

# Antipyretic Potential of *Swertia chirata* Buch Ham. Root Extract

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## Abstract

The aqueous extract of *Swertia chirata* Buch Ham. Root (ASC) (Family: Gentianaceae) was evaluated for its antipyretic potential on Brewer's yeast-induced pyrexia in albino rats and Typhoid-Paratyphoid A, B vaccine induced Hyperexia in rabbits. In both models, the extract, at dose of 200 mg kg<sup>-1</sup> body wt. and 400 mg kg<sup>-1</sup> body weight, produced significant ( $p < 0.001$ ) reduction in elevated body temperature in a dose dependent manner. The antipyretic effect of the extract was comparable to that of paracetamol (150 mg kg<sup>-1</sup> body weight, p.o.), a standard antipyretic agent.

## Keywords

*Swertia chirata* • Chirayta • Antipyretic • Hyperexia • Fever

## Introduction

*Swertia chirata* Buch Ham is an erect annual or perennial herb found in Himalaya and Meghalaya at an altitude of 1200–1300 meters. The drug is extremely bitter in taste. The whole plant used as medicine but root is said to be a therapeutically potential part. The root is small, 5–10 cm long light brown, tapering, bearing a few rootlets [1]. The plant contains a triterpene swertanone, a dimeric xanthone chiratanin [2]. Seco-hopene lactones, swertiamarin [3] swertia lactone – C and swertain – D are also present [4].

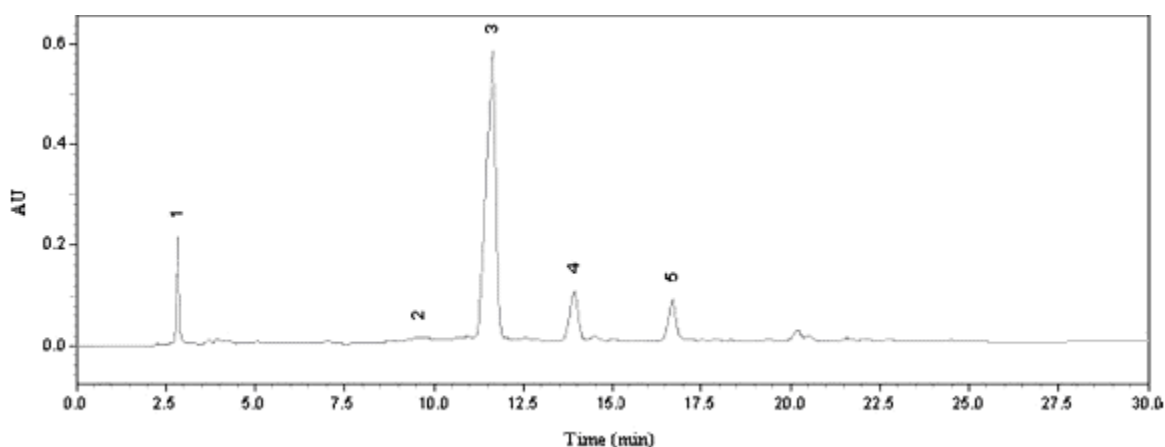
Chirayta is much prized in India as a tonic and bitter without aroma and astringency, unlike other bitters. It possesses all the properties of gentian and can effectively replace it. It is

prescribed in dyspepsia, in the debility convalescence and generally in case in which corroborant measures are indicated. The plant has been reported to possess hypoglycemic activity [5], anti-inflammatory activity [6], hepatoprotective activity [7], wound healing activity [8] as well as antibacterial activity [9] on selected microbial strain and most important antimalarial activity. Various parts of this plant, including the root, stem, flower and leaves are recommended for the treatment of fever in combination and separately. The root juice is given for the relief of fever in whole part of India. *Swertia chirata* is proved key ingredient of Mahasudarshan churna, an Ayurvedic formulation which are widely used in India. Thus an effort has been made to establish the antipyretic effect of aqueous extract of *Swertia chirata* Buch. Ham roots (ASC).

## Results

### Phytochemical Screening

The ASC was tested positive for terpenoids and alkaloids in preliminary phytochemical tests. The HPLC fingerprint of ASC is shown in Fig. 1 and swertiamarin could be identified in ASC. The swertiamarin content of *S. chirata* was found to be 0.44%. The minimum amount of plant material required for the estimation of swertiamarin in *Swertia* species was 2 mg. If the amount of sample was reduced below this limit consistent results could not be obtained. LOD and LOQ for Swertiamarin were 500 and 640 pg, respectively. The linear regression equation was  $Y = 877142X + 1632.8$  and the correlation coefficient ( $r$ ) was 0.9999.



**Fig. 1.** HPLC chromatogram obtained from *Swertia* extract at 254 nm (peak 3 = swertiamarin)

### Toxicity study

**Tab. 1.** Acute Toxicity Study (CPCSEA guideline)

Treatments	Dose (mg kg <sup>-1</sup> body wt.)	No. of animals used	No. of Death	% Death
ASC	2000	3	0	0

In the LD<sub>50</sub> value determination, we observed that the ASC was safe to use in animals and showed no mortality on 2000 mg kg<sup>-1</sup> body wt. Therefore 2000 mg kg<sup>-1</sup> dose was considered as a safe dose, 1/5<sup>th</sup> (400 mg kg<sup>-1</sup> body wt.) and 1/10<sup>th</sup> (200 mg kg<sup>-1</sup> body wt.) of that was selected for all in vivo experiments as maximal dose (Table 1).

### **Effect on Brewer's yeast induced pyrexia**

The effect of the ASC on Brewer's yeast induced pyrexia in rats is presented in Table 2.

The subcutaneous injection of a yeast suspension elevated the rectal temperature markedly after 24 h of administration. Treatment with the ASC at doses of 200 mg kg<sup>-1</sup> body wt. and 400 mg kg<sup>-1</sup> body wt. decreased the rectal temperature of the rats in a dose-dependent manner. The antipyretic effect started as early as 1 h, and the effect was maintained for 4 h, after its administration. The standard drug paracetamol (150 mg kg<sup>-1</sup> body wt.) reduced the yeast-provoked elevation of body temperature significantly. The present results show that the ASC possesses a significant antipyretic effect in yeast-provoked elevation of body temperature in rats, and its effect is comparable to that of paracetamol (standard drug).

**Tab. 2.** Effect of tested samples on Hyperexia induced in rats by Brewer's Yeast

Grp.	Samples	Normal body temp. at 0 hr (°C)	Body temp. 24 hr after admin. of yeast susp. (°C)	Body temp. after drug admin. (°C)			
				1 hr	2 hr	3 hr	4 hr
1	Control	38.29 ±0.22	39.41 ±0.57	39.49 ±0.50	39.61 ±0.47	39.51 ±0.55	39.44 ±0.44
2	ASC (200 mg kg <sup>-1</sup> )	38.26 ±0.41	39.36 ±0.57	38.31 ±0.49*	37.56 ±0.45*	37.51 ±0.48*	37.32 ±0.49*
3	ASC (400 mg kg <sup>-1</sup> )	38.33 ±0.21	39.46 ±0.39	38.31 ±0.49*	38.31 ±0.49*	38.31 ±0.49*	38.31 ±0.49*
4	Paracetamol (150 mg kg <sup>-1</sup> )	38.06 ±0.21	39.3 ±0.35	38.18 ±0.35*	37.48 ±0.30*	37.04 ±0.36*	36.74 ±0.36*

All values are given as mean ± SEM, N=6. \*  $P < 0.001$  compare to yeast suspension treated animals (after Administration of 24 h). Control – 2% Tragacanth sol.

### **Effect on Typhoid-Paratyphoid A, B Vaccine induced Hyperexia**

The effect of the ASC on Typhoid-Paratyphoid A, B Vaccine induced hyperexia in rabbits is shown in Table 3.

Typhoid-Paratyphoid A, B vaccine (0.1 ml) was injected in to the marginal ear-vein and the rectal temperature was recorded in every 15 min intervals. Treatment with the ASC at doses of 200 mg kg<sup>-1</sup> body wt. and 400 mg kg<sup>-1</sup> body wt. decreased the rectal temperature of the rats in a dose-dependent manner. Elevated Temperature significantly reduced by ASC after 30th min. of its administration in rabbits (Table 3). The present results show that the ASC possesses a significant antipyretic effect in Typhoid-Paratyphoid A, B Vaccine induced hyperexia, and its effect is comparable to that of standard.

**Tab. 3.** Effect of tested samples on *Hyperexia* induced in rabbits by Typhoid-Paratyphoid A, B vaccine

Grp.	Samples	Normal body temp. of rabbits (°C)	Body temp. after vaccin. of rabbits (°C)	Body temp. after drug admin. (°C)		
				15 min	30 min	45 min
1	Control (2% Tragacanth)	41.1±0.96	41.90±0.33	41.97±0.26	41.97±0.86	41.93±0.44
2	ASC (200 mg kg <sup>-1</sup> )	41.0±0.26	41.44±0.29	41.52±0.25*	40.76±0.36*	40.26±0.45*
3	ASC (400 mg kg <sup>-1</sup> )	41.1±0.23	41.78±0.33	41.84±0.29*	41.26±0.29*	41.01±0.29*
4	Paracetamol (150 mg kg <sup>-1</sup> )	41.2±0.98	41.66±0.28	40.78±0.25*	40.29±0.32*	39.78±0.24*

All values shown as Mean ± SEM, N=6. \*  $P < 0.001$  compare to vaccinated animals.

## Discussion

This study examined the antipyretic activity of aqueous extract of the root of *Swertia chirata* Buch Ham (ASC) in experimental animal models using rats and rabbits. We observed that ASC lowers the body temperature in a dose-dependent manner up to 4 h after its administration. Fever was induced as described by Abena, A. A, et al. (2003) and Narayanan, N, et al. (2000). Fever may be a result of infection or one of the sequelae of tissue damage, inflammation, graft rejection, or other disease states. Antipyretics are drugs which reduce elevated body temperature. Regulation of body temperature requires a delicate balance between the production and loss of heat, and the hypothalamus regulates the set point at which body temperature is maintained. In fever this set point is elevated, and drugs like paracetamol do not influence body temperature when it is elevated by factors such as exercise or increases in ambient temperature [10]. The present study reveals that the root extract of *Swertia chirata* Buch Ham causes a significant antipyretic effect in yeast-provoked elevation of body temperature (Table 2) as well as Typhoid-Paratyphoid A, B Vaccine induced hyperexia (Table 3). In both the cases, the extract caused a significant lowering of body temperature, with the effect being comparable to that of paracetamol. The preliminary phytochemical analysis reveals that the major chemical constituents of the ASC are terpenoids. The major chemical components of *Swertia chirata* are known to be xanthone and triterpenoids [11]. Thus Swertiamarin (Fig.1) found in ASC, which might be responsible for the antipyretic activity. Thus, the present pharmacological evidence provides support for the folklore claim of *Swertia chirata* as an antipyretic agent.

## Experimental

### Plant materials

Fresh roots of *Swertia chirata* were collected from North Utteranchal in Himalaya region, during February-March 2005. The voucher specimens have been identified and deposited at the Herbarium Section, Dept. of Pharmacognosy, B. R. Nahata Collage of Pharmacy

Mandsaur (M.P.). The material was dried under controlled temperature, powdered and passed through a # 40 mesh sieve and stored in decicator until extraction.

### **Extraction**

Aqueous extract was prepared by cold maceration method and filtered twice through filter paper. The obtained extract was dried by evaporation (yield was 15.6% as compare to powdered material). The extract was stored in refrigerator and weighed quantity was suspended in 2% Tragacanth solution for the experiment.

### **Phytochemical Screening**

The chemical constituents of the ASC were identified by qualitative analysis and confirmed by thin layer chromatography for the presence of flavonoids, tannins, steroids and saponins. HPLC analysis was performed with a Simadzu-10AT<sub>VP</sub> HPLC system which was equipped with software Spinchrom Chennai and detector Simadzu UV VIS SPD-10 A<sub>VP</sub>. The chromatographic separation of samples was achieved by a reversed-phase HPLC column Merck's (Lichrospher 100 ODS C18, 250mm×4.6mm, 5 $\mu$  particle size) using 2% aqueous acetic acid and methanol (80:20) mobile phase with flow rate 1.0mL/min, and the detection wavelength 254 nm.

### **Animal used**

Wistar albino rats (150±20 g) and rabbits of either sex were used for the study. Albino mice weights about 25±5 g were used for the acute toxicity studies of the crude extracts. Institution Animal Ethics Committee has approved the project (918/ac/05/CPCSEA). The animals were kept in departmental animal house in well cross ventilated room at 27±2°C, relative humidity 44–56% and light and dark cycles of 10 and 14 h respectively for 1 week before and during the experiments. Animals were provided with standard diet (Lipton, India) and the food was withdrawn 18–24 h before the start of the experiment and water *ad libitum*.

### **Acute Toxicity Studies**

The acute toxicity of the extracts was determined in albino mice, maintained under standard conditions. The animals were fasted overnight prior to the experiment. Fixed dose (OCED Guideline No. 420) method of CPCSEA was adopted for toxicity studies.

### **Induction of yeast-induced pyrexia**

Rats were divided into five groups of six rats each. The normal body temperature of each rat was measured rectally at predetermined intervals and recorded. Hyperexia was induced in rats by 20 ml/kg administration of 20 % aqueous suspension of brewer's yeast subcutaneously. The animals were then fasted for the duration of study (approx 24 hrs), but water was made available *ad libitum*. Control body temperature was taken 24h after the injection to determine the pyretic response to the yeast. Body temperature was taken 1h prior to drug administration in fevered animal served as pre drug control. Extracts were given in dose 200 mg kg<sup>-1</sup> body wt. 200 mg kg<sup>-1</sup> body wt., orally. Paracetamol was taken as standard drug (150 mg kg<sup>-1</sup> body wt.) [12]

### **Induction of pyrexia by Typhoid-Paratyphoid A, B vaccine**

Rabbits maintained in the laboratory for 24h prior to the experiment were used. Typhoid-Paratyphoid A, B vaccine (0.1 ml) was injected in to the marginal ear-vein and the rectal temperature was recorded in every 15 min. intervals using "Electrolab" 18 channel telethermometer. Sample was given in dose 200 mg kg<sup>-1</sup> body wt. and 400 mg kg<sup>-1</sup> body wt., orally after 60 min Typhoid-Paratyphoid A, B vaccine injection. The rectal temperature were recorded every 30 min up to 3 h. Paracetamol was taken as standard (150 mg kg<sup>-1</sup> body wt.) [13].

### **Statistical Analysis**

The data are expressed as mean  $\pm$  S.E.M. The difference among means has been analyzed by one-way ANOVA. A value of  $P < 0.05$  was considered as statistically significant.

### **Authors' Statements**

#### **Competing Interests**

The authors declare no conflict of interest.

#### **Animal Rights**

The institutional and (inter)national guide for the care and use of laboratory animals was followed. See the experimental part for details.

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