Evaluation of the antipyretic potential of methanol extract of the leaves of \textit{Abies spectabilis} (D. Don) Spach.

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\begin{abstract}
Methanol extract of leaves of \textit{Abies spectabilis} (D. Don) Spach. (MEAS) was evaluated for the antipyretic potential on normal body temperature and yeast induced pyrexia in rats. MEAS showed significant activity at intraperitoneal (i.p.) doses of 200 and 400 mg/kg body weight. The extract, when administered at a dose of 200 mg/kg body weight caused significant lowering of body temperature up to 3h. With 400 mg/kg body weight dose it caused significant lowering of body temperature up to 6h after administration. In the model of yeast induced elevation of body temperature MEAS showed dose-dependant lowering of the body temperature up to 4h at both the doses. The results obtained, were comparable to that of paracetamol, a standard antipyretic agent.

\textbf{Keywords:} \textit{Abies spectabilis}, Antipyretic, Methanol extract, Yeast-induced pyrexia.

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\section*{Introduction}
\textit{Abies spectabilis} (D. Don) Spach. \textsuperscript{1}syn. \textit{A. webbiana} Lindl. (Family: Pinaceae) is a tall evergreen tree, up to 60m in height\textsuperscript{1, 2}. This plant is widely distributed in the Himalayan region from Kashmir to Assam in India\textsuperscript{3} and other parts of country such as Sikkim\textsuperscript{4}. The plant leaves are carminative, expectorant, stomachic, tonic, astringent, antispasmodic and antiperiodic\textsuperscript{4}. Powdered leaves are used along with juice of \textit{Adhatoda zeylanica} Medic. and honey in haemoptysis, phthisis and catarrh of bladder\textsuperscript{5}. The infusion of leaves is given to infants suffering from fever and chest infections. It is also administered in hoarseness and during dentition\textsuperscript{6}. It forms an ingredient of Ayurvedic formulations, \textit{Thalisyaadic choornum} for pulmonary tuberculosis and bronchi\textsuperscript{7}. The powdered leaves increase appetite, aid digestion, stops vomiting and diarrhoea. It also allays cough and bronchopneumonia and corrects flatulence. It is given in enlarged spleen with success\textsuperscript{8}. The antitumour and antitussive activities of the methanol extract of plant and leaves on mice are also reported\textsuperscript{6, 7}. The methanol extract of this plant has been found to have synergistic effect on the sleeping time induced by standard sedatives in mice and different extracts of the plant showed anti-inflammatory activity\textsuperscript{8}. In continuation to earlier work on the plant, \textit{in vivo} antipyretic activity of the methanol extract of the leaves of \textit{A. spectabilis} has been reported here.

\section*{Materials and Methods}
\textbf{Plant material}

The leaves of \textit{A. spectabilis} were collected freshly from Gangtok, Sikkim (India) in the month of October and November and identified by the Botanical Survey of India, Shibpur, Howrah. A voucher specimen (AW-I) has been kept in our laboratory for future reference. The leaves were separated from the branches, dried under shade and pulverized with a mechanical grinder. The powder was passed through a sieve no. 40 and stored in a closed vessel.

\textbf{Preparation of extract}

The leaf powder (150g) was extracted with the help of a Soxhlet apparatus using methanol (600ml) as the solvent. The solvent was removed under vacuum distillation and the reddish brown coloured material (yield 24.88 % w/v with respect to starting material) was obtained. After preliminary phytochemical tests, it was found that the methanol extract contains alkaloids, flavonoids, steroids, saponins, tannins, amino acids and terpenoids\textsuperscript{6}. The extract was stored in a vacuum dessicator for future use. This
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**Study of normal body temperature**

Rats of either sex were divided into three groups, comprising six animals in each group. The rats were restrained in a small cage so that they could not move and a thermister probe was inserted 3–4 cm deep into the rectum and fastened to the tail by adhesive tape. The basal rectal temperature of each rat was recorded on the thermometer at 1h intervals for 6h before and after administration of either 1% Tween 80 (control) or methanol extract at doses of 200 and 400 mg/kg body wt, intraperitoneally (i.p.).

**Induction of fever**

**(Yeast induced pyrexia)**

Fever was induced in rats. The basal rectal temperature of each rat was recorded by the method mentioned above. Fever was then induced by a subcutaneous injection of 10ml/kg body wt of 15% w/v yeast suspended in 0.5% w/v methylcellulose solution. After 19h of yeast injection, the animals were again restrained in individual cage to record their rectal temperatures.

**Drug administration**

Nineteen h after yeast injection, methanol extract of leaves was administered intraperitoneally at 200 and 400 mg/kg body wt to two groups of rats. Similar volumes (5 ml/kg) of 0.1% Tween 80 aqueous solution was administered (i.p.) into the control group, the 4th group received the standard antipyretic paracetamol at a dose of 150mg/kg body wt (i.p.). The dose of methanol extract was selected based on the LD\textsubscript{50} value of the extract, determined previously in our laboratory and was found to be 985.67 mg/kg body wt\textsuperscript{8} by Litchfield and Wilcoxon method. The rectal temperatures of all the rats were measured immediately prior to the administration of any solution. This was followed by the measurement of the rectal temperatures for 4h at one hour interval. The data obtained was analyzed for significance by the unpaired two tailed student’s t-test\textsuperscript{9}.

**Results and Discussion**

The effect of the extract on normal body temperature in rats is summarized in Table 1. It was found that the extract at a dose of 200 mg/kg body wt caused significant lowering of body temperature up to 3h and at a dose of 400 mg/kg body wt, it caused significant lowering of body temperature up to 6h after its administration.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rectal temperature (°C) before and after treatment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>0h</td>
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<tr>
<td>Control vehicle (5ml/kg body wt)</td>
<td>37.2 ± 0.2</td>
</tr>
<tr>
<td>MEAS (200mg/kg body wt)</td>
<td>37.2 ± 0.2</td>
</tr>
<tr>
<td>MEAS (400mg/kg body wt)</td>
<td>37.2 ± 0.2</td>
</tr>
</tbody>
</table>

Each value represents Mean ± SE
\textsuperscript{a}P<0.001, \textsuperscript{b}P<0.01, when compared with the control values of corresponding hour
The effects of the extract on yeast induced pyrexia in rats are shown in Table 2. Subcutaneous injection of yeast suspension markedly increased the rectal temperature, 19h after its administration. A dose-dependent decrease of the body temperature was observed in the experimental animals upon treatment with MEAS at doses of 200 and 400 mg/kg body wt (i.p.). The effect started as early as 1h and the reduced temperature was maintained for 4h after administration. Paracetamol at a dose of 150 mg/kg body wt (i.p.) significantly reduced the yeast provoked elevation of body temperature in rats when compared with the control group.

A delicate balance between the production and loss of heat is maintained by the hypothalamus through a set point. In fever, this set point is elevated and paracetamol like drugs, promote its return to the normal temperature. These drugs however, do not influence the body temperature when elevated by such factors as exercise or increase in ambient temperature. The present investigations revealed that the leaf extract of *A. spectabilis* possesses significant antipyretic effect in yeast provoked elevation of body temperature (Table 2) as well as normal body temperature (Table 1) in rats. The reduction of the body temperature observed in the second case (yeast induced pyrexia) was comparable to that of paracetamol.

**Conclusion**

The study indicates the importance of methanol extract of *A. spectabilis* in relation to the antipyretic activity. The set point of the thermal balance is regulated by the hypothalamus probably through maintaining the local Na⁺/Ca²⁺ ratio. The elevation of the set point may be due to the production of prostaglandins. Prostaglandin inhibitors help to return to the normal temperature. As methanol extract contains various chemical constituents, one or more components may be responsible for the inhibition of prostaglandins and hence, may be responsible for the antipyretic activity. Further detailed studies are required particularly with respect to the isolation of the active principle(s) responsible for the said activities.

**References**