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Antidiarrhoeal efficacy of *Mangifera indica* seed kernel on Swiss albino mice

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ABSTRACT

Objective: To examine the antidiarrhoeal activity of alcoholic and aqueous seed kernel extract of *Mangifera indica (M. indica)* on castor oil-induced diarrhoeal activity in Swiss albino mice. **Methods:** Mango seed kernels were processed and extracted using alcohol and water. Antidiarrhoeal activity of the extracts were assessed using intestinal motility and faecal score methods. **Results:** Aqueous and alcoholic extracts of *M. indica* significantly reduced intestinal motility and faecal score in Swiss albino mice. **Conclusions:** The present study shows the traditional claim on the use of *M. indica* seed kernel for treating diarrhoea in Southern parts of India.

1. Introduction

Gastroenteritis is a clinicopathological term that refers to inflammation of the intestines and results in diarrhoea. Diarrhoeal diseases contribute in a big way to infant and childhood mortality and morbidity in India[1,2]. Diarrhoea is an intestinal disorder characterized by abnormal fluidity and frequency of feacal evaluation, generally the result of increased motility in the colon. The diarrhoea is caused by a variety of enteric pathogenic bacteria such as enterotoxigenic *Escherichia coli*, enteropathogenic *escherichia coli*, enteroinvasive *Escherichia coli*, *Salmonella* sp., *Shigella flexneri*, *Vibrio cholerae*, *Campylobacter jejuni* etc., viruses, protozoans and helminthes can also cause diarrhoea in human[3-6]. The incidence of diarrhoeal still remains high despite the efforts of many government and international organizations to curb it. It is therefore important to identify and evaluate available natural drugs as alternatives to currently used anti-diarrhoeal drugs, which are not always free from adverse effects. A range of medicinal plants with antidiarrhoeal properties is widely used for traditional healers[7-11].

Mangifera indica Linn. (family Anacardiaceae) (*M. indica)* is a large evergreen tree reaching a height of 15 m, indigenous to India. Both unripe and ripe fruits are widely used by the local population. There are few studies on the medicinal value of seeds of *M. indica*. *M. indica* along with *Artocarpus inegrefolia* was given to treat dysentery. *M. indica* seed kernal is a promising source of food additive and enhance oxidative stability of food and used as food preservator and feed additive[12-16]. Various extracts from the seed kernel, leaves and barks of *M. indica* is active against human pathogens[17-21], antioxidant[22-26], antiallergic[27], anti-tyrosinase[28, 29] anticarcinogenic[30] and promote endothelial cell migration[31]. The seed of *M. indica* is reported in

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traditional medicine to cure vomiting, dysentery and burning. Decoction of seed kernel is generally prescribed for diarrhea among the rurals of Kanyakumari district, Tamilnadu, India. As *M. indica* is widely available, cheap and commonly used, it is worthwhile to study its potential antidiarrhoeal activity, which if proved would be an easily accessible home remedy for diarrhoea. In the present study, we have analysed the antidiarrhoeal effects of an alcoholic and aqueous extract of seed kernel of *M. indica* on castor oil-induced diarrhoeal activity in mice.

2. Materials and methods

2.1. Preparation of extracts

The fruits of *M. indica* were purchased from the local market and seeds were separated from the fruit. The hard seed coat (kernel) was removed and the seeds were dried. These dried seeds were coarsely powdered and stored in closed container for further use. Known quantity of powdered seed kernel of *M. indica* was taken and the crude extract was prepared by adding water and 100% of ethyl alcohol. The collected extracts were dried in a vacuum desicator and stored in a sterile container for further use.

2.2. Antidiarrhoeal study

Swiss albino mice (20-35 g) of either sex obtained from King Institute of Preventive Medicine, Guindy, Chennai were used. They were housed in polypropylene cages in the departmental animal house at (26±2)℃ for one week before and during the experiments. Fresh dry husks were used as bed material. They were fed commercially with standard pellet diet and distilled water. Food was withdrawn 18-24 h before the experiment though water was allowed *ad libitum*. Mice were divided into seven groups of 6 animals each. Group Ⅰ: Normal control; Group Ⅱ: Castor oil control (Disease control); Group Ⅲ: Castor oil + Lopramide; Group Ⅳ: Castor oil + 200 mg/mL Alcoholic extract; Group Ⅴ: Castor oil + 400 mg/mL Alcoholic extract; Group Ⅵ: Castor oil + 200 mg/mL Aqueous extract; Group Ⅶ: Castor oil + 400 mg/mL Aqueous extract.

2.3. Effect of extract on castor oil induced diarrhoea

First group served as the control and received distilled water. All other 6 groups received castor oil at a dose of 0.1 mL per animal orally. The second group served as castor oil control. Thirty minutes after castor oil administration, the third group received lopramide. The fourth and fifth groups received alcoholic extract of *M. indica* seed kernel (200 mg/kg b.w. & 400 mg/kg b.w. respectively), sixth and seventh group received aqueous extract of *M. indica* seed kernel (200 mg/kg b.w. & 400 mg/kg b.w. respectively). Following administration, the animals were placed separately in cages with filter paper, which was changed every hour. The total number of faeces and diarrhoeal faeces excreted was recorded for a period of 76 h. The total score of diarrhoeal faeces of diseased control group was considered as 100%.

2.4. Effect of extract on intestinal propulsion

Extraction on intestinal propulsion of Swiss albino mice was done by using charcoal meal as a diet marker. First group served as the control and received distilled water. All other 6 groups received castor oil at a dose of 0.1 mL per animal orally. The second group served as castor oil control. 30 min after castor oil administration, the third group received saline. The fourth and fifth groups received alcoholic extract of *M. indica* seed kernel (200 mg/kg b.w. & 400 mg/kg b.w. respectively), sixth and seventh group received aqueous extract of *M. indica* seed kernel (200 mg/kg bw & 400 mg/kg b.w. respectively). Each animal was given 1 mL of charcoal meal orally (3% deactivated charcoal in 10% aqueous feed) after 30 minutes of castor oil administration. All animals were sacrificed after 30 minutes of charcoal meal administration and the distance covered by the charcoal meal in the intestine, from the pylorus to the caecum was measured and expressed as a percentage of distance moved.

3. Results

The effect of the extract on castor oil induced diarrhoea in mice showed decrease in the weight of faecal matter passed by the animals. Faecal passage was significantly reduced in aqueous and alcoholic extract of *M. indica* seed kernel treated animals from 74% to 88% when compared to castor oil control on day one and 132%-138% on day three. On day 3 plant extract treated animals reduced faecal score drastically, which is similar to the lopramide treated group (Table 1).

Table 2 revealed the charcoal mobility pattern. Charcoal mobility directly demonstrates the intestinal movement pattern in different groups of animals. Normal animal stomach mobility is slower than other groups (23.5 cm) whereas castor oil induced animals have increased intestinal mobility upto 147%. Lopramide treated animals showed only 7% increase in mobility when compared to normal animals. Animals treated with aqueous and alcoholic extracts from the seed kernel of *M. indica* also showed reduced intestinal mobility. This effect is slightly lower than the effect of lopramide.

Table 1
Antidiarrhoeal activity of alcoholic and aqueous extract of *M. indica* seed kernel on castor-oil induced diarrhoea.

Groups	Faecal score		
	Day 1	Day 2	Day 3
Group Ⅰ	3.50±0.96	3.50±1.12	3.80±1.07
Group Ⅱ	8.30±1.10*	8.20±1.07*	8.50±0.96*
Group Ⅲ	5.00±1.18*	4.50±0.96*	3.00±1.07*
Group Ⅳ	5.70±1.54*	5.00±0.82*	3.50±0.50*
Group Ⅴ	5.60±0.81*	4.80±0.81*	3.30±0.47*
Group Ⅵ	5.40±0.11*	5.40±0.14*	3.85±0.10*
Group Ⅶ	5.60±0.12*	4.80±0.21*	3.40±0.48*

Data were expressed as Mean±SD, * $P<0.01$ comparing with the group I.

Table 2
Effect of alcoholic and aqueous extract of *M. indica* seed kernel on small intestinal transit.

Groups	Charcoal mobility(cm)
Group Ⅰ	23.50±2.07
Group Ⅱ	58.00±1.75*
Group Ⅲ	25.20±3.58*
Group Ⅳ	29.20±3.18*
Group Ⅴ	28.00±2.65*
Group Ⅵ	29.00±1.78*
Group Ⅶ	26.00±1.86*

Data were expressed as Mean±SD, * $P<0.01$ comparing with the group I.

4. Discussion

The seed kernel extract of *M. indica* inhibited the electrolyte permeability in the intestine due to castor oil through the inhibition of prostaglandin release. Castor oil induces intestinal permeability and also stimulates prostaglandins release. Secondary metabolites such as saponin, flavonoid, glycocides, tannins and alkaloids present in the seed kernels of *M. indica* have been implicated as having antidiarrhoeal activity and inhibit the intestinal mobility. Reduction of intestinal mobility may be due to the presence of tannins and tannic acid in the seed kernel extract of *M. indica*. Tannins have been implicated as the bitter principle present in the seed kernel of *M. indica*[32-34]. Dried mango seed contain 15% tannin served as astringent in cases of diarrhea, dysentery, uretheritis *etc*[20].

Plants are tremendous source for discovering new products with medicinal value for drug development. Traditionally tribal people of India consume mango seed kernel in roasted form during starvation as it is rich in starch. Hence it is assumed to be suitable for human consumption. It enhances oxidative stability of food and it is used as a food preservator. Past studies revealed that the mango seed kernels are free from toxic substances and seems to be a safe source of antioxidant[20]. These reports establishes the use of *M. indica* as an antidiarrhoeal medicine as claimed by the traditional medicine.

Conflict of interest statement

The author does not have conflict interest from the present study.

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