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EVALUATION OF METHANOLIC ROOT EXTRACT OF MARANTA ARUNDINACEA FOR ANTIDIARRHEAL ACTIVITY

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ABSTRACT: The findings of the present study provide convincing evidence that methanolic root extract of M. arundinacea (MEMA) roots possesses remarkable antidiarrheal activity. Antidiarrheal effect is rapid, long lasting, and statistically significant at both 200 and 400 mg/kg doses. However, further chemical and pharmacological studies are required to isolate the bioactive compounds and elucidate the precise mechanisms responsible for the observed pharmacological activities of this plant.

Keywords: M. arundinacea (MEMA), Antidiarrheal.

INTRODUCTION

Outbreaks of acute diarrhoeal disease have been identified as causes of fatal disease dating back as far as the Sanskrit literature and during Hippocratic times. Diarrhoeal and dysenteric illnesses have played principal roles in the outcomes of military battles throughout history. The importance of the role enteric disease had in the outcome of the Peloponnesian War, British campaigns of the 18th century, Napoleon's campaigns, the Crimean War, the American Civil War, the Franco-Prussian War and the Chino-Japanese War has been documented.

MATERIALS AND METHODS

Materials

Castor oil (WELL's Health Care, Hyderabad), 0.9% sodium chloride solution (normal saline) (Orion Infusions Ltd., Hyderabad), and loperamide (Square Pharmaceuticals Ltd., Hyderabad) were used for antidiarrheal activity test.

METHODS

Maranta arundinacea roots were collected from local botanical gardens, hyderabad, and authenticated by the botanist. The roots of Maranta arundinacea L. were air dried at room temperature and ground into fine powder by pulverization in electric grinder. The powder was successively extracted in methanol (55– 60°C) with occasional agitation and then filtered through a cotton plug followed by Whatman Filter Paper number 1. The solvent was evaporated under vacuum at room temperature to yield semisolid extract. Then, the methanolic extract of Maranta

arundinacea. (MEMA) roots was collected in eppendorf tube and preserved in a refrigerator at 4°C for further use.

Castor oil-Induced Diarrhea in Rats

Rats of both sexes (95–100 g) were fasted for 18 hours. The selected rats for castor oil-induced diarrheal test were divided into four groups (n=6).

Group I was given normal saline (2 mL/kg) orally as control group

Group II received loperamide (5 mg/kg) as standard group.

Groups III-IV received MEMA (200 and 400 mg/kg, i.p.). After 1 h, all groups received castor oil 1 mL each orally.

Then they were placed in cages lined with adsorbent papers and observed for 4 h for the presence of characteristic diarrheal droppings. 100% was considered as the total number of feces of

control group. The activity was expressed as % inhibition of diarrhea. The percent (%) inhibition of defecation was measured using the following formula:

Percent(%)inhibition of defecation=[$(A-B)A$]×100,

where A is mean number of defecation time caused by castor oil and B is mean number of defecation time caused by drug or extract.

RESULTS AND DISCUSSION

Castor Oil-Induced Diarrhea

In case of castor oil-induced diarrheal test, the methanol root extract of Maranta arundinacea showed a marked antidiarrheal effect in the rats (Table 1). In both doses, 200 mg/kg and 400 mg/kg, extract produced significant reduction of defecation. The roots extract doses of 200 mg/kg and 400 mg/kg decrease the total amount of wet feces produced upon administration of castor oil at doses 200 mg/kg and 400 mg/kg compared to the control group (at the dose of 5 mg/kg.

Table 1: Effect of MEMA roots on castor oil-induced diarrhea in rats.

Group	Treatment of feces	Total number of feces	% Inhibition of defecation	Total number of diarrheal feces	% Inhibition of diarrhea
I	Castor oil (2 mL/ 1 + Saline kg/p.o)	20.16 ± 1.91**	-	11.05 ± 1.08**	-
II	Castor oil + Loperamide (5 mg/ kg/ i.p)	12.12 ± 0.66**	60.32	5.00 ± 0.33**	54.75
III	Castor oil + (Roots Extract 200 mg/kg i.p)	8.21 ± 0.81**	40.99	6.33 ± 0.93**	42.67
IV	Castor oil + (Roots Extract 400 mg/kg i.p)	10.48 ± 1.52**	50.99	5.79 ± 0.52**	57.75

Values were expressed as mean ± SEM. (n= 5). * P < 0.05, ** p < 0.01 when compared with control group (ANOVA followed by Dunnett's *t*-test).

DISCUSSION

Traditionally, people use plant(s) or plant-derived preparations considering them to be efficacious against diarrheal disorders without any scientific basis . These experimental models were therefore employed to validate antidiarrheal efficacy of methanolic extract of M. arundinacea roots in the current study. Diarrhea can be described as the abnormally frequent defecation of feces of low consistency which may be due to a disturbance in the transport of water and electrolytes in the intestines. Instead of the multiplicity of etiologies, (i) increased electrolytes secretion (secretory diarrhea),

(ii) increased luminal osmolarity (osmotic diarrhea), (iii) deranged intestinal motility causing a decreased transit time, and (iv) decreased electrolytes absorption may be responsible for pathophysiology. Recent study claims that nitric oxide in castor oil is responsible for the diarrheal effect, although it is evidenced that ricinoleic acid produces diarrhea through a hypersecretory response which is the most active component of castor oil. There are several mechanisms proposed to explain the diarrheal effect of castor oil including inhibition of intestinal Na+ K+ ATPase activity, consequently reducing normal fluid absorption, activation of adenylate cyclase or mucosal cAMP-mediated active secretion, and stimulation of prostaglandin formation and platelet activating factor. Usually castor oil is metabolized into ricinoleic acid in the gut, which causes irritation and inflammation in the intestinal mucosa, resulting in the release of inflammatory mediators (e.g., prostaglandins and histamine). The released prostaglandins initiate vasodilatation, smooth muscle contraction, and mucus secretion in the small intestines. In experimental animals as well as in human beings, prostaglandins of the E series are considered to be good diarrheagenic agents.

Our study showed that the overall antidiarrheal study reveals the dose dependent activity. In our study, MEMA roots showed significantly reduced amount of feces in castor oil-induced rat by 44.99% and 55.99% at the doses of 200 and 400 mg/kg, respectively, and % inhibition of diarrhea was 42.67 and 57.57 at 200 and 400 mg/kg, respectively. Moreover, our results directly demonstrate an inhibition of castor oil-induced enteropooling with reduction of the weight and volume of intraluminal contents by 30.33% and 40.16% at 200 and 400 mg/mL, respectively. These results suggest that roots of M. arundinacea contain antidiarrheal components. Also, from these results, it can be predicted that reduction of water and electrolytes secretion into the small intestine may enhance electrolyte absorption from the intestinal lumen consistent with inhibition of hypersecretion. Besides different pathophysiological conditions of diarrhea, hypermotility characterizes diarrhea where the secretory component is not the causative factor. Castor oil produces ricinoleic acid leading to irritation, inflammation of intestinal mucosa, and ultimately

diarrhea. At this condition, prostaglandins stimulate gastrointestinal motility and secrete water and electrolytes. It is also well established that loperamide inhibits diarrhea induced by castor oil and charcoal passage test is used to determine the effect of test substance on gut motility. In gastrointestinal motility, MEMA suppressed the propulsive movement or transit of charcoal meal through the gastrointestinal tract which demonstrates that the roots extract may be able to reduce the frequency of stool in diarrheal conditions.

Previous report on the phytochemical screening on M. arundinacea roots has shown that alkaloids, tannin, cardiac glycosides, steroids, and saponins are absent but phenols and flavonoids are significantly present. It was reported that flavonoids and polyphenols were responsible for the antidiarrheal activity properties. Moreover, in vivo and in vitro tests have also shown that flavonoids are able to inhibit prostaglandin E2 induced intestinal secretion and spasmogens induced contraction and also inhibit release of prostaglandins and autocoids. Thereby, flavonoids as the inhibitors of prostaglandins biosynthesis are considered to delay castor oil-induced diarrhea. Polyphenols also can show antidiarrheal property by interacting and inhibiting cytochrome P450 systems. So, the antidiarrheal activity of the methanolic extract of the root of M. arundinacea could therefore be due to the presence of flavonoids and pheno

CONCLUSION

The findings of the present study provide convincing evidence that methanolic root extract of M. arundinacea (MEMA) roots possesses remarkable antidiarrheal activity. Antidiarrheal effect is rapid, long lasting, and statistically significant at both 200 and 400 mg/kg doses. However, further chemical and pharmacological studies are required to isolate the bioactive compounds and elucidate the precise mechanisms responsible for the observed pharmacological activities of this plant.

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