

Antidiarrhoeal Evaluation of *Ficus racemosa* LINN., Latex

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Abstract

A study was undertaken to evaluate the effects of latex of *Ficus racemosa* Linn., for its antidiarrhoeal potential against several experimental models of diarrhoea in latex treated rats. The latex exhibited significant inhibitory activity against castor oil-induced diarrhoea and enteropooling in latex treated rats. It also exhibited significant reduction in gastrointestinal motility following charcoal meal in rats. The results obtained thus justify and further support the traditional application of the latex as an antidiarrhoeal agent.

Keywords: *Ficus racemosa*, latex, anti-diarrhoeal, castor oil, diphenoxylate

Introduction

Diarrhoea continues to be one of the leading causes of morbidity and mortality especially in children, in developing countries including India (Black *et al.*, 1982) and the cause of 4–5 million deaths throughout the world annually (Mukherjee *et al.*, 1998). To combat the problems on diarrhoea, the World Health Organization (WHO) has constituted a Diarrhoeal Diseases Control Programme (CDD) which includes the study of traditional medical practices, together with the evaluation of health education and prevention approaches (Syder and Merson, 1982; WHO Expert Committees, 1964; Lutterodt, 1989; Raghunathan and Mitra, 1982). Considering the need to explore the natural remedies to combat deadly disease, the present study was undertaken.

Ficus racemosa Linn., syn. *Ficus glomerata* Roxb. (Moraceae), is a moderate to large-sized spreading tree widespread in moist land of India (Anonymous, 1952). The leaves are used in dysentery, bilious affection, and as a mouth wash in spongy gum. The roots are used in cases of dysentery and diabetes. The fruits are used as a stomachic and carminative, to relieve dysentery, diarrhoea and for treatment of diabetes. The bark is used for treatment of dysentery (Kirtikar and Basu, 1975; Nadkarni *et al.*, 1996; Chopra RX *et al.*, 1985; Chopra RN *et al.*, 1985). The sap of this plant is a popular remedy for mumps and other inflammatory enlargements, the milky juice of this plant is popular among traditional healers as an anti-inflammatory remedy (Kirtikar and Basu, 1975). In Sri Lankan indigenous system of medicine, it is used in the treatment of skeletal fracture (Ekanayake, 1980). The hypoglycaemic and, anti-

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diarrhoeal activity of *F. racemosa* leaves has been reported (Mandal *et al.*, 1997). The Australian aborigines use this plant in the treatment of mumps, smallpox, haematuria, menorrhagia and inflammatory conditions (Lassak and Mc Carthy, 1997). In traditional practice the latex of this plant has been used to control severe diarrhoea, particularly in children. The claim that the antidiarrhoeal activity of *F. racemosa* resides in the latex is speculative and has not yet been documented. In the present study an attempt has been made to evaluate the antidiarrhoeal efficacy of *F. racemosa* latex in validated models of rats.

Materials and Methods

Plant material: Fresh latex of the tree *F. racemosa* was collected locally during the month of June-July. The plant from which latex has been collected was preserved as authenticated specimen for reference. The latex was collected in brown containers, maintained in dark and refrigerated as soon as possible; till used. In traditional practice the latex is used as it is obtained from the plant without any modification. Hence, in the present study the same was followed.

Animals used: Wistar rats of either sex weighing between 180–210 g were used. They were kept in the Central Animal house of Navodaya Medical College and Research Centre, Raichur, in cross-ventilated room at $27\pm 2^{\circ}$ C, and relative humidity of 45-55%, light and dark cycles of 10 and 14 h, respectively, for one week before and during the experiments. Animals were provided with standard rodent pellet diet (Amrut, India) and the food was withdrawn 18–24 h before experiment, water was allowed *ad libitum*.

The study was undertaken with due to approval of the study protocol by the Institution Animal Ethics Committee and the experiments were performed according to the current guidelines for the care of the laboratory animals and the ethical guidelines for the investigation of experimental pain in conscious animals (Zimmerman, 1983). All the chemicals used were of the analytical grade.

Castor oil-induced diarrhoea: The method of Awouters *et al.* (1978) as modified by Nwodo and Alumanath (1991) was used. Rats fasted for 24 hours were randomly distributed into three groups. Animals were housed in three perforated steel cages containing six in each. Group-I was administered 2% (W/V) aqueous tragacanth suspension; which served as control. The dose of the latex used was selected on a trial basis and was administered orally (5ml/kg) by orogastric cannula to the second group. The group-III received diphenoxylate (5mg/kg) orally in suspension as standard drug for comparison.

One hour after the treatment, each animal received 1ml of castor oil orally by gavage and then was observed for defecation. Up to 4 hours after the castor oil challenge the presence of characteristic diarrhoeal droppings were noted in the transparent plastic dishes placed beneath individual rat cages.

Gastrointestinal motility tests: Animals were fasted for 18 hours and placed in three polypropylene cages containing six rats in each. Each animal was administered orally 1 ml of charcoal meal (3% deactivated charcoal in 10% aqueous tragacanth), immediately after that, the first group of animals were administered orally the tragacanth solution (5ml/kg, p.o.) as control. The second group of received atropine (0.1 mg/kg, i.p.) the standard drug for comparison. The third group was treated with latex (5ml/kg). Thirty minutes later, each animal was sacrificed and the intestinal distance taken by the charcoal meal from the pylorus was cut and measured and expressed as the percentage of the distance from the pylorus to the caecum.

Castor oil-induced enteropooling: This was determined according to the method of Robert *et al.* (1976) modified by Di Carlo *et al.* (1994). In this method the rats of either sex, fasted for 24

hours, but allowed to take adequate water were randomly categorised into three groups of six rats. The animals of Group I were orally administered aqueous tragacanth solution; which served as control. Group II was administered castor oil only (2ml) and group III received latex (5ml/kg), one hour prior to castor oil administration. After 30 minutes each rat was killed by cervical dislocation and the small intestine was ligated both at pyloric sphincter and at the ileocaecal joints. The entire intestine was then dissected out and its contents were collected into graduated measuring cylinders and the volume of fluid was noted down.

Statistical Analysis: The data was analyzed by using one way analysis of variance (ANOVA). Post hoc comparisons for castor oil-induced diarrhoea and inhibition of gastro-intestinal motility were done by Dunnett's multiple comparison tests; for anti-enteropooling effect Newman-Keuls multiple comparison tests were used. *p*-values lower than 0.05 were considered statistically significant.

Table 1. Effect of *Ficus racemosa* latex on castor oil-induced diarrhoea in rats

Groups	Oral pretreatment at 1h	Mean defecations/group	Mean No. of wet faeces/group	P-value
Group-I (Control)	Tragacanth solution (5ml/kg)	3.25±0.75	3.25±0.75	----
Group-II	Ficus Racemosa Latex (5ml/kg)	0.00±0.00	0.00±0.00	<0.01
Group-III	Diphenoxylate (5mg/kg)	0.25±0.25	0.00±0.00	<0.01

Each value represents (Mean±SEM) (n=6)

Significance vs. control group

Table 2. Inhibition of gastro-intestinal motility by *Ficus racemosa* Latex

Treatment after Charcoal meal	Movement of charcoal meal as %	P-value
Tragacanth solution (5 ml/ kg) (control)	82.33 ± 2.70	-----
Atropine (0.1 mg/ kg)	43.33 ± 1.26	< 0.01
Ficus racemosa Latex (5ml/kg)	41.17±1.17	< 0.01

P-value calculated with respect to control group (n = 6)

Table 3. Anti-enteropooling effect of *Ficus racemosa* latex treatment

Treatment	Volume of intestinal fluid in ml	P-value
Control (Tragacanth solution)	1.97±0.07	----
Castor oil	3.75±0.10	<0.001 ^a
<i>F.racemosa</i> latex	1.15±0.11	<0.001 ^b

(a) significant with respect to control.

(b) significant with respect to castor oil treatment (n = 6)

Results

Inhibition of castor oil-induced diarrhoea: The latex of *F. racemosa* like the standard antidiarrhoeal agent, diphenoxylate, inhibited significantly the frequency of defecation when compared to untreated rats (Table 1).

Effects on gastro-intestinal motility: The latex decreased propulsion of the charcoal meal through the gastrointestinal tract when compared with the control group. Atropine reduced the motility of the intestine significantly (Table 2).

Intestinal fluid accumulation: It is evident from Table 3, that, there was a significant reduction in fluid accumulation in latex treated animals compared to castor oil treated group ($p < 0.001$).

Discussion

The results of the present study strongly confirm the antidiarrhoeal efficacy of the latex of *F.racemosa* in various validated models in rats. There has been a statistically significant reduction in the incidence and severity of diarrhoea produced in experimental animal model ($p < 0.01$). *F. racemosa* latex like the standard antidiarrhoeal agent, diphenoxylate, inhibited significantly ($p < 0.01$) the frequency of defecation, wetness of fecal droppings when compared with untreated control rats.

The antimuscarinic drug atropine and the latex decreased intestinal propulsive movement ($p < 0.01$) in charcoal meal treated animal models, the former being more potent than the latter. The mechanism for this inhibition of motility may be due to the nonspecific spasmolytic activity of the latex. Similarly the latex inhibited significantly the castor oil-induced enteropooling ($p < 0.001$).

The above observations suggest that, the latex reduced diarrhoea by inhibiting intestinal peristalsis, gastrointestinal motility and castor oil-induced enteropooling.

Latex is the milky exudate of plants that coagulate upon exposure to air. The chemical composition of latex is very complex. It is composed of proteins, alkaloids, starches, sugars, oils, tannins, resins, gums, among other compounds (Ricardo *et al.*, 2004). It is known that, the

active constituent of the castor oil; ricinoleic acid is an irritant to the intestinal mucosa. Further, castor oil increases the peristaltic activity and produces permeability changes in the intestinal mucosal membrane to electrolytes and water (Bruton, 1985), all together leading to characteristic diarrhoeal droppings as witnessed.

As the chemical composition of the latex is very complex, it is difficult to pinpoint the exact responsible constituent for its antidiarrhoeal activity. However, it would be more agreeable, if the tannins and alkaloids of the latex were made responsible. Since tannins denature proteins forming protein tannate, which makes the intestinal mucosa more resistant and reduces the secretions. Furthermore the possible presence of atropine like alkaloids in the latex may reduce the intestinal motility by virtue of their antimuscarinic property and therefore by acting as excellent antidiarrhoeal. These inhibitory effects of the *F. racemosa* latex further support its use in traditional practice and justify its use as a non-specific antidiarrhoeal agent.

However, the positive results of the bioactive latex in the present study have encouraged a lot to further investigate the active responsible principles.

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References

- Anonymous. (1952). *The Wealth of India*, vol. 4, Council of Scientific and Industrial Research, New Delhi, pp. 35–36.
- Awouters, F., Niemegeers, C.J.E., Lenaerts, F.M. and Janssen, P.A.J. (1978). Delay of castor oil induced diarrhoea in rats; a new way to evaluate the prostaglandin synthesis. *J. Pharm. Pharm.* 30: 41-45.
- Black, R.E., Brown, K.H., Becker, S. and Yunus, M. (1982). Longitudinal studies of infectious diseases and physical growth of children in rural area of Bangladesh. *Am. Epidemiol.* 115: 305-314.
- Bruton, L.L. (1985). Agent affecting gastrointestinal water flux and motility, digestants; and bile acids, In: Gilman AG, Rall TW, Nies AS, Tylor P (Eds), *The Pharmacological Basis of Therapeutics*. Vol. 2, 8th ed. Mc Graw-hill International Editions. New York, p. 914.
- Chopra, R.N., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1985). *Indigenous Drugs of India*, 2nd edn. Academic Publisher, Calcutta, p. 674.
- Chopra, R.X., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1985). *Indigenous Drugs of India*, 2nd edn. Academic Publisher, Calcutta, p. 508.
- Di Carlo, G., Mascolo, N., Izzo, A., Capasso, F. and Autore, G. (1994). Effect of quercetin on gastrointestinal tract in rats and mice. *Phytotherapy Res.* 8: 42-45.
- Ekanayake, D.T. (1980). Plants used in the treatment of skeletal fractures in the indigenous system of medicine in Sri Lanka. *Sri Lanka Forest.* 14 (4): 145–152.
- Kirtikar, K.R. and Basu, B.D. (1975). *Indian Medicinal Plants*, vol. 3, 2nd edn. Bishen Singh Mahandra Pal Singh, Dehra Dun, pp. 2327–2328.

- Lassak, E.V. and McCarthy, T. (1997). *Australian Medicinal Plants*. Reed Books Australia, Vic., Australia.
- Lutterodt, G.D. (1989). Inhibition of gastrointestinal release of acetylcholine by quercetin as a possible mode of action of *Psidium guajava* leaf extracts in the treatment of acute diarrhoeal disease. *J. Ethnopharmacol.* 25: 235-247.
- Mandal, S.C., Mukherjee, P.K., Das, J., Pal, M. and Saha, B.P. (1997). Hypoglycaemic activity of *Ficus racemosa* L. (Moraceae) leaves on streptozotocin-induced diabetic rats. *Nat. Prod. Sci.* 3: 38-41.
- Mandal, S.C., Mukherjee, P.K., Saha, K., Pal, M. and Saha, B.P. (1997). Antidiarrhoeal evaluation of *Ficus racemosa* Linn. leaf extract. *Nat. Prod. Sci.* 3: 100-103.
- Mukherjee, P.K., Saha, K., Murugesan, T., Mandal, S.C., Pal, M. and Saha, B.P. (1998). Screening of anti-diarrhoeal profile of some plant extracts of a specific region of West Bengal, India. *J. Ethnopharm.* 60: 85-89.
- Nadkarni, K.M., Nadkarni, A.K. and Chopra, R.N. (1996). *Indian Materia Medica*, vol. 1. Popular Prakashan, Bombay, pp. 548-550.
- Nwodo, O.F.C. and Alumanah, E.O. (1991). Studies on *Abrus precatorious* seed II: Antidiarrhoeal activity. *J. Ethnopharm.* 31: 395-398.
- Raghunathan, K. and Mitra, R. (1982). *Pharmacognosy of indigenous drugs*: Central Council for Research in Ayurveda and Siddha, India, pp. 806-833.
- Ricardo, O., Guerrero, Y., Angel, L. and Guzman G. (2004). Bioactivities of latexes from selected tropical plants. *Rev. Cubana Plant Med.* 9 (1): 1-6.
- Robert, A., Nezamis, J.E., Lancaster, C., Hanchar, A.I. and Klepper, M.S. (1976). Enteropooling assay: A test for diarrhoea produced by prostaglandins. *Prostaglandins.* 11: 809-814.
- Syder, J.D. and Merson, M.H. (1982). The magnitude of the global problem of acute diarrhoeal diseases: a review of active surveillance data. *Bulletin of the World Health Organisation*, 60: 605-613.
- WHO Expert Committees (1964): In: *WHO Technical Report Series on Enteri Infection.* 288.
- Zimmerman, M. (1983). Ethical guidelines for investigation of experimental pain in conscious animal. *Pain*, 16: 109-110.

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