ABSTRACT
Since the dawn of civilization, human being is dependant on higher plant species for their foods, clothing, shelter and health care need. The plant species were the main part of folk medicine practiced by the ancient peoples in different parts of the world, which include India, China, Middle East, Africa and South America. In India the earliest use of plant in medicine can be traced in Rig veda. The present study was designed to evaluate the analgesic of the methanol extract of whole plant of *Swertia chirayita* (Roxb. ex Fleming) H. Karst (*Family Gentianaceae*) in young albino mice and wistar rats. The analgesic activity was determined by using Hotplate and Tail flick methods. The crude extract was used in two doses as 100 mg/kg and 200 mg/kg and Nimusulide was used as the standard drug. The finding reveals that methanolic extract of *Swertia chirayita* possesses analgesic activity.

Key words: Analgesic, *Swertia chirayita*, Nimusulide, Eddy’s hot plate, Analgesiometer.

1: INTRODUCTION
India is much known for its variety of agro-climatic diversity and also for its rich heritage of traditional systems of medicines. The Indian System of Medicine (ISM) comprises of Ayurveda, Siddha, Unani and Tibetan system of medicine along with the other folk medicinal practices and age old home remedies. All these systems have placed India, as the leading nation in using natural medicinal therapeutic field, which is based on the traditional...
knowledge of the use of medicinal plants. India possesses a rich treasure of biodiversity, which has been used for health care, for the last more than four thousand years. Medicinal plants are those plants that contain substances which could be used for therapeutic purposes or which are precursors for the synthesis of useful drugs\textsuperscript{(1)}.

*Swertia chirayita* (Roxb. ex Fleming) H. Karst (Family Gentianaceae) is one of the important traditional medicinal plant. It is an erect annual or perennial herb, found in Himalaya and Meghalaya at an altitude of 1200-1300 meters\textsuperscript{(2)}. The entire plant possesses medicinal property, however the root is mentioned to be the most powerful part. It has been reported to have anti-inflammatory\textsuperscript{(3)}, anti-viral\textsuperscript{(4)}, antihelmintic\textsuperscript{(5)}, anticarcinogenic\textsuperscript{(6)}, hepatoprotective\textsuperscript{(7)}, hypoglycemic\textsuperscript{(8)} and wound\textsuperscript{(9)} healing activity as well as antibacterial activity.

The present study was carried out to investigate the analgesic activity in methanolic extract of *Swertia chirayita* (whole plant) by Hotplate and Tail flick method in mice and rats respectively.

## 2: MATERIAL AND METHODS

### 2.1: Collection and Identification of plant

The plant of *Swertia chirayita* was collected in the month of September from the Kauntalani Nursery, which is located at N-30°45’123” Latitude and E- 077°53’00’’ and is 2580 m (above mean sea level), Fortrex 201 GPS. Kauntalani Nursery belongs to the Chakrata Forest Division, District Dehra Dun, Uttarakhand. Its botanical identity was confirmed and authenticated by the plant taxonomist of Department of Botany, Forest research institute, Dehradun. The accession number \textbf{16429} has been assigned to the specimen submitted to FRI herbarium for identification and is identified as *Swertia chirayita* (Roxb.Ex Flem) Karst.

### 2.2: Preparation of extracts

The plant sample was dried and powdered. The dried powder of Swertia *chirayita* (50 gm O.D. basis) extracted with methanol using Soxhlet apparatus. After extraction, extract was filtered through whatman filter paper and reduced to small volume in a flash rota evaporator under reduced pressure. This extract was stored for further examination for its analgesic activity.
2.3: Experimental animals
Young Albino mice (18–25 g) and Wistar rats (180–200 g) of either sex have been used in the present studies which were acquired from Shri Guru Ram Rai Institute of Technology and Science, Dehradun. All animals were kept in the animal house. They were allowed free access to standard food and water. The experimental protocol has been approved by the Institutional animal Ethical committee.

2.4: Chemicals & Drug Used
Nimuslide was used as the standard drug for analgesic activity, which was gifted by Panesia Biotech. Carboxy methyl cellulose was used as a vehicle which was purchased from LOBA Chemmie. Pvt Ltd, Mumbai & Normal Saline. All the chemicals/drugs and solvents used in this study were of analytical grade.

2.5: Analgesic Activity was determined using two methods.
(a) Hot Plate Method by Eddy’s Hot Plate (Elico India)
(b) Tail Flick Mehtod by Analgesiometer (Elico India)

2.5 (a1) Eddy’s hot plate
Principle
In this method heat is used for the induction of pain. This method was first described by Eddy and Leimbach\(^{(10)}\). Hot plate device consists of a water bath in which a metallic cylinder (diameter 20cm and height 10cm) is placed. The temperature of the cylinder is set at 55±1°C.

Procedure
The animals were weighed and appropriately marked. After 15 minutes of drug administration the animals were individually placed on a hot plate and the basal reaction time was taken by observing hind paw licking or jump response (whichever appears first) was taken as end point. The reaction time in second was recorded at the interval of 15, 30, 45, and 60 minutes of drug administration with a cut off period of 15 sec.

Experimental design
Four groups were designed, each group comprised of six albino mice (18–25 gm).

**Group I:** Normal saline (10 ml/Kg, intraperitoneal) was administered.

**Group II:** Test drug methanol extract of *Swertia chirayita* (100 mg/kg) orally was administered.
Group III: Test drug methanol extract of Swertia chirayita (200 mg/kg) orally was administered.

Group IV: Nimuslide (10 mg/Kg intraperitoneal) was administered.

2.5 (b1) Tail flick method

Principle
An analgesiometer was used to record the flicking time of tail [reaction time] of the animals using the heated nichrome wire as the source of heat stimulus. The strength of the current passing through the naked nicrome wire was kept constant at 5 ampere. Cut-off reaction time was 10 sec to avoid any tissue injury during the process\(^{(11)}\).

Procedure
The animals were weighed and appropriately marked. After 15 minutes of drug administration to the animals, the basal reaction time was taken by placing the tip (last 1-2 cm) of the tail of animals on the radiant heat source. The tail-withdrawal from the heat (flicking response) was taken as an end point. Normally mouse withdraws its tail within 3-5 sec. A cut off period of 10-12 sec was observed to prevent damage to the tail. The test drug was administered to each group animal and notes the reaction time at the 15, 30, 45, and 60 minutes. As the reaction time reaches 10 sec it is considered maximum analgesia and the tail is removed from the source of heat to avoid tissue damage.

Experimental design
Four groups were designed, each group comprised of six wistar rats (180–200 g).

Group I: Normal saline (10 ml/Kg, intraperitoneal) was administered.

Group II: Test drug methanol extract of Swertia chirayita (100 mg/kg) orally was administered.

Group III: Test drug methanol extract of Swertia chirayita (200 mg/kg) orally was administered.

Group IV: Nimuslide (10 mg/Kg intraperitoneal) was administered.

3: RESULT

3.1 Statistical analysis
All the data is expressed as ± S.E.M. (standard mean error) statistical difference between mean were determined by one-way ANOVA. P<0.05 were as considered significant.
3.2 Analgesic Activity By Hot Plate Method

Results of analgesic activity by Hot Plate are depicted in the following Table-1

Table 1: Analgesic effect of methanol extract of *Swertia chirayita* on swiss albino mice using Hot plate method

<table>
<thead>
<tr>
<th>Drug Treatment</th>
<th>Time</th>
<th>PR</th>
<th>JR</th>
<th>PR</th>
<th>JR</th>
<th>PR</th>
<th>JR</th>
<th>PR</th>
<th>JR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15min</td>
<td>30min</td>
<td>45min</td>
<td>60min</td>
<td>15min</td>
<td>30min</td>
<td>45min</td>
<td>60min</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>5.0sec± 0.25</td>
<td>7.0sec± 0.36</td>
<td>5.6sec± 0.49</td>
<td>6.5 sec± 0.42</td>
<td>5.8sec± 0.3</td>
<td>6sec± 0.36</td>
<td>7.1sec± 0.6</td>
<td>7.3sec± 0.5</td>
</tr>
<tr>
<td>Test-1 (100mg/kg)</td>
<td></td>
<td>11.3sec± 0.91a</td>
<td>8.6sec± 0.55b</td>
<td>9.1sec± 0.3b</td>
<td>8.1 sec± 0.47</td>
<td>7.3sec± 0.49</td>
<td>6.5sec± 0.42</td>
<td>8.6sec± 0.49</td>
<td>7.8sec± 0.4</td>
</tr>
<tr>
<td>Test-2 (200mg/kg)</td>
<td></td>
<td>9.8sec± 0.6a</td>
<td>11sec± 0.36a</td>
<td>9.5sec± 0.61a</td>
<td>9.8 sec± 0.6b</td>
<td>9.5sec± 0.42b</td>
<td>9.3sec± 0.33b</td>
<td>8sec± 0.25</td>
<td>7.8sec± 0.3</td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td>10.5sec± 0.61a</td>
<td>11.8 sec± 0.47a</td>
<td>11sec± 0.7a</td>
<td>11.5 sec± 0.56a</td>
<td>10sec± 0.42b</td>
<td>10sec± 0.57b</td>
<td>9.5sec± 0.34b</td>
<td>8.5sec± 0.4</td>
</tr>
</tbody>
</table>

PR-Pawlicking Response  JR-Jump Response

Fig. 1 Graphical presentation of Analgesic activity by Hot plate method

Each group (n=6) represents mean ± SEM a=p<0.001 Vs control group, b=p<0.01 Vs control group
The result showed a significant increase in the latency period of the extract treated animals as compared to the control group. The finding reveals that methanolic extract of *Swertia chirayita* possesses analgesic activity. The crude extract was administered in two doses as 100 mg/kg and 200 mg/kg of animals on which the tests were performed. The results of the extract treated animals, when compared with standard (Nimbuslide) showed their analgesic activity comparable with Nimbuslide. It was found that the administration of methanolic extract of *Swertia chirayita* at the doses of 100mg/kg and 200mg/kg shows most significant response after 15 minutes of dose administration in comparison to control group. Both dose show significant response during the test time durations. It is observed that the standard drug Nimbusulide increases significantly the basal reaction time. Fig. 1 exhibits the graphical presentation of Analgesic activity by Hot Plate method.

### 3.3 Analgesic Activity by Tail Flick Method

Results of analgesic activity by tail flick method are depicted in the Table-2

<table>
<thead>
<tr>
<th>Drug treatment</th>
<th>Time</th>
<th>15min</th>
<th>30min</th>
<th>45min</th>
<th>60min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td>4.6Sec ± 0.42</td>
<td>4.8 Sec ± 0.30</td>
<td>5.6 Sec ± 0.33</td>
<td>5.8 Sec ± 0.60</td>
</tr>
<tr>
<td>Test-1 (100mg/kg)</td>
<td>7.3 Sec ± 0.55&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.5 Sec ± 0.34&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.1 Sec ± 0.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.6 Sec ± 0.33</td>
<td></td>
</tr>
<tr>
<td>Test-2 (200mg/kg)</td>
<td>6.6 Sec ± 0.42&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.8 Sec ± 0.30&lt;sup&gt;c&lt;/sup&gt;</td>
<td>7 Sec ± 0.35&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.5 Sec ± 0.21&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>7.5 Sec ± 0.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.6 Sec ± 0.40&lt;sup&gt;c&lt;/sup&gt;</td>
<td>8 Sec ± 0.25&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.3 Sec ± 0.33&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

The result showed a significant increase (on an average about 40 to 50%) in tail flick time i.e., an increase in the latency period of the extract treated animals as compared to the control group. The findings suggested that Methanolic extract of *Swertia chirayita* possess analgesic activity. The crude methanolic extract was used in two doses of 100 mg / kg and 200 mg / kg of tested animals under test (Group II and Group III).

Test I (100mg/Kg) showed significant analgesic effect at 15 minutes (7.3 Sec ± 0.55), 30 minutes (6.5 Sec ± 0.34) and 45 minutes (7.1 Sec ± 0.6). However in Test II (200mg/Kg)
produced significant results at 15 minutes (6.6 Sec ± 0.42), 30 minutes (7.8 Sec ± 0.30), 45 minutes (7 Sec ± 0.35) and 60 minutes (8.5 Sec ± 0.21). The results of the extract treated animals, when compared with control group produced significant results. Standard drug (Nimuslide) gave significantly increased tail flicking of rats at in all observed time interval. The graphical representation of analgesic activity by tail flick method between the response time and activity time on the animals using methanolic extract has been presented in Fig. 2

![Graphical presentation of Analgesic activity by Tail flick method.](image)

**Fig. 2** Graphical presentation of Analgesic activity by Tail flick method.

Each group N=6 represents mean ± SEM, a = P < 0.01 Vs Control group, b = P < 0.05 Vs Control group, c = P < 0.001 Vs Control group

4. DISCUSSION

Animal tests of analgesic drugs commonly measure nociception and involve testing the reaction of an animal to painful stimuli \(^{(12)}\). In the present study the thermal test was selected because of several advantages including the sensitivity to strong analgesics and limited tissue damage.

The hot plate and tail flick method involve spinal reflexes and is regarded as one of the most suitable methods for studying the involvement of centrally acting analgesics \(^{(13)}\). Drugs that act primarily on the central nervous system inhibit both phases equally while peripherally acting drugs inhibit the late phase \(^{(14)}\).

An increase in reaction time is generally considered as an important parameter of analgesic activity in Heat conduction method. In these models, increase in stress tolerance capacity of the animals indicates the possible involvement of a higher centre \(^{(15)}\). It is therefore thought that the analgesic effect of *Swertia chirayita* seen in this study may involve central activity.
Therefore, the result of this study proved the uses of this plant in folklore medicine for the management of pain.

5. CONCLUSION
The present experimental findings suggest that *Swertia chirayita* is a promising analgesic drug and will be able to replace synthetic analgesic drug. Further study is needed to explore the exact mechanism of the methanolic extract for its activity and hence it is necessary to evaluate its analgesic activity on human being in clinical conditions.

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REFERENCES


