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## RESEARCH ARTICLE

## IN VIVO ANTI-DIARRHOEAL ACTIVITY OF METHANOL EXTRACT OF *BOMBAX BUONOPOZENSE*

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### ABSTRACT

**Objective:** Diarrhoeal disease is responsible for mortality and morbidity, especially among children in developing countries causing a major healthcare problem. The purpose of the present study was to evaluate anti-diarrhoeal effects of methanolic extract of whole plant of *Bombax buonopozense* against castor oil-induced-diarrhoea model and small intestine transit model in rats.

**Methods:** Albino wistar rats were used for estimation of anti-diarrhoeal activity. Small intestinal transit models in rats the number of droppings and the distance traveled by charcoal in intestine were measured. Loperamide (2.5 mg/kg) was used as standard drug, and it has shown significant reductions in fecal output and frequency of droppings whereas extract at the doses of 200 and 400 mg/kg reduced the castor-oil induced frequency and consistency of diarrhoea.

**Results:** The results obtained establish the efficacy and substantiate the folklore claim as an anti-diarrhoeal agent.

**Conclusion:** Results conclude that the leaves extract of *Bombax buonopozense* contains bioactive natural substances with antidiarrhoeal properties

**Keywords:** Antidiarrhoeal activity, *Bombax buonopozense*, castor oil induced diarrhoea, charcoal, small intestinal transit.

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### INTRODUCTION

Diarrhoea can be defined as an alteration in the normal bowel movement, characterized by at least three loose or liquid bowel movements each day and adult daily stools exceeds 300 g and contains 60-95 % water. It can result in dehydration due to fluid loss and can lead to death<sup>1</sup>. The common reason for causing diarrhoea is gastrointestinal infection by various types of bacteria, virus, and parasites<sup>2</sup>. According to WHO, after pneumonia it is second most common cause of infant mortality in developing countries, and it is responsible for the death of about 2-4 million children every year, especially in Africa and it is still a big public in developing countries<sup>3</sup>. Due to unhygienic livelihood condition especially in rural areas, peoples are very prone to diarrhoea and several other diseases. This infection can be spread out through food, drinking water, and unhygienic environment. Furthermore rural populations live very far away from health centers, so there is lack of availability of proper medical facilities<sup>4</sup>. There are many antibiotics available that are used as anti-diarrhoeal drug, but these drugs sometimes show some adverse effects and microorganisms are tends to

develop resistance against them<sup>5</sup>. In these conditions, medicinal plants appear as an alternative health care solution in the management of diarrhoea. The roles of plants in maintaining human health are well documented. Many plant species have been screened for substances with therapeutic activity. For the treatment of diarrhoea, medicinal plants are a potential source of antidiarrhoeal drugs *Bombax buonopozense* P. Beauv. (Bombacaceae) is a tropical tree that grows up to 40 meters in height with large buttress roots that can spread six meters. It is native primarily in West Africa where it is found in rainforests of Sierra Leone in the northwest, east Gabon<sup>6</sup>. It has common vernacular names in different languages such as Vabga (Dagbani) and Kurya (Hausa) and different parts are used for different purposes.

The bark of younger trees is covered with spine and shedding the spines with age to some degree and large deep pink-to-red flowers emerge while the tree is leafless. The leaves are compound and have 5 to 9 leaflets and 15 to 25 secondary veins. The individual leaflets have entire margins and are large. The undersides of the leaflet may be glabrous or

puberulous. The conspicuous flowers emerge while the tree is leafless and are either solitary or arranged in small auxiliary cymes<sup>6</sup>. There is limited scientific evidence supporting the potential use of leaves of *B. buonopozense* as an antidiarrhoeal agent. Present study therefore investigated the scientific basis for the efficacy of its antidiarrhoeal properties<sup>7</sup>.

## MATERIALS AND METHODS

### Plant collection

The leaves of *Bombax buonopozense* were collected from Suleja, Niger State by an experienced, identified and authenticated. The plant material was air-dried at room temperature and pulverized into a dry powder, then macerated with 70% methanol in water for 72 hrs with constant shaking. The resultant mixture was filtered using Whatman (No 1) filter paper and the filtrate was concentrated using a rotary evaporator and dried on a water bath to give a yield 7.7% (w/w). The extract was reconstituted in normal saline at appropriate concentrations for the various experiments conducted<sup>8</sup>.

### Animals used

Albino wistar rats (150-230g) of either sex were selected for the study. The animals were maintained in a well-ventilated room with 12:12 hour light/dark cycle in polypropylene cages. The animals were used in accordance with the NIH Guide for the care and use of laboratory animals.

### Determination of antidiarrhoeal activity

#### Castor oil-induced diarrhoea

Animals were fasted for 24 h but allowed free access to water. One hour after administration, all animals were given 0.5 ml of castor oil orally and individually placed in cages in which the floor was lined with transparent paper and changed every hour. Rats were divided into four groups of six animals each, diarrhoea was induced by administering of any treatment, 2 ml of castor oil orally to rats. Group I treated as control (2 ml/kg, p.o. saline), group II received Loperamide (5 mg/kg p.o) served as standard and group III and IV received extract (200 and 400 mg/kg, p.o) 1 hr before castor oil administration. Then observed for consistency of faecal matter and frequency of defaecation for 4 hrs<sup>9</sup>.

$$\% \text{ of inhibition} = \frac{\text{Average no of WFC} - \text{Average no of WFT}}{\text{Average no of WFC}} \times 100$$

here, WFC = average number of wet feces in control group and WFT = average number of wet feces in test group.

#### Small intestinal transit

Albino rats of either sex (200-250g) were randomly divided into five groups of six rats each. Rats were fasted for 24 hr divided into four groups of six animals each, Group I received 2ml normal saline orally, group II received atropine sulphate (5 mg/kg, i.p.), group III and IV received extract 200 and 400 mg/kg p.o respectively, 1 hr before administration of castor oil. One ml of marker (10% charcoal suspension in 5% gum acacia) was administered orally 1 hr after castor oil treatment. The rats were sacrificed after 1h and the distance travelled by charcoal meal from the pylorus

was measured and expressed as percentage of the total length of the intestine from the pylorus to caecum<sup>11</sup>.

## RESULTS

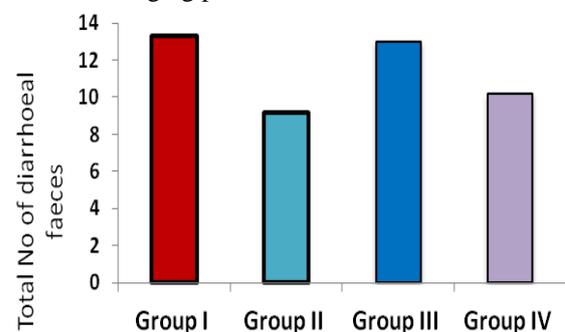
### Castor oil-induced diarrhoea

As shown in Table 1, it was observed that administration of methanol extract of *Bombax buonopozense*, induced insignificant decrease in the total number of feces and number of diarrhoeal feces and percent inhibition of diarrhoea.

**Table 1: Effect of methanol extract of *Bombax buonopozense* on castor oil induced diarrhoea in mice**

| Group | Treatment                             | Number of wet faeces in 4 hrs | % Inhibition |
|-------|---------------------------------------|-------------------------------|--------------|
| I     | Castor oil + Saline (2 ml/Kg p.o)     | 13.3±0.43                     | --           |
| II    | Castor oil + Loperamide (5 mg/Kg i.p) | 9.20±0.37                     | 66.43        |
| III   | Castor oil + Extract (200 mg/Kg i.p)  | 13.00±0.89                    | 52.62        |
| IV    | Castor oil + Extract (400 mg/Kg i.p)  | 10.20±0.58                    | 56.31        |

After 30 min administration of castor oil the diarrhoea was clinically apparent in all the animals of control group, for the next 4 h. This was markedly reduced by loperamide (2.5 mg/kg p.o) (75%). Marked reduction in the number of defecations over four hours was achieved with *Bombax buonopozense* at the doses of 200 and 400 mg/kg p.o.



**Figure 1: Total number of diarrhoeal faeces in castor oil-induced diarrhoea in albino rats**

#### Small intestinal transit

The percent intestinal transit was increased with control, but it was reduced in both doses of extract, and much more markedly by Loperamide (5 mg/kg i.p).

Methanol extract of *Bombax buonopozense* 200 mg/kg, p.o dose of extract produced 42.58 % intestinal transit induced by castor oil respectively. Whereas, 400 mg/kg, p.o dose produced 53.68 % of castor oil induced charcoal meal transit (Table 2 and Figure 2).

#### Statistical analysis

All analyses were carried out in triplicates. Data were presented as mean±SEM. The significance of difference between the control and treated groups was determined using two way analysis of variance (ANOVA), followed by Student's *t*-test. *P* value of 0.05 or 0.01 was considered as significant.

## DISCUSSION

Diarrhoea is due to imbalance between the absorptive and secretory mechanisms in the intestinal tract, associated with excess loss of fluid in the faeces. Castor oil produces diarrhoeal effect due to its active component of ricinoleic acid, inhibition of intestinal  $\text{Na}^+$ ,  $\text{K}^+$ -ATPase activity to reduce normal fluid absorption, activation of adenylyl cyclase, stimulation of prostaglandin formation, platelet-activating factor

and recently nitric oxide was contribute to the diarrhoeal effect of castor oil. Since the alcoholic extract successfully inhibits the castor oil induced diarrhoea, the action might be via anti-secretory mechanism<sup>12</sup>. Loperamide at present is one of the most efficacious and widely employed anti diarrhoeal agents and effectively antagonizes the action of castor oil due to its antimotility and antisecretory property<sup>13</sup>.

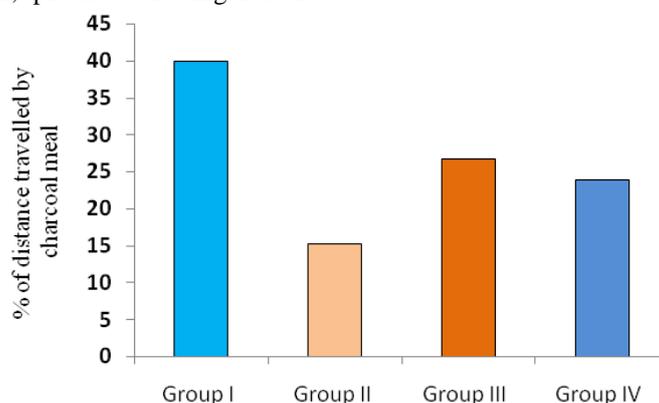


Figure 2: Percentage of distance travelled by charcoal meal (cm) in albino rats.

Table 2: Effect of methanolic extract of *Bombax buonopozense* on small intestinal transit in mice

| Group | Treatment                             | Total length of intestine (cm) | Distance travelled by charcoal (cm) | % Inhibition |
|-------|---------------------------------------|--------------------------------|-------------------------------------|--------------|
| I     | Castor oil + Saline (2 mL/kg p.o)     | 56.09±0.85                     | 39.83±0.34                          | --           |
| II    | Castor oil + Loperamide (5 mg/kg i.p) | 54.16±0.93                     | 15.21±0.63                          | 74.27        |
| III   | Castor oil + Extract (200 mg/kg i.p)  | 48.20±0.66                     | 26.72±0.63                          | 42.58        |
| IV    | Castor oil + Extract (400 mg/kg i.p)  | 51.06±0.83                     | 23.81±0.84                          | 53.68        |

At doses of 200 and 400 mg/kg, the methanol extracts of *Bombax buonopozense* showed significant antidiarrhoeal activity against castor oil-induced diarrhoea as compared with the control group. It significantly ( $P < 0.01$ ) reduced the frequency of diarrhoea and consistency of defecations. It also showed a dose related decrease in castor oil-induced diarrhoea. It was observed that, the administration of the extract of *Bombax buonopozense* in rats caused a significant reduction in the progression of charcoal meal and in the intestinal transit time.

## CONCLUSION

Diarrhoea is a result of altered motility and fluid accumulation within the intestinal tract. Plants play a vital role in the maintenance of human health. Results conclude that the leaves extract of *Bombax buonopozense* contains bioactive natural substances with antidiarrhoeal properties thus justifying its widespread use by the local population for these purposes. Present study concluded that *Bombax buonopozense* contains pharmacologically active substances that are effective for management of diarrhoea. However, further *in-vivo* studies are required to fully investigate the mechanisms responsible for this observed antidiarrhoeal activity.

## CONFLICT OF INTEREST

The author has declared that there is no conflict of interest related to this paper.

## AUTHOR'S CONTRIBUTION

The manuscript was carried out, written, and approved in collaboration with all authors.

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