimulation, acid secretion in control group showed a significant increase in comparison to its basal value with P value <0.001 ( $10.14 \pm 1.34$  micro mol/15min in vs  $4.1 \pm 0.36$  micro mol/15min) but its value decreases in study group ( $10.5 \pm 1.89$  micro mol/15min basal value). In control group following pentagastrin stimulation, pepsin secretion showed a significant increase in comparison to its basal value with P value <0.001 ( $6.9 \pm 0.12$  micro gm/15min in case group vs  $5.62 \pm 0.12$  micro gm/15min), while in study group there is no significant difference from its basal value ( $7.03 \pm 0.03$  micro gm/15min vs  $7.27 \pm 0.15$  micro gm/15min basal value).

**Conclusion:** Garlic extract have a stimulatory effect on acid and pepsin secretion. The possible mechanism cloud be: a) Increase in parietal or chief cell activities due to Ach release. b) Due to its stimulatory effect on histamine release. However, on pentagastrin stimulation acid secretion decline and pepsin level remain same in study group and this effect may be due to rapid emptying of gastric acid stock or due to inhibition of gastric activity because of attachment of some components in garlic extracts to gastrin receptors on parietal cells.

**KEY WORDS:** Garlic, Acid secretions, Pepsin secretions, Rats.

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## INTRODUCTION

There has been a significant increase in using herbal drugs for preventive and therapeutic purposes throughout the world especially in Iran. Garlic (*Allium Sativum*) is a plant

widely used in traditional medicine.<sup>1</sup> The beneficial effects of garlic on decreasing blood pressure,<sup>1</sup> triglyceride level<sup>2</sup> and oxidative activities, its anticarcinogenic, antibacterial,<sup>3,4</sup> antifungal<sup>1,5,6</sup> and antiviral<sup>7</sup> properties have been proved. Garlic can also increase white cells,<sup>3</sup> inhibits platelet aggregation<sup>8</sup> and enhances fibrinolytic activity.<sup>9</sup>

According to Kathi and co-workers, garlic contains active chemical components such as allein, allicin, ajoen, allylpropyl disulfide, alliinase, peroxides and fibronase and elements such as selenium, germanium, tellurium and others.<sup>10</sup> Considering these components, its several effects on various body organs and activities is not surprising. In traditional medicine texts, there are some points about the tonic effects of garlic on stomach, but we could not find any study on its effect on gastric secretion. In the present study, the effect of acute consumption of garlic on basal and pentagastrin-stimulated gastric acid and pepsin secretions has been investigated in rats.

## MATERIALS AND METHODS

In this study, two groups (n=12) of Wistar rats weighing 200-250 gr were used. The animals were kept in 12-hour light/dark cycles in the animal room of Kerman Medical School and had access to normal food and drinking water. Twenty-four hours prior to the experiments, the animals were transferred to isolated cages, where they were deprived of food but had access to water.<sup>11,12</sup> In order to eliminate the effect of day/night rhythms, the experiments were started regularly every morning at 8:00 a.m. At first, the animals were anaesthetized by an intraperitoneal injection of 50-mg/kg sodium thiopental,<sup>11</sup> and then tracheostomy was performed.<sup>11,13</sup> Cervical esophagus was tied in order to prevent the transferring of gastric secretions into the oral cavity through the esophagus. In the next step, laparotomy was done and a polyethylene cannula with 3 mm diameter was placed in the stomach via the duodenum, and the probable remaining gastric secretions were extracted. Then, 1ml normal saline (37°C) was injected into the

stomach, and after waiting for 30 minutes to give the animals time for relief from the operation stress, their stomachs were emptied. Next, in the control group 1 ml normal saline and in the garlic group 1 ml garlic extract 100mg/kg<sup>14,15</sup> was introduced into the stomach. After 15 minutes, 1 ml normal saline was injected, and immediately all the gastric content was collected by the wash-out technique<sup>16</sup> for measuring basal secretion. This action was done in order to eliminate the effect of gastric wall distention due to the high amount of the injected liquid. From the collected secretion, 1ml was used for acid titration and the remaining was used for the measurement of pepsin by the Anson method.<sup>17</sup> In order to measure pentagastrin-stimulated acid and pepsin secretions, pentagastrin 25 µg/kg (IP) was used. The obtained data were recorded as Mean ± SE, and for the analysis and comparison of the data, t-test and paired t-test were used. P<0.05 was considered significant.

## RESULTS

Basal acid secretion in the garlic group showed a significant increase in comparison to the control group ( $15.6 \pm 1.63 \mu\text{mol}/15\text{min}$  vs.  $4.1 \pm 0.36 \mu\text{mol}/15\text{min}$ ,  $p < 0.001$ ). In the control group, pentagastrin-stimulated acid secretion had a significant increase in comparison to the basal state ( $10.14 \pm 1.34 \mu\text{mol}/15\text{min}$  vs.  $4.1 \pm 0.36 \mu\text{mol}/15\text{min}$ ,  $p < 0.001$ ). Although pentagastrin is an increasing factor on acid secretion, in the garlic group pentagastrin-stimulated acid secretion had a significant decline in comparison to the basal level ( $10.5 \pm 1.89 \mu\text{mol}/15\text{min}$  vs.  $15.6 \pm 1.63 \mu\text{mol}/15\text{min}$ ,  $p < 0.001$ ). The obtained results are shown in Fig-1.

Basal pepsin secretion in the garlic group showed a significant increase in comparison to the control group ( $7.27 \pm 0.15 \mu\text{g}/15\text{min}$  vs.  $5.62 \pm 0.12 \mu\text{g}/15\text{min}$ ,  $p < 0.001$ ). In the control group, pentagastrin-stimulated pepsin secretion had a significant increase in comparison to the basal status ( $6.9 \pm 0.12 \mu\text{g}/15\text{min}$  vs.  $5.62 \pm 0.12 \mu\text{g}/15\text{min}$ ,  $p < 0.001$ ), while in the garlic group, there was no significant difference

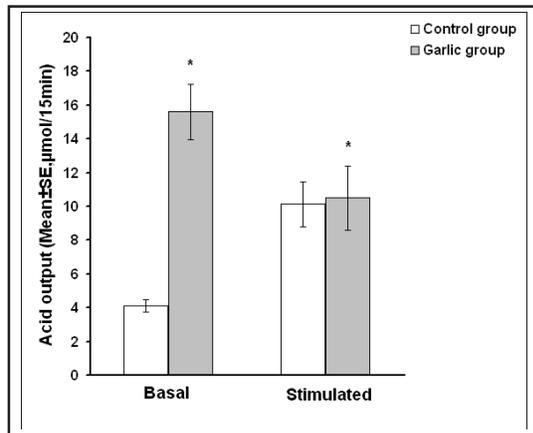


Fig-1: Comparison of the acid secretion between the control and garlic groups (n=12 in each group) \*P<0.001

between pentagastrin-stimulated pepsin secretion and basal pepsin secretion ( $7.03 \pm 0.23 \mu\text{gr}/15\text{min}$  vs.  $7.27 \pm 0.15 \mu\text{gr}/15\text{min}$ ). The detailed results are shown in Fig-2.

## DISCUSSION

As shown in the figures, in the control group pentagastrin increased acid and pepsin secretions in comparison to the basal status ( $p < 0.05$ ). It is likely that this result is through the effect of pentagastrin on gastrin receptors (CCK-B) in parietal, chief and enterochromaffin cells in the stomach. Pentagastrin is a pentapeptid and its synthetic form is similar to gastrin; therefore, it can attach gastrin receptors and imitate their effect.<sup>18-20</sup> Some researchers have reported that in rats gastrin increase leads to an increase in acid and pepsin secretions via two mechanisms:

1. Directly, through its effect on its receptors in parietal and chief cells.<sup>20</sup>
2. Indirectly, through its stimulatory effect on enterochromaffin cells and histamine release.<sup>20</sup>

It has also been shown that in rats gastrin increases gastric acid secretion mostly via histamine release.<sup>21,22</sup> Figs-1 and 2 show that basal acid & pepsin secretions in the group which received garlic had a significant increase compared to the control group; however, in pentagastrin-stimulated state acid secretion showed a significant decrease in comparison to the basal status ( $p = 0.001$ ). Moreover, in the

garlic group, pentagastrin-stimulated pepsin secretion showed no significant difference with the basal status.

There are several studies about the effect of garlic extract on various parts of the body. Garlic contains active chemical components.<sup>10</sup> It has been reported that alliinase in garlic is activated following crushing and heat and changes allein to allicin.<sup>10</sup> In rats, allein is absorbed in 10 minutes and excreted from the body within 6 hours. This filtration occurs through the kidneys, liver and respiratory system.<sup>10</sup> In the present study, in the garlic group, basal acid secretion showed a significant increase in comparison to the control group; nonetheless, by the passage of time, there was a significant decline in acid secretion and even in response to pentagastrin acid secretion showed a significant decrease comparing to the basal status (Fig-1).

The increase in acid and pepsin secretions in the garlic group in comparison to the control group may be due to the special components in garlic that either increase parietal or chief cells activities, release Ach from enteric plexus or stimulate histamine release. Further studies on garlic in order to find the component responsible for the increase in gastric basal acid and pepsin secretions are suggested.

As mentioned earlier, there was an unexpected decline in acid secretion in response to pentagastrin. This observation may be due to either the rapid emptying of gastric acid stock

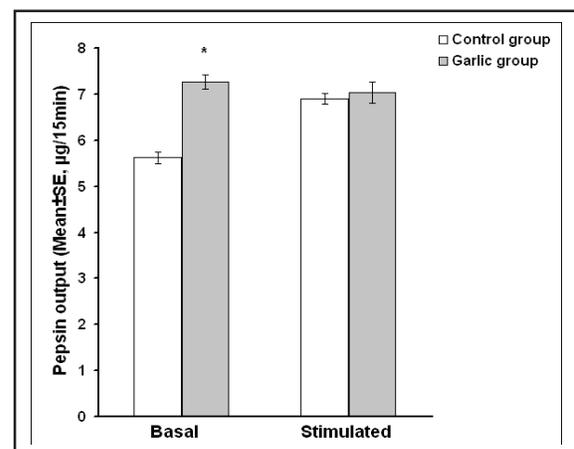


Fig-2: Comparison of the pepsin secretion between the control and garlic groups (n=12 in each group) \*P<0.001

or the inhibition of gastric activity because of the attachment of some components in garlic to the gastrin receptors on parietal cells.

### CONCLUSION

In the garlic group, pentagastrin stimulation caused no significant difference in pepsin secretion compared to the basal status. It seems that severe stimulation of gastric glands by garlic extract causes the rapid release of acid into the stomach left no place for pentagastrin activity. The other assumption is that some components in garlic may attach gastrin receptors and block the pentagastrin effect on gastrin release. Further studies are recommended to clarify the true mechanism of this effect.

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### REFERENCES

1. Zargari A. Herbal Drugs. Publication of Tehran University 1996; pp: 619-20.
2. Arora RC, Arora S. Comparative effect of clofibrate, garlic and onion on alimentary hyperlipemia. *Atherosclerosis* 1981; 39: 447-52.
3. Delaimy KS, Ali SH. Antibacterial action of vegetable extracts on the growth of pathogenic bacteria. *J Sci Food Agric* 1970; 21: 110-2.
4. Sharma VD, Sethi MS, Kumar A, Rarotra JR. Antibacterial property of *Allium sativum* Linn: in vivo and in vitro studies. *Indian J Exp Biol* 1977; 15: 466-8.
5. Ariga T, Shiba S, Tamada T. Platelet aggregation inhibitor in garlic. *Lancet* 1981; 1: 150-1.
6. Appleton JA, Tansey MR. Inhibition of growth of zoopathogenic fungi by garlic. *Myocologia* 1975; 67:882-5.
7. Tsai Y, Cole LL, Davis LE, Lock SJ, Simmons V, Wild GC. Antiviral properties of garlic: in vitro effects on influenza B, herpes simplex and Cocksackie's viruses. *Planta Med* 1985; 460-1.
8. Kato S, Abe Y, Konishi M, Kuroda N, Takeuchi K. Mechanism of gastric hyperemic response during acid secretion in rats: relation to nitric oxide prostaglandins and sensory neurons. *J Clin Gastroenterol* 1997; 25(1): S48-55.
9. Chtani SK, Bordia A. The effect of fried versus raw garlic on fibrinolytic activity in man. *Atherosclerosis* 1981; 38: 417-21.
10. Kathi J Kemper MD. Garlic (*Allium sativum*) the Longwood Herbal Task Force.
11. Fatemeh NR, Fatemeh M, Jalal V, Farzaneh E. The effects of chronic consumption of heroin on basal and vagal electrical-stimulated gastric acid and pepsin secretion in rat. *Saudi Med J* 2004; 25(10): 1356-9.
12. Yang H, Tache Y. Substance P in the dorsal vagal complex inhibits medullary TRH-induced gastric acid secretion in rats. *As J Physiol* 1997; 272(35): G987-93.
13. Mctigue DM, Rogers RC. Pancreatic polypeptide stimulates gastric acid secretion through a vagal mechanism in rats. *Am J Physiol* 1997; 269(38): R983-7.
14. Fallon MB, Abrams GA, Abdel RTT, Dai J, Chen SJ, Chen YF, et al. Garlic prevent hypoxic pulmonary hypertension in rats. *Am J Physiol* 1998; 275(2pt1): L283-7.
15. Lee JH, Kang HS, Roh J. Protective effects of garlic juice against embryo toxicity of methyl mercuric chloride administered to pregnant Fischer 344 rats. *Yonsei Med J* 1999; 40(5): 483-9.
16. Salim AS. Gastric diversion: A method for H output estimation in the rat. *Digestion* 1988; 39: 47-51.
17. Berstad A. A modified hemoglobin substrate method for the estimation of pepsin in gastric. Juice. *Scand J Gastroent* 1970; 5: 343-8.
18. Bertaccine G, Coruzzi G. Regulation of receptors on parietal cells on acid secretion. *Scand J Gastroenterol* 1988; 23(146): 22-3.
19. Hills DM, Gerskowitch VP, Welsh NJ, Shankley NP, Black JW. Pharmacological analysis of the CCK B/ gastrin receptors mediating pentagastrin-stimulated gastric acid secretion in the isolated stomach of the immature rat. *Br J Pharmacol* 1996; 119(7): 1401-10.
20. Hansen LF, Sundler F, Ying LI, Gillespie PJ, Greenson JK, Owyang Cet al. Impaired gastric acid secretion in gastrin-deficient mice. *Am J Physiol* 1998; 274(37): G561-8.
21. Kato S, Kitamura M, Korolkiewicz RP, Takeuchi K. Role of nitric oxide in regulation of gastric acid secretion in rats effects of no donors and no synthesis inhibitor. *Br J Phamacol* 1998; 123(5):839-46.
22. Liloyd KC, Raybould HE, Tache Y, Wolsh JH. Role of acid secretion in anesthetized rats. *Am J Physiol* 1992; 262(25): G747-55.

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