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Research Article

Antidiarrhoeal and Antispasmodic Effect of *Berberis aristata*

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ABSTRACT

Berberis aristata (family Berberidaceae) has been traditionally used as an ingredient of polyherbal formulations for the treatment of diarrhoea. Aqueous extract of stems of *Berberis aristata* (100, 200, 400 mg/kg, p.o.) was tested for its antidiarrhoeal and antispasmodic effect in mice. The method of magnesium sulphate (2 g/kg) induced diarrhoea were used to evaluate antidiarrhoeal activity, while charcoal meal test and castor oil induced intestinal secretions were used for testing antimotility and antisecretory activity in mice. Aqueous extract of *Berberis aristata* (BA) treated mice, significantly reduced the induction time of diarrhoea, number of wet stools and total no of stools in the diarrhoea induced by magnesium sulphate. It has also produced antimotility and antisecretory activity in castor oil induced intestinal transit and intraluminal fluid accumulation in mice. These results indicate that BA produces its antidiarrhoeal effect through decreasing intestinal secretions and antispasmodic effect through inhibiting the intestinal motility.

Key words: *Berberis aristata*, antidiarrhoeal and antispasmodic.

INTRODUCTION

Diarrheal disease is a leading cause of mortality and morbidity, especially among children in developing countries resulting in a major health care problem[1]. In view of this, the World Health Organization has initiated Diarrhoea Disease Control Program to study traditional medical practices and other related aspects[2, 3].

The plant *Berberis aristata* DC. Belongs to family Berberidaceae known as Indian barberry in English and Daruhaldi in Hindi. It is a erect spinous shrubs with leaves are simple spiny and yellowish brown stem found growing wild in sub-Himalayan tract of India[4]. It is used in Ayurvedic medicine from very long time. The plant is used traditionally in inflammation, wound healing, skin diseases, diarrhoea jaundice and infection of eyes[5].

EXPERIMENTAL SECTION

Drugs: i) Castor oil (refined pure) – Paras Chemical Industries, ii) Loperamide hydrochloride – Cipla Pharmaceuticals Ltd., iii) Chlorpromazine hydrochloride – Rhone Poulene (India) Ltd., iv) Activated Charcoal – E. Merck, v) Magnesium sulphate – Merck, vi) Atropine sulphate – Sigma chemicals Ltd.

Plant material and preparation of the extract: Stems of *Berberis aristata* were obtained from local market. The botanical identification of the fruits was done at Pharmacognosy Department, Government College of Pharmacy, Aurangabad (M.S.), India. The dried stems were coarsely powdered. The powdered stems (200 gm) were taken in a round bottom flask and was extracted with water for 48 hr at room temperature. After 48 hr, the solution was filtered and the filtrate was concentrated in a rotary evaporator and the last trace was removed in vacuum. The various concentrations of the aqueous extract of *Berberis aristata* (BA) were given 0.1 ml orally.

Animals: "Swiss albino mice" of either sex, weighing; 20 – 25 gm obtained from VIPER, Pune, were used for the experiments. They were kept in standard environmental condition, fed standard food and water ad libitum. All experiments were performed after an overnight fast. The study was approved by Institutional Animal Ethical Committee of Government College of Pharmacy, Aurangabad, Maharashtra, India (GCPA/IAEC/2011/235, 11/03/2011).

Experimental procedure for antidiarrhoeal activity: Acute toxicity: BA studied for acute oral toxicity as per revised OECD guidelines number 423. BA was devoid of any toxicity up to 2000 mg/kg in albino mice by oral route. Hence for further studies doses of 100 to 400 mg/kg of BA was used [6].

Magnesium sulphate induced diarrhea: The animals were divided in to control, positive and test groups containing six in each group. Each mouse was kept for observation under a glass funnel, the floor of which was lined with blotting paper and observed for 4 h. Diarrhea was induced by administering 2 gm/kg magnesium sulphate orally to mice. The control group received only distilled water (10 ml/kg, po); the positive control group received loperamide (2 mg/kg, po); test group received BA at doses of 100, 200, 400 ml/kg, po, body weight 30 min before the administration of magnesium sulphate. During an observation period of 4 h, the parameters observed were: onset of diarrhoea, total number of faecal output, and number of wet faeces [7].

Small intestinal secretions: Effect of BA on intestinal secretion was indirectly studied by enteropooling assay. The mice were divided into different groups and treated with BA (100, 200, 400 mg/kg, po), distilled water (10 ml/kg, po) and Chlorpromazine (30 mg/kg, po) before the oral administration of castor oil 0.2 ml per mouse. These mice were sacrificed 30 min later and entire small

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Table 1: Effect of *Berberis aristata* on magnesium sulphate induced diarrhoea in mice.

Group	Dose (mg/kg)	Onset of diarrhoea (min)	Total numbers of stools	Number of wet stools	% Inhibition
Control		46±1.55	13.83±0.51	12.00±0.42	
BA	100	63±2.23	9.66±0.42	9.50±0.41	20.83
BA	200	72±3.45	8.66±0.45	8.66±0.39	27.83
BA	400	85±3.63	7.50±0.32	7.50±0.38	37.50
Loperamide	2	193±5.27	1.50±0.29	1.16±0.19	90.33

Values are mean ± standard error of mean.
Each value represents average of six determinations.
P < 0.05 vs. control, student's 't' test.

Table 2: Effect of *Berberis aristata* on intraluminal fluid accumulation in mice.

Experimental Group	Dose (mg/kg)	Weight of small intestine (mg)	Castor oil induced intraluminal fluid (mg)	% Inhibition
Normal		1133±31		
Control		1583±42	450±33	
BA	100 mg	1504±38	371±25	17.55
BA	200 mg	1480±29	347±22	22.88
BA	400 mg	1449±21	316±18	29.77
Chlorpromazine	30 mg	1224±19	91±11	79.77

Values are mean ± standard error of mean.
Each value represents average of six determinations.
P < 0.05 vs. control, student's 't' test.

Table 3: Effect of *Berberis aristata* on intestinal transit in mice.

Group	Dose (/kg)	% intestinal transit	% Inhibition
Control		78.45±2.47	
BA	100 mg	66.37±2.62	15.39
BA	200 mg	62.48±2.31	20.35
BA	400 mg	56.32±2.18	28.20
Atropine sulphate	5 mg	31.66 ± 1.16	59.64

Values are mean ± standard error of mean.
Each value represents average of six determinations.
P < 0.05 vs. control, student's *'t'* test.

intestine from each animal was weighed and their group average was calculated. The difference in the weight of intestine in control and castor oil treated group was considered as the castor oil induced accumulation of intestinal fluid [8].

Gastrointestinal motility by charcoal meal: The animals were divided in to control, positive and test groups of six mice each. Each animal was given orally 0.2 ml of charcoal meal (3% charcoal in 5 % gum acacia). The test groups received the BA at doses of 100, 200, 400 mg/kg, po, body weight immediately after charcoal meal administration. The positive control group received atropine sulphate (5 mg/kg, ip), while the control group received distilled water (10 ml/kg, po). After 30 min., the animals were sacrificed and the movement of charcoal from pylorus to caecum was measured. The peristaltic index, which is the distance travelled by charcoal meal to the total length of small intestine expressed in terms of percentage [9].

STATISTICS

The results of all experiments were reported as mean ± S.E.M. Statistical analysis was carried out using Student's *'t'*-test. A level of significance of *P*< 0.05 was regarded as statistically significant.

RESULTS

Effect of *Berberis aristata* on magnesium sulphate induced diarrhea: All the mice in control group produced diarrhoea after magnesium sulphate administration during the observation period of 4 h. Pretreatment of mice with the different doses of BA caused a significant dose dependent reduction of number of wet stools and total no of stools as shown in Table 1.

Effect of *Berberis aristata* on small intestinal secretion: BA dose dependently reduced the castor oil induced intraluminal accumulation of fluid as shown in Table 2.

Effect of *Berberis aristata* on small intestinal transit: The results revealed that BA inhibited the castor oil induced gastrointestinal transit of charcoal in mice by dose dependent manner as shown in Table 3.

DISCUSSION

Magnesium sulphate produces the diarrhoea by osmotic properties, preventing reabsorption of water ions, leading to increase in the volume of the intestinal content. It promotes the liberation of cholecytokinin from the duodenal mucosa, which increases the secretion and motility of small intestine and thereby prevents the reabsorption of sodium chloride and water [10]. BA found to reduce the diarrhoeic condition in this model may be by increasing the absorption of water and electrolyte from the gastrointestinal tract.

Diarrhoea occurs when the bowels secrete more electrolytes and water than they absorb. Castor oil produces permeability changes in the intestinal mucosa membranes to water and electrolytes resulting in fluid and watery luminal content that flows rapidly through small and large intestines [11]. BA inhibited the castor oil induced intestinal fluid accumulation.

Gastro intestinal motility describes the contraction of the muscles that mix and propel contents in the gastrointestinal tract. Charcoal meal test in mice is a method used to study the effect of drugs on the motility of intestine [12]. BA was found to be the inhibitor of intestinal motility, showing its antispasmodic effect.

CONCLUSION

These results indicate that *Berberis aristata* possesses antidiarrhoeal and antispasmodic effect. Antidiarrhoeal effect may be produced by decreasing intestinal secretions and by increasing the absorption of water and electrolyte from the gastrointestinal tract while antispasmodic effect by inhibiting the intestinal motility.

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