An evaluation of garlic and onion as antithrombotic agents

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Summary Garlic (Allium sativum) and onion (Allium cepa) have been evaluated as possible antithrombotic agents. Rats were given aqueous extracts of garlic and onion, orally or intraperitoneally, daily for a period of 4 weeks after which the rats were sacrificed. The blood was collected from the heart without anticoagulant and the serum was prepared. The level of thromboxane B2 (TXB2) in the serum was measured by radioimmunoassay. TXB2 levels in serum of rats treated with the low dose of aqueous extract of garlic (50 mg/kg) was significantly inhibited regardless of the mode of administration (orally or intraperitoneally). At the high dose of garlic and onion (500 mg/kg), a further decrease of TXB2 levels in the serum of the rats was observed. Boiled garlic and onion at high concentration (500 mg/kg) had very little effect on TXB2 synthesis. This shows that garlic and onion should be consumed in a raw rather than cooked form in order to achieve a beneficial effect. Boiling of these plants may cause the decomposition of the potential antithrombotic ingredient present in these herbs. Garlic was found to be more potent than onion in lowering the TXB2 levels. A high dose of garlic and onion produces toxicity in the rats (unpublished observation). These results show that garlic and onion can be taken frequently in low doses without any side effects, and can still produce a significant antithrombotic effect.

INTRODUCTION

A number of non-steroidal anti-inflammatory drugs (NSAIDs) such as aspirin and indomethacin have been tested as possible antithrombotic agents in animal models of thrombosis. These drugs in vitro and in vivo cause inhibition of platelet aggregation and thromboxane formation.1-4

During the past decade, there has been a great awareness of the potential medicinal uses of garlic and onion. Several reports have suggested that garlic has a protective effect against stroke, coronary thrombosis and atherosclerosis.3-7 These beneficial effects of garlic have been attributed to its ability to inhibit thromboxane formation and platelet aggregation.5-11

A number of studies have suggested the possible use of garlic as an antithrombotic agent.12-14 The father of Ayurvedic medicine claimed that garlic maintains the fluidity of blood and strengthens the heart.7 Onion, like garlic, has also been reported to act as a heart tonic and prevent heart disease.15 A number of sulfur compounds have been extracted and identified from the garlic extracts and have been shown to possess antithrombotic properties.

Due to its thermolabile nature, there have been controversial reports concerning the efficacy of different preparations of garlic.16 The most recommended preparation of garlic is the aqueous extract of fresh garlic.17 Therefore, in the present study, we have used the aqueous extract of fresh garlic and onion. The aim of the present study was to evaluate whether or not garlic and onion could be used as possible antithrombotic agents. Aqueous extracts of garlic and onion were given to rats in low (50 mg/kg) and high doses (500 mg/kg) by different modes of administration (orally and intraperitoneally) daily for a period of 4 weeks. The serum TXB2 levels of the animals were then measured as an index of the efficacy of the antithrombotic agent.
METHODS AND MATERIALS

Female Sprague-Dawley rats weighing 200–250 g were used throughout the experiment. Rats were fed a normal diet and were divided into seven groups. Group I served as the control and received normal saline. Group II were orally force fed onion using a ball tipped needle via stomach gavage. One half of group II rats received a low dose of onion (50 mg/kg) and half received a high dose of onion (500 mg/kg). Group III received onion intraperitoneally, with half receiving a low dose (50 mg/kg) and half receiving a high dose (500 mg/kg). Group IV were orally force fed garlic using the same procedure as in group II. Group V were treated with garlic intraperitoneally. One half of the rats in Groups IV and V received a low dose of garlic (50 mg/kg) and half received a high dose of garlic (500 mg/kg). Group VI received a high dose of boiled onion (500 mg/kg). Half of the rats were force fed the dose and half were given the dose intraperitoneally. Group VII received a high dose of boiled garlic (500 mg/kg). Half of the rats were force fed the garlic dose and half were given the dose intraperitoneally. The rats were given 0.5 ml aqueous extract of garlic or onion daily for a period of 4 weeks.

Garlic and onion was extracted by the previously described procedure. Boiled garlic and onion extracts were prepared similarly, with the exception that the garlic and onion were boiled in a water bath for approximately 15 min before homogenization. The concentration in milligrams of raw and boiled garlic and onion refers to the soluble content of garlic and onion, excluding the fibrous portion.

After 4 weeks of treatment, the rats were sacrificed under urethane anaesthesia. The blood was collected by cardiac puncture and allowed to clot for 30 min at 37°C. The clotted blood was then centrifuged at 1300 × g for 30 min. The serum was separated and stored at −80°C until further use.

The thromboxane B₂ (TXB₂) level was determined in the serum of the rats by the previously described method by radioimmunoassay (RIA), using RIA kits for TXB₂ supplied by Amersham, England.

Statistical analysis was performed on an IBM PC computer. The data was analyzed by the two-tailed Student's t-test. A level for p below 0.05 was considered to be significant. The data is expressed as mean ± SEM.

RESULTS

Table 1 shows the effect of raw and boiled garlic on serum levels of TXB₂ in rats. These results indicate that there was a significant reduction of TXB₂ levels when the rats were treated with low (50 mg/kg) and high (500 mg/kg) doses of aqueous extract of garlic. Serum levels of TXB₂ compared to control were significantly lower irrespective of the mode of administration of garlic (orally or intraperitoneally). Boiled intraperitoneal administration of garlic (500 mg/kg) had no significant effect on the level of TXB₂ as compared to the control value.

Table 2 shows the effect of raw and boiled onion on serum levels of TXB₂ in rats. Raw onion was not as effective in reducing the serum TXB₂ level as compared to garlic at a low dose (50 mg/kg). However, the high dose of onion (500 mg/kg) had significant inhibitory effects on the level of serum TXB₂ when given either orally or intraperitoneally. The low dose (50 mg/kg) of onion was only effective in decreasing TXB₂ levels when given intraperitoneally to rats (Table 2). Boiled onion (500 mg/kg) had no effect on the level of serum TXB₂.

DISCUSSION

It has been shown previously that NSAIDs, if given in small doses for an extended period of time, inhibit platelet aggregation and thromboxane formation. We have
shown previously that a single intravenous dose of an aqueous extract of garlic inhibits the synthesis of thromboxane in platelet ex vivo experiments. The protective action of garlic against collagen and arachidonic acid toxicity has been reported in rabbits. This action was supported by histopathological evidence. In the present study, aqueous extracts of garlic and onion were given to rats orally and intraperitoneally in low (50 mg/kg) and high (500 mg/kg) doses daily for a period of 4 weeks. It appears that garlic, given in low doses (50 mg/kg), significantly reduced serum TXB2 levels in rats (Table 1).

These results confirm the previously reported observation with NSAIDs. Similar effects were seen with high doses (500 mg/kg) of garlic where the effect was more pronounced. However, high doses of garlic had a toxic effect on the organs of the animals (unpublished observation). Onion produced significant effects in lowering TXB2 levels only at high doses (500 mg/kg). The low dose of onion (50 mg/kg) was only effective when given intraperitoneally to rats (Table 2). It is possible that onion, if taken orally at low doses, could be beneficial if administered over a longer period of time. Boiled garlic and onion extracts had little effect on serum TXB2 levels suggesting that if these herbs are consumed in a cooked form, they will have little or no beneficial effect. The antithrombotic effect of garlic can only be achieved by ingestion of the raw form. Cooking of garlic and onion at high temperatures may destroy the volatile and chemically unstable, active, antithrombotic ingredients. The clinical efficacy of garlic and onion in thrombosis may be due to their ability to inhibit thromboxane synthesis and platelet aggregation. Further studies will have to be carried out to evaluate the minimum dose of garlic and onion required over a prolonged period of time to obtain the optimal benefit.

ACKNOWLEDGEMENT

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Table 2 Effect of raw and boiled onion extracts on the serum levels of thromboxane B2 in rats

<table>
<thead>
<tr>
<th>Treatment Administration</th>
<th>Saline</th>
<th>Thromboxane B2 (ng/ml serum)</th>
<th>Raw onion 50 mg/kg</th>
<th>Raw onion 500 mg/kg</th>
<th>Boiled onion 500 mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline</td>
<td>65.00 ± 2.83 (8)</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Oral onion</td>
<td>-</td>
<td>62.50 ± 13.01 (6)</td>
<td>34.16 ± 5.90 (6)</td>
<td>73.83 ± 12.91 (6)</td>
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<tr>
<td>Intraperitoneal onion</td>
<td>-</td>
<td>41.25 ± 9.05 (6)</td>
<td>34.84 ± 7.12 (6)</td>
<td>65.00 ± 2.23 (6)</td>
<td>-</td>
</tr>
</tbody>
</table>

*aNumber of rats used in each group.
*bSignificantly different from control using Student’s t-test, p < 0.001.
*cNot significantly different from control.

REFERENCES


