ORIGINAL ARTICLE

Antidiarrheal activity of *Capparis zeylanica* leaf extracts

Karanayil R. Sini, Barij N. Sinha[1], Aiyolu Rajasekaran[2]

Department of Pharmaceutical Chemistry, Grace College of Pharmacy, Palakkad, [1]Department of Pharmaceutical Sciences, BIT, Mesra, Ranchi, [2]KMCH College of Pharmacy, Coimbatore, India

J. Adv. Pharm. Tech. Res.

ABSTRACT

The antidiarrheal activity of the methanolic extract of the leaves of *Capparis zeylanica* (Capparidaceae) was investigated by castor oil-induced diarrhea and small intestine transit method on mice. Like loperamide (3 mg/kg body weight), *C. zeylanica* methanolic extract (100,150,200 mg/kg body weight) produced a significant decrease in the severity of diarrhea. The percentage protection in extract-treated animals showing diarrhea was compared with castor oil-treated and loperamide-treated animals. The activity was found to be dose-dependant. Its effect when evaluated on intestinal transit produced a decrease in intestinal transit (75.97%).The results revealed that the methanolic extract significantly reduced diarrhea in mice with reduction in weight of stools.

Key words: *Capparis zeylanica*, castor oil, intestinal transit, loperamide

INTRODUCTION

Diarrheal diseases are responsible for the death of millions of people each year.[1] There are large numbers of epidemiological and experimental evidence pertaining to worldwide acute diarrheal disease, which is one of the principal causes of death in the infants.[2] Worldwide distribution of diarrhea accounts for more than 5-8 million deaths each year in infants and children below 5 years old especially in developing countries.[3] Most people are affected by diarrhea at some time in their lives. It is often accompanied by stomach pains, feeling sick and vomiting. It is usually due to consumption of drinking water contaminated with bacteria, undercooked meat and eggs or inadequate kitchen hygiene-in other words-an infection .According to WHO estimates for 1998, about 7.1 million deaths were caused by diarrhea.[4] Despite immense technological advancement in medicine; many people in developing countries still rely on traditional healing practices and medicinal plant for their daily health care need.[5] *Capparis* is a genus of perennial flowering shrubs known collectively by the common name caper shrubs or caper bushes. The genus *Capparis* L. (Capparaceae) consists of about 250 species distributed mostly in tropical and subtropical regions.[6] Compounds that have been isolated and characterized from the genus *Capparis* include flavonoids, fatty acids, lipids, alkaloids and glucosinolates. *Capparis zeylanica*, a rigid, wiry and much-branched shrub, is widely distributed in Bangladesh, India, Sri Lanka and Malaysia.[7] Plants are 2-3 meters in height, armed with 3-6 mm long recurved thorns, branched, leaves are elliptic or broadly lanceolate,rounded base, apex mucronate; flower profuse, pinkish white, later turning pink, berries are globular or elliposide, 3-4 cm in diameter and seeds are globase, embedded in white pulp. The plant grows in a moist habitat. It is used traditionally as stomachic, sedative, antihydrotic and also in cholera, hemiplegia, neuralgia and rheumatism.[8] In northern India, the leaves are used as a rubefacient,[9] counter irritant and as a cataplasm in boils, swellings and piles.[10] The leaf juice has been used by the folklore in the treatment of diarrhea. Hence the methanolic extract of *C. zeylanica* leaf extract was investigated for its antidiarrheal activity to substantiate folklore claim. The plant has previously been reported to produce fatty acids.[11] *Capparis* species have been reported to have anthelminthic, antimicrobial and anti-inflammatory activities.[12-13] In northern India, the leaves are widely used as counter-irritant, febrifuge and as a cataplasm in swellings, boils and piles.[14] The various species of genus *Capparis* are useful in the treatment of cough, asthma, inflammation, fevers, and also useful as poultice in gout.[15] Phytochemical

Address for correspondence

Mrs. K. R. Sini,
'Punarjani', Ponkattparamb Kalekkad, Palakkad, Kerala - 678015, India. E-mail: sinikaranayil@gmail.com

Access this article online	
Quick Response Code:	Website: www.japtr.org
	DOI: 10.4103/2231-4040.79803

screening of the plant has shown the presence of fatty acids and flavonoids in the leaves.[16,17] Whole plant showed the presence of saponin, p-hydroxybenzoic, syringic, vanillic, ferulic and p-coumanic acid. Leaves and seeds showed presence of β-carotene, thioglycoside, glycocapparin, *N*-triacontane, α-amyrin and fixed oil where as a root bark showed presence of an alkaloid, a phytosterol, a water-soluble acid and a mucilaginous substance.

MATERIAL AND METHODS

Plant Material

The fresh leaves of *C. zeylanica* (Capparidaceae), collected at the flowering stage in the month of March 2010 from the tribal areas of Palakkad district, Kerala, South India were authenticated by the Botanical survey of India, Coimbatore, Tamilnadu (BSI). A voucher specimen (no.BSI/SRC/5/23/10-11/Tech-565) is deposited in the departmental herbarium. Leaves were dried in shade for 20 days and then powdered to get a coarse powder. This powder was stored in air-tight container and used for further successive extraction.

Preparation of Crude Extract

The dried and powdered plant material was soxhlet extracted with methanol. The extraction was carried out for 24 h at room temperature with mild shaking. The extract was filtered and concentrated at 45°C, and the weight of the residue was recorded. The percentage yield of methanolic extract was found to be 36.50%w/w and was used for further studies.[18]

Animals

Healthy Swiss albino mice of male sex weighing between 15 and 30 g obtained from Kerala Veterinary College, Mannuthy, Kerala. The animals were housed under standard conditions of light/dark at 12/12-hr cycle. They were fed with commercial pellet diet and water *ad libitum*. All animal experiments were carried out in accordance with guidelines of CPCSEA and the study was approved by the institutional Animal Ethics Committee (NCP/IAEC/CLEAR/05/03/2007-08).

Drugs and Chemicals

Loperamide (Janssen), castor oil (Bell Sons and Co., England), atropine sulphate (S.D Fine chemicals, Mumbai), normal saline solution (0.9% NaCl) and vehicle (0.5% v/v Tween 80 in distilled water) were used.

Acute Toxicity Study

The method previously described by Lorke (1983) was adopted using 13 mice.[19] In the first phase, three doses of the methanolic extract (10, 100 and 1000 mg/kg were administered to three groups each containing three mice). In the second phase, more specific doses were administered to four groups each containing one mouse. The median lethal dose (LD50) was determined as the geometric mean of the highest non lethal dose and lowest lethal dose of which there is 0/3 and 0/1 survival.

Castor Oil-induced Diarrhea

Twenty-four mice were allowed to fast for 18 h and divided into five groups of six animals each. All groups received castor oil at a dose of 0.4 ml/animal orally. Thirty minutes after castor oil administration, the first group (control group) received vehicle (0.5% Tween 80 in distilled water), the second group received reference drug loperamide (3mg/kg body weight) and third, fourth and fifth group received 100, 150 and 200 mg/kg body weight, respectively, of the methanolic extract of *C. zeylanica* (MCZ). After the administration, the animals were placed separately. The severity of diarrhea was assessed each hour for 6 h [Table 1]. The total weight of feces was recorded within a period of 24 h and compared with the control group. The total number of diarrhea feces of the control group was considered 100%. The results were expressed as a percentage of inhibition of diarrhea.[20,21]

Small Intestinal Transit

Animals were divided into five groups of six mice each, and were given orally 1 ml of charcoal meal (5% activated charcoal suspended in physiological saline) 60 min after an oral dose of drugs or vehicle. Group I was administered with physiological saline (10 ml/kg) and animals in groups II, III and IV were administered MCZ (100, 150 and 200 mg/kg). Group V received atropine sulphate (0.1 mg/kg) as standard drug [Table 2]. After 30 min animals were killed by

Table 1: Effect of MCZ on castor oil-induced diarrhea

Treatment (oral)	Dose	Weight of stools (g) (Mean±SEM)	% protection
Control	2 ml/kg	1.164±0.055*	–
Standard	3	0.244±0.0233**	79.03
MCZ	100	0.477±0.0238**	59.02
MCZ	150	0.377±0.0245**	67.61
MCZ	200	0.258±0.0648**	77.83

***P*<0.01 and **P*<0.05 statistically (Mean±SEM) significant from control group (n=6)

Table 2: Effect of MCZ on small intestinal transit method

Treatment	Dose (mg/kg)	Mean distance travelled by charcoal as % total length of small intestine (cm)	Reduction (%)
Control	2 ml/kg	84.257±1.999	–
Loperamide	0.1	15.244±2.040	81.91
MCZ	100	39.667±2.112*	52.92
MCZ	150	30.333±1.090*	64.00
MCZ	200	20.244±2.444*	75.97

**P*<0.001; data are expressed as (Mean±SEM); n=6 (One way ANOVA followed by Dunnett's test)

cervical dislocation, and the intestine was removed without stretching and placed lengthwise on moist filter paper. The length of the intestine (pyloric sphincter to cecum) and the distance travelled by the charcoal as a percentage of that length were evaluated for each animal, and group means were compared and expressed as percentage inhibition.[22]

Statistical Analysis

All the experimental results were expressed as mean±S.E.M. Data were analyzed by analysis of variance (ANOVA) followed by Dunnett's test.

RESULT AND DISCUSSION

Preliminary phytochemical screening of the methanolic extract of *C. zeylanica* (MCZ) revealed the presence of alkaloids, flavonoids, carbohydrates, glycosides, tannins, terpenoids, phenols and absence of fixed oils and steroids. The median lethal dose of the extract was found to be greater than 5000 mg/kg bodyweight. Castor oil causes diarrhea due to its active metabolite, ricinolic acid,[23,24] which stimulates peristaltic activity in the small intestine, leading to changes in the electrolyte permeability of the intestinal mucosa. Its action also stimulates the release of endogenous prostaglandin.[25] In this study, the methanol extract of *C. zeylanica* (36.5%w/w) exhibited a significant antidiarrheal activity. Its effect was dose-dependant. The results were similar to that of the standard drug loperamide (3 mg/kg) with regard to the severity of diarrhea. Phytochemical screening revealed the presence of tannins, sterol and/or triterpenes and reducing sugars, which may be responsible for the mechanism of action of *C. zeylanica* antidiarrheal activity. The antidiarrheal activity of this extract may also be due to the presence of denatured proteins, which form protein tannates. Protein tannates make the intestinal mucosa more resistant and hence, reduce secretion.[26] This can be due to the fact that the extract increased the reabsorption of water by decreasing intestinal motility as observed in the decrease of intestinal transit by charcoal meal. Loperamide, apart from regulating the gastrointestinal tract, is also reported to slow down transit in the small intestine, reduce colon flow rate, and consequently any effect on colonic motility.[27] The methanol extract of *C. zeylanica* administered at the dose of 100, 150 and 200 mg/kg showed 59.02%, 67.61% and 77.83% protection, respectively. This reduction in diarrheal episodes is significant and maximum effect is observed at the dose of 200 mg/kg. Mean distance travelled by charcoal, as % total length of small intestine (cm) is less at 200 mg/kg of the dose of MCZ and is comparable with standard drug atropine sulfate which is used as positive control. The study reveals that the methanol extract exhibited significant diarrheal activity. Thus, *C. zeylanica* can increase the absorption of water and electrolytes from the gastrointestinal tract since the extract decreased the small intestinal transit that proves to its efficacy in an extensive range of diarrheal conditions.

In conclusion, the results of this investigation revealed that *C. zeylanica* contains pharmacologically active substance(s) with antidiarrheal properties. These properties confirm the use of *C. zeylanica* as an antidiarrheal drug as proposed by traditional healers. Further research is to be carried out to fractionate and purify the extract, in order to find out the molecules responsible for the antidiarrheal activity observed.

REFERENCES

1. Carlos CC, Saniel MC. Etiology and epidemiology of diarrhoea. Phillips J Microbiol Infect Dis 1990;19:51-3.
2. Lutterodt GD. Inhibition of gastrointestinal release of acetyl choline by quercetin as possible mode of action of psidium guajava leaf extracts in the treatment of acute diarrhoeal disease. J Ethnopharmacol 1989;25:235-49.
3. Fauci AS, Bravnwold E, Isselpacker K, Wilson JD, Kasper DL, Hauser SL, *et al*. Harrison's Principles of Internal Medicine. New York: McGraw Hill Company; vol. 1, 1993. p. 236-42.
4. Park K. Park's Textbook of preventive and social medicine. Jabalpur, India: M/S Banarsidas Bharat Publishes; 2000. p. 172-5.
5. Ojewole JA. Evaluation of the antidiabetic, anti inflammatory and antidiabetic properties of sclerocarya birrea (A. rich) hochst. stem bark aqueous extract in mice and rats. Phytother Res 2004;18:601-8.
6. Trease GE, Evans EC, editors. In: Pharmacognosy, 12th ed. London: Bailliere Tindal; 1983. p. 185.
7. Hooker JD, Clarke CB. "Flora of British India," Vol. 1, London: L. Reeve and Co. Ltd; 1875. p. 741.
8. Duke JA. Dr. Duke's phytochemical and ethno botanical databases, phytochemical Database, USDA-ARS-NGRL, Beltsville Agricultural Research Centre, Maryland, USA: 2000. Available from: http:yywww.ars-grin.govycgi-binydukeyethnobot.pl. [cited in 2000].
9. Lewis WH, Elvin-Lewis MP. Medical botany: Plants affecting man's health. New York: John Wiley; 1977.
10. Biswas K, Ghosh E. In: Bharotyo Banoushodhi 1, Calcutta University Press 1973. p. 79.
11. Mahmood C, Daulatabad JD, Desai VA, Hosamani KM. Indian Eng Chem Res 1991;30:2596.
12. Mali RG, Hundiwale JC, Sonawane RS, Patil RN, Hatapakki BC. Evaluation of Capparis deciduas for Anthelmintic and Antimicrobial activities. Indian J Nat Prod 2004;20:10-2.
13. Chaudhary SR, Chavan MJ, Gaud RS. Anti inflammatory and analgesic activity of *Capparis zeylanica* root extracts. Indian J Nat Prod 2004;20:36-9.
14. Chopra RN. Glossary of Indian Medicinal Plants. New Delhi: Council of Scientific and Industrial Research; 1969. p. 49.
15. Kirtikar KR, Basu BD. Indian Medicinal Plants, vol. 1, 2nd ed. Dehradun, India: Oriental Enterprises; 1987. p. 200-1.
16. Haque ME, Rahman MM, Mossadik MA, Sarker SD. E-octadec-7-en-ynoic acid from the roots of *Capparis zeylanica*. Fitoterapia 2004;74:130-3.
17. Sharaf MA. Flavonoids of four Cleome and three Capparis species. Biochem Syst Ecol 1997;25:161-6.
18. Mukaherjee PK. Quality control of herbal drugs (an approach to evaluation of Botanicals), New Delhi: Business Horizon's; 2002. p. 380-421.
19. Lorke D. A new approach to practical acute toxicity testing. Arch Toxicol 1983;54:275-87.
20. Iwao I, Terada Y. On the mechanism of diarrhoea due to castor oil.

Jpn J Pharmacol 1962;12:137-42.

21. Vogel HG. Drug discovery and evaluation-pharmacological assays. New York: Springer; 2nd ed. 2002. p. 875-6.
22. Rao CV, Vijayakumar M, Sairam K, Kumar V. Antidiarrhoeal activity of the standardised extract of Cinnamomum tamala in experimental rats. J Nat Med 2008;62:396-402.
23. Ammon PJ, Thomas, Philips S. Effects of oleic and recinoleic acids net jejunal water and electrolyte movement. J Clin Investig 1974;53:374-9.
24. Watson WC, Gordon R. Studies on the digestion absorption and metabolism of castor oil. Biochem Pharmacol 1962;11:229-36.
25. Galvez J, Zarzuelo A, Crespo ME. Antidiarrhoeic activity of Scleroarya birrea bark extract and its active tannin constituent in rats. Phytother Res 1991;5:276-78.
26. Tripathi KD. Essentials of medical pharmacology. New Delhi: Jaypee Brothers Medicals Publishers (P); 1994. p. 775.
27. Theoderau V, Fioramont J, Hachet T, Bueno L. Absorptive and motor components of anti-diarrhoeal action of loperamide: An *in vivo* study in pigs. Gut 1991;32:1355-9.

How to cite this article: Sini KR, Sinha BN, Rajasekaran A. Antidiarrheal activity of *Capparis zeylanica* leaf extracts. J Adv Pharm Tech Res 2011;2:39-42.

Source of Support: Nil, **Conflict of Interest:** Nil.