Comparative anti-inflammatory evaluation of five plants of Solanaceae members

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ABSTRACT

Inflammation is processed by which the body responds to the external stimulus that causes any harm or damage to the human body. Inflammation is good with some respect and if it grows and builds up in the body will lead to many other complications and manifests itself in the form of pain, redness, swelling and spike in surrounding tissue temperature [1]. During this process, several enzymes are involved in the inflammation process are cytokines and reactive free radicals. These can become dangerous if not appropriately addressed and reduced. They will migrate to the inflamed area, and they cause inflammatory responses. There are many plants known to possess anti-inflammatory chemical constituents in nature [2]. There are several types of research that prove the activity of those plants that fight the inflammation in the body. They are classified as antipyretics, analgesics, antioxidants etc.

Out of those plants, Solanaceae members are known to have rich chemical constituents and a variety of them being alkaloids. Whatever may be the chemical constituent, most of the Solanaceae members have been already investigated and proven for their anti-inflammatory activity in many available methods. In research, all five species of Solanum had been compared for their anti-inflammatory activity in two models to determine which has a better activity in comparison to the other. Overall it can be said that Solanum nigrum showed a better activity compared to other extracts and the activity was comparably significant and similar to that of the standard drugs dexamethasone and indomethacin too.

INTRODUCTION

Inflammation is processed by which the body responds to the external stimulus that causes any harm or damage to the human body. Inflammation is good with some respect and if it grows and builds up in the body will lead to many other complications and manifests itself in the form of pain, redness, swelling and spike in surrounding tissue temperature [1].

During this process, several enzymes are involved in the inflammation process are cytokines and reactive free radicals. These can become dangerous if not appropriately addressed and reduced. They will migrate to the inflamed area, and they cause inflammatory responses. There are many plants known to possess anti-inflammatory chemical constituents in nature [2]. There are several types of research that prove the activity of those plants that fight the inflammation in the body. They are classified as antipyretics, analgesics, antioxidants etc.

Out of those plants, Solanaceae members are known to have rich chemical constituents and a variety of them being alkaloids. Whatever may be the chemical constituent, most of the Solanaceae members have been already investigated and proven for their anti-inflammatory activity in many available methods. S. Lycopersicum [3], S. trilobatum [4], S. nigrum [5], S. parabens [6], S. corymbiform [7] had been already investigated for the activity.
In this research, all five species of Solanum had compared for anti-inflammatory activity in two models to determine which has a better activity in comparison to the other. So this also established a medium to use one drug as an anti-inflammatory effect when other is absent or unavailable [8].

MATERIALS AND METHODS

Plants and Extraction

Plant leaves of Solanum Lycopersicum, Solanum trilobatum, Solanum xanthocarpum, Solanum nigrum and Solanum corymbiflorum had been collected from a local supplier and were correctly authenticated. The herbarium samples were submitted to the college library and used for future reference [9]. All the leaves were shade dried for five days and powdered and stored for extraction. All the powders except S. nigrum and S. tilobatum were extracted with 60% ethanol in cold maceration method, and these plants were extracted using methanol by Soxhlet set up [10]. All the filtrates were collected and desiccated using a water bath and evaporator. The obtained extract was a thick greenish-brown paste with a characteristic odour. The extractive value or the percentage yield was noted down, and the extracts were named as SLEE-12.61% w/w, SXEE-13.42% w/w, SCEE-12.69% w/w, STME-14.28% w/w and SNME16.80% w/w [11, 12].

Animal Experiments

The animals used for the investigation and comparison of the activity are albino rats which are weighing around 190-210gm. Both female and male rats were included in the study. They are well kept under standard conditions with very free access for food and water in the cages. Coprophagy was prevented. The animals were inhabited in the cages and prepared for an experiment for two days.

Croton oil-induced topical inflammation

The animals were divided into seven groups which had five animals in each group. The rats were taken out of the cages and administered the standard drug and extracts. Group 1 did not give any medication or extract. Group 2 was provided with dexamethasone as a conventional drug in a dose of 1mg/kg body weight; extracts were given to all the other groups at a dose of 250mg/kg orally. After 1hr of the administration, they were then applied with croton oil on to the right ear with the help of cotton smear. The dose per rat was 1mg of croton oil. The thickness of the ear was measured before and 3hr after application of the croton oil to measure the activity.

Acute inflammation in the Carrageenan method

The rats used in the above experiment were continued to this method also. Same rats were used, and the groups were also maintained as same except groups two, which was given indomethacin as a standard drug in this method. After the previous experiment, the animals were let ween off of the drugs and extracts for two days, and the rats were given drug and extracts in the fixed doses orally. 0.1ml of 1% Carageenan suspension was injected into the right hind paws of the animals, and the paw volumes were measured at regular intervals like 1h, 2h, 3h 4hr and 5hr [13]. The %inhibitono of oedema was calculated by

\[ \% \text{ activity} = \left(1 - \frac{V_t}{V_c}\right) \times 100,\]  

where \( V_t \) - volume in extract group and \( V_c \) - volume in control group.

RESULTS AND DISCUSSION

The comparison of different members of Solanaceae for their anti-inflammatory potential had been investigated in two methods. In the croton oil method, the ear thickness of all rats in groups was in the range of 100.120 micrometres. The administration of the croton oil to the groups increased the ear thickness by almost 5times than usual which was evident in the control group, which did not receive any drug. It was swollen up to 710 microns in diameter (Figure 1).

The standard drug controlled the swelling and kept the ear in average thickness which is of 125. The extracts showed better activity comparable to the standard but not as good as standard. The highest activity was shown by S. nigrum extract with control in thickness to just 140microns which was significant compared to the power. It is followed by S. tilobatum with 175 and the rest all were high with above 200 and 300 too, which were significantly not that much better a than standard drug dexamethasone [14].

In the carrageenan method also, the results were similar to that of the croton oil method. The paw oedema was calculated and tabulated in Table 1. Here also nigrum showed comparatively better activity than other extracts and can be explained due to the presence of alkaloids in the methanol extract of nigrum. Different extracts were less in performance may be due to the interference of other material like starches that are common in Solanaceae members [15].

Overall it can be said that Solanum nigrum showed a better activity compared to other extracts and the activity was comparably significant and similar to that of the standard drugs dexamethasone and indomethacin too.
Table 1: Comparison of anti-inflammatory activity of Solanaceae members

<table>
<thead>
<tr>
<th>Treatment</th>
<th>The volume of the paw</th>
<th>% of inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1h</td>
<td>2h</td>
</tr>
<tr>
<td>Control</td>
<td>0.182±</td>
<td>0.342±</td>
</tr>
<tr>
<td></td>
<td>0.0042</td>
<td>0.0064</td>
</tr>
<tr>
<td>Standard</td>
<td>0.211±</td>
<td>0.243±</td>
</tr>
<tr>
<td></td>
<td>0.0049</td>
<td>0.0058</td>
</tr>
<tr>
<td>SLEE</td>
<td>0.173±</td>
<td>0.240±</td>
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<tr>
<td></td>
<td>0.0049</td>
<td>0.016</td>
</tr>
<tr>
<td>SCEE</td>
<td>0.187±</td>
<td>0.217±</td>
</tr>
<tr>
<td></td>
<td>0.0071</td>
<td>0.0073</td>
</tr>
<tr>
<td>STME</td>
<td>0.182±</td>
<td>0.271±</td>
</tr>
<tr>
<td></td>
<td>0.0062</td>
<td>0.029</td>
</tr>
<tr>
<td>SXEE</td>
<td>0.197±</td>
<td>0.23±</td>
</tr>
<tr>
<td></td>
<td>0.0085</td>
<td>0.0024</td>
</tr>
<tr>
<td>SNME</td>
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<td>0.24±</td>
</tr>
<tr>
<td></td>
<td>0.0052</td>
<td>0.0064</td>
</tr>
</tbody>
</table>

Figure 1: Comparison of the thickness of the ear in croton oil method

CONCLUSION

Claims for the Solanaceae members possessing anti-inflammatory activity were considered, and the activity was compared by taking five members of Solanaceae and tested for anti-inflammatory activity in two methods. Out of all the extracts, Solanum nigrum showed a better activity which was because of alkaloids present in the plant. It is evident that the potency of the drug is more in this extract at even a low dose, but on the other hand, it raises a concern that the drug can be toxic given its toxic alkaloid content.

CONFLICT OF INTEREST

Authors declared no conflict of interest.

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REFERENCES


