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ANTIDIARRHOEAL EVALUATION OF *FICUS CARICA* LINN., LATEX

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Abstract

The aim of the present study was undertaken to evaluate the effects of latex of *Ficus carica* 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. There has been a statistically significant reduction in the incidence and severity of diarrhoea produced in experimental animal model ($p < 0.01$). *Ficus carica* 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 results obtained thus justify and further support the traditional application of the latex as an antidiarrhoeal agent.

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

Introduction

Herbal medicine has become a popular form of therapy. World Health Organization estimates that one third of adults in developed nation and more than 80% of the population in many developing countries use herbal medicines in the hope of promoting health and to manage the common maladies such as cold, inflammation, heart disease, diabetes and central nervous system diseases. To date, there are 11000 species of herbal plant that are in use medicinally, and, of these, about 500 species are commonly used in Asian and other countries (1). Diarrhoea continues to be one of the leading causes of morbidity and mortality especially in children, in

developing countries including India (2) and the cause of 4-5 million deaths throughout the world annually (3). 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 (4-7). Considering the need to explore the natural remedies to combat deadly disease the present study was undertaken.

The fig tree (*Ficus carica* L.) is one of the unique *Ficus* species widely spread in tropical and subtropical

countries which has edible fruits with high commercial value. Commercial fig production is either located around the Mediterranean Sea or is realized in countries possessing Mediterranean climate as in the case of California, Australia or South America(8,9). A small or moderate-sized deciduous tree, 15-30 ft. high with broad ovate or nearly orbicular leaves, more or less deeply 3-5 lobed, rough above and pubescent below; fruits axillary, usually pear shaped, variable in size and color. The fruit of *Ficus carica*, like those of other species of *Ficus*, is a syconium a fleshy hollow receptacle with a narrow aperture at the tip. The bark is a cylindrical and pale grey color (10). Previous reports concerning the nutrient composition of dried figs have indicated that it has the best nutrient score among the dried fruit, being an important source of minerals and vitamins (11). *Ficus carica* Linn. (Syn: *Ficus sycomorus*; family: Moraceae) is commonly referred as "Fig". Its fruit, root and leaves are used in the native system of medicine in different disorders such as gastrointestinal (colic, indigestion, loss of appetite and diarrhea), respiratory (sore throats, coughs and bronchial problems), inflammatory and cardiovascular disorders (12, 13). Fig has been traditionally used for its medicinal benefits as metabolic, cardiovascular, respiratory, antispasmodic and anti-inflammatory remedy (14, 15). The root is tonic, useful in leucoderma and ringworm. The fruit is sweet, antipyretic, tonic, purgative useful in inflammation, weakness, paralysis, thirst "Vatta diseases" of head, diseases of liver and spleen, pain in chest, cures piles, stimulate growth of hair. The milky juice is expectorant, diuretic, and dangerous for eye. Fig latex is used as an anthelmintic (16).The *Ficus carica* leaves has been reported hypoglycaemic (17), hepatoprotective (18, 19) immunodulatory (20), antipyretic(21) , anthelmintic(22) and latex reported the anthelmintic(23)activity.

In traditional practice the latex of this plant has been used to control severe diarrhoea, particularly in children and other *Ficus* species various parts reported to possess the antidiarrhoeal on the basis

the claim that the antidiarrhoeal activity of *Ficus carica* 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 *Ficus carica* latex in validated models of rats.

Materials and Methods

Plant material: Fresh latex of the tree *Ficus carica* was collected locally during the month of May-June. The plant from which latex has been collected was preserved as authenticated specimen for reference. The latex was collected in brown colored 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 TVES's Hon'ble Loksevak Madhukarrao Chaudhari College of Pharmacy, Faizpur, in cross-ventilated room at 27±2 0 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 experimental protocol and animal house has been approved by the institutional animal ethics committee and by the animal regulatory body of the Indian Government (Registration No.652/02/a/ CPCSEA, dated 25/ 01/1999).

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 (24). All the chemicals used were of the analytical grade.

Castor oil-induced diarrhoea: The method of Awouters et al (25). As modified by Nwodo and Alumanath (26) 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 (27) modified by Di Carlo et al (28). 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.

Results

Inhibition of castor oil-induced diarrhoea: The latex of *Ficus carica* like the standard antidiarrhoeal agent, diphenoxylate, inhibited significantly the frequency of defecation when compared to untreated rats (**Table1**).

Table1. Effect of *Ficus carica* 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)	4.25±0.55	4.25±0.55	---
Group-II	<i>Ficus carica</i> 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

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 (Table2).

Table2. Inhibition of gastro-intestinal motility by *Ficus carica* Latex

Treatment after Charcoal meal	Movement of charcoal meal as %	P-value
Tragacanth solution (5 ml/kg) (control)	83.33 ± 2.75	---
Atropine (0.1 mg/kg)	43.35 ± 1.27	< 0.01
<i>Ficus carica</i> Latex (5ml/kg)	41.27±1.27	< 0.01

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

Intestinal fluid accumulation: It is evident from Table3, that, there was a significant reduction in fluid accumulation in latex treated animals compared to castor oil treated group (p<0.001).

Table3. Anti-enteropooling effect of *Ficus carica* latex treatment

Treatment	Volume of intestinal fluid in ml	P-value
Control (Tragacanth solution)	2.93±0.09	---
Castor oil	4.77±0.13	<0.001a
<i>Ficus carica</i> latex	2.25±0.12	<0.001b

(a) significant with respect to control.

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

Discussion

The results of the present study strongly confirm the antidiarrhoeal efficacy of the latex of *Ficus carica* 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). *Ficus carica* 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 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 (29). 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 (30), 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 *Ficus carica* 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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