A PHARMACOLOGICAL INVESTIGATION OF SOME INDIGENOUS DRUGS OF PLANT ORIGIN FOR EVALUATION OF THEIR ANTIPYRETIC, ANALGESIC AND ANTI-INFLAMMATORY ACTIVITIES

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Introduction

Several plants have been described in the indigenous medicine to be useful in fevers, pains and inflammatory swellings. Among these Hibiscus rosa-sinensis, Withania somnifera, Tephrosia purpurea, Nigella sativa and Nerium indicum have been commonly used in these conditions (Kirtikar and Basu, 1944; Chopra et al., 1956). Considering their usefulness in these conditions, their antipyretic, analgesic and anti-inflammatory activities were evaluated in different experimental models in animals.

Material and Methods

The alcoholic extracts of the plants under study were prepared by percolation at room temperature with 70% ethyl alcohol. Each extract was concentrated in vacuo below 50 °C till a residue was obtained. The residue was suspended in normal saline for the pharmacological study. The pure glycoside (plumieride) obtained from roots of Nerium indicum (Singh et al., 1976) was also used in this study. It was dissolved in normal saline. The following plants were studied for their antipyretic, analgesic and anti-inflammatory activities. Acetylsalicylic acid or hydrocortizone was used as a reference control.

1. Hibiscus rosa-sinensis (leaves)
2. Withania somnifera (defatted seeds)
3. Tephrosia purpurea (whole plant)
4. Nigella sativa (seeds)
5. Nerium indicum (Plumieride from the roots).

ANTIPYRETIC ACTIVITY

Brewer’s yeast induced pyrexia

Healthy albino rats weighing 150-200 gm were used in groups of six animals each. Normal rectal temperature was recorded by a clinical thermometer and its hourly variation was noted over a period of three hours at the beginning of the experiment. Pyrexia was produced by injecting 15% suspension of dried Brewer’s yeast in 2% gum acacia in normal saline according to the method of Gujral et al. (1955). Eighteen hours after Brewer’s yeast

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3. Demonstrator,
4. Professor.
injection, temperature was recorded and com-
ounds were injected intraperitoneally. The
rectal temperature was again recorded after
two and four hours of drug treatment and the
results were analysed.

ANALGESIC ACTIVITY

Aconitine induced writhing response in albino
mice

Albino mice weighing between 20 and 25 gm
were divided in groups of ten animals each.
The compounds were given per orally (p. o.)
one hour before intraperitoneal injection of
aconitine (2 μg/mice) according to method of
BhaJla et al., (1969). The animals were ob-
served for the characteristic ‘writhing’ response
over a period of thirty minutes.

ANTI-INFLAMMATORY ACTIVITY

Carrageenin-induced oedema

Adult albino rats weighing between 80-
100g were divided into groups of ten animals
each. Freshly prepared suspension of carra-
geenin 0.05 ml (1.0% in 0.9% of saline) was in-
jected under planter aponeurosis of right hind
paw of the rats by the method of Winter et al.
(1962). The animals were pretreated with the
test drugs one hour before carrageenin injec-
tion. The volume of the root was measured
before and three hours after carrageenin treat-
ment by micropipette method described by
Buttle et al. (1957). Percent anti-inflammatory
effect was calculated.

ACUTE TOXICITY

Acute intraperitoneal LD₅₀ was deter-
mined in albino mice according to the method
of Smith (1960).

Results

Antipyretic activity

The effect of the drugs on pyrexia induced
by Brewer’s yeast in albino rats has been
given in table 1. Alcoholic extracts of Habiseus
rosa-sinensis and Withania somnifera and the
glycoside plumacride showed highly significant
antipyretic activity, while other extracts had
poor antipyretic activity.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Dose mg/kg i. p.</th>
<th>Rectal initial</th>
<th>Temperature 18hr aber yeast</th>
<th>Of (Mean ± S. E.) After Drug 2 hr.</th>
<th>4 hr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline (control)</td>
<td>0.5 ml</td>
<td>99.8±0.20</td>
<td>102.4±0.24</td>
<td>102.6±0.21</td>
<td>102.4±0.11</td>
</tr>
<tr>
<td>Acetylsalicylic acid</td>
<td>30</td>
<td>99.6±0.31</td>
<td>103.0±0.18</td>
<td>99.8±0.12*</td>
<td>98.8±0.23*</td>
</tr>
<tr>
<td>Hibiscus Rosa sinensis</td>
<td>100</td>
<td>99.4±0.32</td>
<td>102.6±0.26</td>
<td>98.6±0.16*</td>
<td>99.8±0.25*</td>
</tr>
<tr>
<td>Withania somnifera</td>
<td>100</td>
<td>99.2±0.16</td>
<td>101.8±0.3</td>
<td>98.8±0.22*</td>
<td>99.0±0.20*</td>
</tr>
<tr>
<td>Tephrosia purpurea</td>
<td>100</td>
<td>99.6±0.28</td>
<td>102.4±0.19</td>
<td>102.2±0.30</td>
<td>102.3±0.24</td>
</tr>
<tr>
<td>Nigella sativa</td>
<td>100</td>
<td>99.9±0.24</td>
<td>102.2±0.28</td>
<td>102.4±0.26</td>
<td>102.6±0.30</td>
</tr>
<tr>
<td>Nerium indicum (glycoside)</td>
<td>100</td>
<td>99.7±0.18</td>
<td>103.1±0.21*</td>
<td>100.0±0.28</td>
<td>100.2±0.30*</td>
</tr>
</tbody>
</table>

* ζP 0.001
Analgesic activity

The effect of drugs against aconitine induced writhing in mice has been given in Table 2. In this test, *Withania somnifera*, *Hibiscus rosa-sinensis* and plumieride showed significant analgesic activity, *Withania somnifera* being most potent amongst these. The order of potency was found to be acetyl salicylic acid > *Withania somnifera* > Plumieride > *Hibiscus rosa-sinensis*.

3. Anti-inflammatory activity

The anti-inflammatory activity of various drugs against exudative phase (carrageenin induced oedema) of inflammation in albino rats is shown in Table 3. Hydrocortisone served as a reference drug. *Withania somnifera*, *Hibiscus rosa-sinensis* and Plumieride had highly significant (P ≤ 0.001) anti-inflammatory activity while others showed poor activity.

Acute LD₅₀

Acute i. p. LD₅₀ of these drugs in mice are shown in Table 4.

Discussion

Five drugs (four crude extracts and one pure plant glycoside) were tested for their antipyretic, analgesic and anti-inflammatory activities in albino mice and rats. These plants have been described to possess these properties

**TABLE 2**

*Effect of drugs against aconitine induced writhing in albino mice.*

<table>
<thead>
<tr>
<th>Compound</th>
<th>PD₅₀ in mg/kg (p.o)±S. E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline (control)</td>
<td>—</td>
</tr>
<tr>
<td>Acetyl salicylic acid</td>
<td>18.8±2.4</td>
</tr>
<tr>
<td><em>Hibiscus rosa-sinensis</em></td>
<td>125.0±9.6</td>
</tr>
<tr>
<td><em>Withania somnifera</em></td>
<td>62.5±6.2</td>
</tr>
<tr>
<td><em>Tephrosia purpurea</em></td>
<td>252.0±15.8</td>
</tr>
<tr>
<td><em>Nigella sativa</em></td>
<td>102.0±8.2</td>
</tr>
</tbody>
</table>

* No protection with normal saline (0.5 ml) and *Nigella sativa* (dose upto 500 mg/kg p. o.)

**TABLE 3**

*Effect of various drugs against carrageenin induced oedema in albino rats.*

<table>
<thead>
<tr>
<th>Compound</th>
<th>Dose mg/kg i. p.</th>
<th>n</th>
<th>Mean volume of oedema in ml±S. E.</th>
<th>Percent anti-inflammatory effect</th>
<th><em>P</em> Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline (control)</td>
<td>0.5 ml</td>
<td>10</td>
<td>0.99±0.02</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>10</td>
<td>10</td>
<td>0.48±0.06</td>
<td>51.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><em>Hibiscus rosa-sinensis</em></td>
<td>100</td>
<td>10</td>
<td>0.40±0.03</td>
<td>59.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><em>Withania somnifera</em></td>
<td>100</td>
<td>10</td>
<td>0.36±0.04</td>
<td>63.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><em>Tephrosia purpurea</em></td>
<td>100</td>
<td>10</td>
<td>0.68±0.08</td>
<td>31</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td><em>Nigella sativa</em></td>
<td>100</td>
<td>10</td>
<td>0.76±0.09</td>
<td>23</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Plumieride</td>
<td>100</td>
<td>10</td>
<td>0.56±0.04</td>
<td>43</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
TABLE 4

LD$_{50}$ (i. p.) of various drugs in albino mice.

<table>
<thead>
<tr>
<th>Name of the extract</th>
<th>mg/kg Mean± S. E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hibiscus rosa-sinensis</td>
<td>1533±25</td>
</tr>
<tr>
<td>2. Withania somnifera</td>
<td>1250±31</td>
</tr>
<tr>
<td>3. Tephrosia purpurea</td>
<td>1138±41</td>
</tr>
<tr>
<td>4. Nigella sativa</td>
<td>561±21</td>
</tr>
<tr>
<td>5. Plumieride</td>
<td>4206±68</td>
</tr>
</tbody>
</table>

in our ancient literature so the present work was an exploration of the same properties by various experimental techniques used in pharmacology. Among these plant materials tested, Withania somnifera, Hibiscus rosa-sinensis and Plumieride, the glycosides from Nerium indicum, were found to possess potent antipyretic, analgesic and anti-inflammatory activities. In the other two plant extracts (Nigella sativa and Tephrosia purpurea) these activities were less significant. The acute LD$_{50}$ of the pharmacologically active drugs was also quite large and the glycoside of Nerium indicum was least toxic.

The presence of these properties in Withania somnifera and Hibiscus rosa-sinensis indicate the isolation of active constituent(s) in the extracts. Since the extracts have low toxicity and high safety margin, they may be assessed for their usefulness in Ayurvedic medicine for the treatment of rheumatism, and pain.

Summary

In the present study 70% alcoholic extracts from Hibiscus rosa-sinensis (leaves), Withania somnifera (defatted seeds), Tephrosia purpurea (whole plant), Nigella sativa (seeds) and the pure glycoside (Plumieride) obtained from the roots of Nerium indicum were studied for their antipyretic, analgesic anti-inflammatory activities.

Among these drugs, the extracts from Hibiscus rosa-sinensis and Withania somnifera and pure glycoside from Nerium indicum showed the presence of potent antipyretic, analgesic and anti-inflammatory activities in albino rats and mice. Since, the extracts have low toxicity and high safety margin, they may be assessed for their usefulness in Ayurvedic system of Medicine in cases of fever, pain and rheumatism.

REFERENCES


   : Plethysmometric measurement of swelling in the feet of small laboratory animals. Nature (Lond.) 179, 629-632.


हिन्दी सारांश

कुछ स्वदेशी चिकित्सोपयोगी वनस्पतियों के ज्वरहर, शोथहर तथा बेदनाहर गुणों का द्रव्यगुण-वैज्ञानिक अध्ययन

एनो सिंह, आरो नाथ, एरो केर अग्रवाल तथा आरो पीर कौली

कुछ वनस्पतियों का प्रयोग ज्वरहर, शोथहर तथा बेदनाहरण के लिए आयुर्वैदिक चिकित्सा पद्धति में होता है। वर्तमान अध्ययन गुह्ठ, अश्वगन्धा, सर्पुंड्रा तथा कलोंजी के सुराविलेय तत्वों का अर्थ कनेर के गुढ़ स्त्राइकोसाइड का उपरोक्त गुणों का द्रव्यगुण-वैज्ञानिक अध्ययन है।

गुड़हल एवं अश्वगन्धा (सुराविलेय तत्व) तथा कनेर (गुढ़ स्त्राइकोसाइड, में बेदनाहरण, ज्वरहर तथा शोथहर गुण अत्यधिक मात्रा में पाये गये हैं। इन वैष्ठिक्यों में विपाकता भी कम पायी गयी है। चिकित्सा में इनका उपयोग बेदना तथा शोध में प्रयोग के लिए आम अध्ययन की आवश्यकता है।