**INTRODUCTION**

Natural products from medicinal plants, either as pure compounds or as standardized extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. Due to an increasing demand for chemical diversity in screening programs, seeking therapeutic drugs from natural products, interest particularly in edible plants has grown throughout the world. Many beneficial biological activity such as anticancer, antimicrobial, antioxidant, antidiarrheal, analgesic and wound healing activity were reported from various plants. In many cases the people claim the good benefit of certain natural or herbal products. However, pre-clinical and clinical trials are necessary to demonstrate the effectiveness of a bioactive compound to verify this traditional claim.  

*Solanum indicum* Linn. (Synonym: *Solanum anguivi*) belongs to the family Solanaceae commonly known as Byakur, Guta begun, Kata begun, Brihati, Indian Night shade etc. It is a bushy herb containing prickly spikes in the stem and available throughout the India and all over the tropical and subtropical regions of the world. The fruits are edible and traditionally used to treat various diseases. The different parts (fruits, leaves, roots) of this plant used by the traditional practitioners in the treatment of loss of appetite and anorexia, blood disorders, rhinitis, cough, asthma, sore throat and hiccups, sexual disorders, abdominal pain and worm infestation, pain and fever, inflammation, insomnia, urinary complications, cardiac weakness etc. It has been reported earlier, fruits and roots of this plant contains wax, fatty acids, alkaloid solanine and solanidine, disogenin, lanosterol, β-sitosterol, solasorne, solamargine and solasidine etc.  

However, the medicinal properties have not been properly reported in previous studies. This led to the present team to investigate into the preliminary phytochemistry and pharmacological action of the crude methanolic extract (ME) of fruits of *Solanum indicum* Linn.
Laboratory, Department of Botany, Tripura University (A Central University).

The fresh fruits (berries) of Solanum indicum Linn. were dried under sunlight and powdered in a hand mill. 300 gm of dried fine powder (# 40 mesh size) was treated with petroleum ether (60-80) for 24 hours to remove the fatty materials and was extracted with MeOH in a Soxhlet apparatus exhaustively at 40-45°C temperature for 12 hours. The crude MeOH (Methanolic) extract was concentrated under reduced pressure in vacuum to get a semisolid residue (48 gm). This semisolid residue of MeOH extract (ME) has been used for further experiments.

**Phytochemical screening**

The crude MeOH extract obtained was subjected to different qualitative chemical tests for the identification of various phyto-constituents. Different qualitative tests like tests for alkaloids, steroids, flavonoids, saponins, reducing sugars, tannins, gums, amino acids and anthraquinones etc. were performed according to the established procedure.

**Selection of Experimental Animals**

Adult Albino rats (Wistar strain) of either sex with weighing 180–200 gm were used for screening of Pharmacological activity. The animals were maintained on the suitable nutritional and environmental condition throughout the experiment. The animals were housed in polypropylene cages with paddle house bedded under standard laboratory condition for an acclimatization periods of 7 days prior to performing the experiment. The animals had access to laboratory chow and water ad libitum. The experimental protocols were approved and a written permission from Institutional Animal Ethical Committee (Regd. No.:1006/ac/06/CPCSEA, 2006, from Ministry of Environment & Forests, Govt. of India) has been taken to carry out and complete this study.

**Acute Toxicity Study**

The acute toxicity was determined as per the OECD guideline no. 425 (OECD guideline 425, 2000). Immediately after dosing, the animals were observed continuously for the first 4 hours for any behavioral changes. Thereafter, they were kept under observation up to 14 days after drug administration to find out the mortality if any. It was observed that the test extract was not lethal to the rats even at 2000mg/kg dose. Hence, the dose of 250 and 500 mg/kg was arbitrarily selected for the study.

**Evaluation of Analgesic activity by radiant tail flick method**

The central analgesic activity was determined by radiant heat tail-flick method in rats. Tail-flick latency was assessed by using the analgesiometer (INCO, India). Animals of either sex were divided into four (4) groups containing six in each group for this experiment. The animals of different groups were treated with drugs (test extract 250 mg/kg and 500 mg/kg, Aspirin 100 mg/kg as standard, p.o.) and normal saline (1 ml p. o.) as control. The time taken by rats to withdraw (flick) the tail was taken as the reaction time. The animals were subjected to the same test procedure at +30, +60 and +120 min after the treatment.

**Evaluation of Antipyretic activity by Brewer’s yeast induced pyrexia method**

Albino rats of either sex were divided into four groups containing six in each group for this experiment. The antipyretic activity was evaluated using Brewer’s yeast induced pyrexia in Wistar Albino rats. All the animals were injected subcutaneously with 15% Brewer’s yeast suspended in 0.5% carboxy methyl cellulose in normal saline. After 18 hours of yeast induction rectal temperature of all the animals was recorded. All the treatments (Control, standard drug and test drugs) were administered to different respective groups after 19 hours of induction of pyrexia. 10 ml/kg (p.o) of normal saline was administered to the control groups of animals and Paracetamol at dose of 150mg/kg (p.o) was administered to standard group of animals. The test extract was administered at a dose of 250 mg/kg and 500 mg/kg (p.o) of body weight to the respective groups of animals. Rectal temperature was recorded by clinical thermometer upto 4 hrs (20, 21, 22, and 23 hour) after drug administration.

**Evaluation of Anti-inflammatory activity by Carrageenan induced paw oedema method**

Anti-inflammatory activity of the extract was evaluated by carrageenan induced paw oedema method. Animals of either sex were divided into four (4) groups containing six in each group for this experiment. After acclimatization to the laboratory environment the test rats were treated with both test extract (250 and 500 mg/kg), Diclofenac Sodium (1 mg/kg) and normal saline (1 ml p.o) as control. All the treatments were given orally to the respective groups. After 30 min. of drug treatment right hind paw of all the animals were injected with 0.1 ml of 1% Carrageenan suspension in normal saline. Paw volume was measured by using mercury plethysmometer at 0, 2, 4, 6 and 24 h after induction of edema. Inhibition of edema was calculated from the difference in paw volume between control and extract treated rats as:

\[
\text{Percent inhibition} = \left[\frac{V \text{c} - V \text{t}}{V \text{c}}\right] \times 100
\]

Where \(V \text{c}\) is average increase in paw volume of control rats and \(V \text{t}\) is average increase in paw volume of treated rats.

**Evaluation of CNS depressant activity by locomotion inhibition method**

Adult Wistar albino rats of 180 – 200 gm body weight were used. The spontaneous locomotor activity of each rat was recorded individually for 10 min using Actophotometer (INCO, India) before the drug administration. After that, test drugs (250 and 500 mg/kg...
p.o) and standard diazepam 0.5 mg/kg (p.o) were administered and control group was treated with normal saline 10 ml/kg (p.o). Number of movements of each animal after drug administration was observed in Actophotometer at 1, 2, 3 hour intervals respectively.

Statistical analysis
Data are analysed by one way ANOVA followed by Tukey’s multiple correlation test. Comparison was made with control and the significance level was considered at P ≤ 0.05. All the data were analyzed using Graph Pad Prism 5.0 software.

RESULTS AND DISCUSSION
Phytochemical screening
Extract showed positive reactions for flavonoids, steroid, saponins, anthraquinones, reducing sugars, tannins but exhibited negative response for gums, amino acids and alkaloids.

Antipyretic activity by Brewer’s yeast induced pyrexia method

Table 2: Antipyretic activity of Solanum indicum Linn. fruits MeOH extract

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rectal Temp. (°C) before and after drug administration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basal 0 h</td>
</tr>
<tr>
<td>Control (NS)</td>
<td>37.42 ± 0.15</td>
</tr>
<tr>
<td>ME (250 mg/kg)</td>
<td>37.31 ± 0.44</td>
</tr>
<tr>
<td>ME (500 mg/kg)</td>
<td>37.38 ± 0.61</td>
</tr>
<tr>
<td>Paracetamol (150 mg/kg)</td>
<td>37.28 ± 0.34</td>
</tr>
<tr>
<td>Paracetamol (200 mg/kg)</td>
<td>37.27 ± 0.18</td>
</tr>
</tbody>
</table>

Each value represents mean ±SEM of 6 rats, *p value ≤0.05

Anti-inflammatory activity by Carrageenan induced paw oedema method

Table 3: Anti-inflammatory activity of Solanum indicum Linn. fruits MeOH extract

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Time after phlogistic (Oedema induction) agent administration (volume displaced in ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 h</td>
</tr>
<tr>
<td>Control (NS)</td>
<td>0.46 ± 0.005</td>
</tr>
<tr>
<td>ME (250 mg/kg)</td>
<td>0.45 ± 0.005</td>
</tr>
<tr>
<td>ME (500 mg/kg)</td>
<td>0.46 ± 0.005</td>
</tr>
<tr>
<td>Diclofenac Sodium (1 mg/kg)</td>
<td>0.45 ± 0.005</td>
</tr>
</tbody>
</table>

Each value represents mean ±SEM of 6 rats, *p value ≤0.05

CNS depressant activity by locomotion inhibition method

Table 4: CNS depressant activity of Solanum indicum Linn. fruits MeOH extract

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Actophotometer Score after drug administration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 h</td>
</tr>
<tr>
<td>Control (NS)</td>
<td>195.66 ± 9.24</td>
</tr>
<tr>
<td>ME (250 mg/kg)</td>
<td>197.5 ± 12.13</td>
</tr>
<tr>
<td>ME (500 mg/kg)</td>
<td>199.33 ± 11.62</td>
</tr>
<tr>
<td>Diazepam (0.5 mg/kg)</td>
<td>203.13 ± 3.38</td>
</tr>
</tbody>
</table>

Each value represents mean ±SEM of 6 rats, *p value ≤0.05

Acute oral toxicity study
Oral acute toxicity study revealed that the herbal extract (Methanolic extract) did not show any untoward effect till dose of 2000 mg/kg (p. o).

Analgesic activity by radiant tail flick method

Table 1: Analgesic activity of Solanum indicum Linn. fruits MeOH extract
The analgesic activity of MeOH fruit extract of *S. indicum* was found to be significant (p ≤ 0.05) with respect to the control group as well as the reference drug Aspirin (100mg/kg) in increasing the latency period. Highest activity exhibited by extract (ME 500 mg/kg) at 60 min. (5.83±0.32) after drug administration whereas, Aspirin showed less efficacy (4.5±0.14) after same time interval as test drug. The antipyretic activity of the MeOH extract was assessed by the Brewer’s yeast induced pyrexia method exhibited significant (p ≤ 0.05) antipyretic effect compared to the control and standard group in a dose and time dependant manner. Results exhibited marked reduction of rectal temperature in treated groups (38.43±0.18 for ME 250mg/kg, 36.76±0.12 for ME 500mg/kg and 35.88±0.14 for Paracetamol at 20 hour) after yeast induction and treatment. MeOH extract of *S. indicum* fruit exhibited comparable anti-inflammatory activity on Wistar rats in comparison to the reference drug Diclofenac sodium (1mg/kg) after 6 hours of treatment, showed (46.77% for ME 250 mg/kg, 53.37% for ME 500 mg/kg and 58.06% for Diclofenac sodium) inhibition of paw oedema. CNS depressant activity of MeOH extract was found to be significantly (p<0.05) better than the standard drug diazepam (0.5 mg/kg) in case of ME 500 mg/kg after 1 hour of treatment (52.03±2.60). The results of all the extracts including the standard drug are compared with the result produced by control and it was considered as significant as P<0.05. All the data were presented as mean ± SEM and analyzed by one way ANOVA followed by post hoc Tukey’s multiple comparison tests.

**CONCLUSION**

In the light of all these above mentioned experimental evidences lead to hypothesize that the fruit extract of *Solanum indicum* Linn. indeed possesses significant analgesic, antipyretic, anti-inflammatory and CNS depressant activity as depicted in the animal model. However, further studies using larger sample size may be warranted to corroborate the present experimental findings. From the present study findings it is amply evident that the traditional therapeutic claims of the fruits of *Solanum indicum* Linn. fruit has some scientific basis to it.

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REFERENCES


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