ANALGESIC ACTIVITY OF BOILED AND NON-BOILED BRASSICA OLERACEA L. VAR. GONGYLODES SWOLLEN STEMS

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ABSTRACT

Background. The objective of this study was to evaluate the analgesic potential of swollen stems of Brassica oleracea var. gongylodes, which are eaten in the cooked or boiled form in many parts of the world.

Methods. Analgesic activity was determined through decreases by the methanol extract of non-boiled and boiled stems in intraperitoneally administered acetic acid induced writhings in Swiss albino mice.

Results. There were no appreciable differences between alleviation of pain by non-boiled versus boiled extract. At doses of 50, 100, 200 and 400 mg per kg body weight, the methanol extract of non-boiled stems dose-dependently and significantly reduced the number of acetic acid induced writhings by, respectively, 22.2, 40.7, 48.1, and 51.9%. At the same doses, the methanol extract of boiled stems dose-dependently and significantly reduced the number of writhings, respectively, by 22.2, 37.0, 48.1, and 51.9%. By comparison, a standard analgesic drug, aspirin, when administered at doses of 200 and 400 mg per kg reduced significantly the number of writhings by 33.3 and 51.9%, respectively. Thus at the highest dose tested, both extracts of non-boiled and boiled stems showed same efficacy as the highest dose of aspirin. Conclusion. Crude extract of both non-boiled and boiled stems are effective in alleviating pain.

KEY WORDS: Analgesic, Brassica oleracea, kohlrabi, Brassicaceae.
BACKGROUND

*Brassica oleracea* L. var. *gongylodes* is a vegetable crop belonging to the Brassicaceae family. It is mainly cultivated in Bangladesh and other parts of the world for its edible swollen stems, which are eaten in the cooked or boiled form. The plant is known as ‘kohlrabi’ in English and as ‘ol kopi’ in Bangladesh. In Bangladesh, the plant is cultivated during the months of October till about May.

We had been exploring the potential of a number of Bangladesh wild plants, food crops, spices, and aromatic plants for their antihyperglycemic and analgesic activities.[1-17] The objective of the present study was to evaluate the analgesic potential of swollen stems of kohlrabi. Since the stem is edible, a further objective was to determine whether boiling would destroy any analgesic potential of the stem. If analgesic potential is still maintained following boiling, an efficacious way of relieving pain could be just consumption of the stems in the boiled form. Notably, the stems are readily available and a common and less expensive food crop of Bangladesh.

METHODS

*Plant material collection*

Stems of kohlrabi were collected during February 2014 from a local market in Dhaka city and identified at the Bangladesh National Herbarium (Accession Number 38,099).

*Preparation of methanolic extract of stems (MEKR)*

For preparation of non-boiled stem extract, stems were sliced and thoroughly dried in the shade and 100g of dried and powdered stems were extracted with methanol (w:v ratio of 1:5, final weight of the extract 9.938g). For preparation of boiled stem extract, stems were sliced and steamed for 15 min, which is the average time in Bangladeshi households for boiling or cooking the stems to make them soft and edible. Following steaming, the sliced stem pieces were thoroughly dried in the shade and 100g of dried and powdered boiled stems were extracted with methanol (w:v ratio of 1:5, final weight of the extract 20g). It is to be noted that following boiling, the weight of the methanol extract increased about two-fold suggesting that boiling possibly caused breakdown of complex methanol insoluble substances into methanol soluble substances.
Chemicals and Drugs
Aspirin was obtained from Square Pharmaceuticals Ltd., Bangladesh. All other chemicals were of analytical grade.

Animals
Swiss albino mice, which weighed between 14-18g were used in the present study. The animals were obtained from International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). The animals were acclimatized for three days prior to actual experiments. The study was conducted following approval by the Institutional Animal Ethical Committee of University of Development Alternative, Dhaka, Bangladesh.

Analgesic activity evaluation through abdominal writhing test
Analgesic activity of extract was examined as previously described.[18] Mice were divided into eleven groups of five mice each. Group 1 served as control and was administered vehicle only. Groups 2 and 3 were orally administered the standard analgesic drug aspirin at doses of 200 and 400 mg per kg body weight, respectively. Groups 4-7 were administered MEKR (non-boiled) at doses of 50, 100, 200 and 400 mg per kg body weight, respectively. Groups 8-11 were administered MEKR (boiled) at doses of 50, 100, 200 and 400 mg per kg body weight, respectively. Following a period of 60 minutes after oral administration of standard drug or MEKR, all mice were intraperitoneally injected with 1% acetic acid at a dose of 10 ml per kg body weight. A period of 15 minutes was given to each animal to ensure bioavailability and onset of chemically induced irritation of acetic acid following a slight variation of an earlier described method [19], following which period, the number of abdominal constrictions (writhings) was counted for 10 min. The percent inhibitions of abdominal constrictions were calculated according to the formula given below.

Percent inhibition = \(1 - \frac{W_e}{W_c}\) X 100,
where \(W_e\) and \(W_c\) represents the number of writhings in aspirin or MEKR (non-boiled and boiled) administered mice (Groups 2-11), and control mice (Group 1), respectively.

Statistical analysis
Experimental values are expressed as mean ± SEM. Independent Sample t-test was carried out for statistical comparison. Statistical significance was considered to be indicated by a p value < 0.05 in all cases.[8]
RESULTS

Extracts of both non-boiled as well as boiled kohlrabi were effective in relieving pain in mice caused by intraperitoneal administration of acetic acid. At doses of 50, 100, 200 and 400 mg per kg body weight, the methanol extract of non-boiled stems dose-dependently and significantly reduced the number of acetic acid induced writhings by, respectively, 22.2, 40.7, 48.1, and 51.9%. At the same doses, the methanol extract of boiled stems dose-dependently and significantly reduced the number of writhings, respectively, by 22.2, 37.0, 48.1, and 51.9%. By comparison, a standard analgesic drug, aspirin, when administered at doses of 200 and 400 mg per kg reduced significantly the number of writhings by 33.3 and 51.9%, respectively. Thus at the highest dose tested, both extracts of non-boiled and boiled stems showed same efficacy as the highest dose of aspirin. It is to be noted that at even the two lower doses, i.e. 100 and 200 mg MEKR per kg, both non-boiled and boiled extract gave better pain relieving activity than 200 mg per kg aspirin. The results are shown in Table 1 and suggest that both forms of MEKR possess significant analgesic potential.

Table 1: Analgesic effect of crude methanol extract of non-boiled and boiled kohlrabi swollen stems (MEKR) in acetic acid-induced pain model mice.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dose (mg/kg body weight)</th>
<th>Mean number of abdominal constrictions</th>
<th>% inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>10 ml</td>
<td>5.4 ± 0.24</td>
<td>-</td>
</tr>
<tr>
<td>Aspirin</td>
<td>200 mg</td>
<td>3.6 ± 0.40</td>
<td>33.3*</td>
</tr>
<tr>
<td>Aspirin</td>
<td>400 mg</td>
<td>2.6 ± 0.51</td>
<td>51.9*</td>
</tr>
<tr>
<td>(MEKR) non-boiled</td>
<td>50 mg</td>
<td>4.2 ± 0.37</td>
<td>22.2*</td>
</tr>
<tr>
<td>(MEKR) non-boiled</td>
<td>100 mg</td>
<td>3.2 ± 0.20</td>
<td>40.7*</td>
</tr>
<tr>
<td>(MEKR) non-boiled</td>
<td>200 mg</td>
<td>2.8 ± 0.37</td>
<td>48.1*</td>
</tr>
<tr>
<td>(MEKR) non-boiled</td>
<td>400 mg</td>
<td>2.6 ± 0.40</td>
<td>51.9*</td>
</tr>
<tr>
<td>(MEKR) boiled</td>
<td>50 mg</td>
<td>4.2 ± 0.37</td>
<td>22.2*</td>
</tr>
<tr>
<td>(MEKR) boiled</td>
<td>100 mg</td>
<td>3.4 ± 0.40</td>
<td>37.0*</td>
</tr>
<tr>
<td>(MEKR) boiled</td>
<td>200 mg</td>
<td>2.8 ± 0.58</td>
<td>48.1*</td>
</tr>
<tr>
<td>(MEKR) boiled</td>
<td>400 mg</td>
<td>2.6 ± 0.24</td>
<td>51.9*</td>
</tr>
</tbody>
</table>

All administrations (aspirin and extract) were made orally. Values represented as mean ± SEM, (n=5); *P < 0.05; significant compared to control.

DISCUSSION

It is of interest that methanol extract of both non-boiled and boiled stems of kohlrabi essentially gave similar analgesic activity results. The amount of methanol extract obtained from the boiled form of swollen stems was 20% of the starting dry material. Since the amount of 400 mg per kg extract was equivalent to that of 400 mg per kg aspirin, so at least
theoretically, direct consumption of 2g of boiled and subsequently dried kohlrabi swollen stem should be equivalent to taking 400 mg aspirin. Thus any person suffering from chronic or acute pain can, instead of aspirin, consume kohlrabi, and benefit from both alleviating pain as well as gaining other necessary nutrients. In fact, the kohlrabi swollen stems possibly need not be dried at all. Assuming water content of at least 50% in raw kohlrabi swollen stems, a person suffering from pain can consume just 4g of kohlrabi swollen stems in the boiled form and get pain relief. Experiments are now underway on human volunteers to test this hypothesis and to identify the active constituent(s).

CONCLUSION
The results suggest that methanolic extracts of both non-boiled and boiled kohlrabi swollen stems are effective in relieving pain.

Conflicts of interest
The author(s) declare that they have no competing interests.

REFERENCES


