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Significance of nutmeg in diarrhoea

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ABSTRACT

Nutmeg (Myristica fragrans, family- Myristicaceae) is used as an active ingredient of most of the ayurvedic antidiarrhoeal formulations. Antidiarrhoeal effect of an aqueous extract of Myristica fragrans (AEMF) was evaluated in magnesium sulphate induced diarrhoea, intestinal secretion and charcoal meal test in mice at a dose of 25, 50, 100 mg/kg. AEMF treated mice, significantly reduced the induction time of diarrhoea, number of wet stools and total no of stools in the diarrhoea induced by magnesium sulphate. It has also produced antimotility and antisecretory activity in castor oil induced intestinal transit and intraluminal fluid accumulation in mice. These results indicate that AEMF produces its antidiarrhoeal effect through decreasing intestinal secretions and inhibiting the intestinal motility.

Key words: Nutmeg, diarrhoea, intestinal transit, intestinal secretion.

INTRODUCTION

Diarrhoea includes increase in volume or fluidity of stools, change in consistency and increase frequency of defecation [1]. Diarrhoea involves both an increase in the motility of the gastrointestinal tract, along with increased secretion, and a decrease in the absorption of fluid and thus a loss of electrolytes and water [2]. It remains one of the major health threats to populations in the tropical and subtropical poor countries. In developing countries, the majority of people living in rural areas almost exclusively use traditional medicines in treating all sorts of diseases including diarrhoea. Due to these facts, the World Health Organization (WHO) incorporates studies of traditional medicinal practice in its diarrhoeal disease control program [3, 4].

Nutmeg (Myristica fragrans) seed is widely used as a spice. In India it is mainly cultivated in South India particularly in certain pockets of Kerala, Tamil Nadu and Karnataka. It has a characteristic pleasant fragrance and slightly warm taste. It is used to flavour many kinds of baked goods, confections, puddings, meats, sausages, saucers, vegetables, and beverages [5]. It is used as an active ingredient of most of the ayurvedic antidiarrhoeal formulations.The aim of the present paper is to study the antidiarrhoeal, antimotility and antisecretory effect of Nutmeg.

MATERIALS AND METHODS

Drugs

i) Castor oil (refined pure) – Paras Chemical Industries, ii) Loperamide hydrochloride – Cipla Pharmaceuticals Ltd., iii) Chlorpromazine hydrochloride – Rhone Poulene (India) Ltd., iv) Activated Charcoal – E. Merck, v) Magnesium sulphate – Merck, vi) Atropine sulphate – Sigma chemicals Ltd.

Plant material and preparation of the extract

Seeds of Nutmeg (Myristica fragrans family Myristicaceae) were purchased from local market. The botanical identification of the fruits was done by Dr. Dhabe, Herbarium incharge Department of Botany, Dr. Babasaheb

Ambedkar Marathwada University, Aurangabad (M.S.), India, where a voucher specimen has been deposited. The dried seeds were coarsely powdered. The powdered seeds (200 gm) were taken in a round bottom flask and was extracted with water for 48 hr at room temperature. After 48 hr, the solution was filtered and the filtrate was concentrated in a rotary evaporator and the last trace was removed in vacuum. The various concentrations of the aqueous extract of Myristica fragrans (AEMF) were given 0.1 ml orally.

Animals

"Swiss albino mice" of either sex, weighing; 20 – 25 gm obtained from VIPER, Pune, were used for the experiments. They were kept in standard environmental condition, fed standard food and water ad libitum. All experiments were performed after an overnight fast. The study was approved by Institutional Animal Ethical Committee of Government College of Pharmacy, Aurangabad, Maharashtra, India (GCPA/IAEC/2011/235, 11/03/2011).

Experimental procedure for antidiarrhoeal activity

Acute toxicity

AEMF studied for acute oral toxicity as per revised OECD guidelines number 423. AEMF was devoid of any toxicity up to 300 mg/kg in albino mice by oral route. Hence for further studies doses of 25 to 100 mg/kg of AEMF was used [2].

Magnesium sulphate induced diarrhea

The animals were divided in to control, positive and test groups containing six in each group. Each mouse was kept for observation under a glass funnel, the floor of which was lined with blotting paper and observed for 4 h. Diarrhea was induced by administering 2 gm/kg magnesium sulphate orally to mice. The control group received only distilled water (10 ml/kg, po); the positive control group received loperamide (2 mg/kg, po); test group received AEMF at doses of 25, 50, 100 ml/kg, po, body weight 30 min before the administration of magnesium sulphate. During an observation period of 4 h, the parameters observed were: onset of diarrhoea, total number of faecal output, and number of wet faeces [6].

Small intestinal secretions

Effect of AEMF on intestinal secretion was indirectly studied by enteropooling assay. The mice were divided into different groups and treated with AEMF (25, 50, 100 mg/kg, po), distilled water (10 ml/kg, po) and Chlorpromazine (30 mg/kg, po) before the oral administration of castor oil 0.2 ml per mouse. These mice were sacrificed 30 min later and entire small intestine from each animal was weighed and their group average was calculated. The difference in the weight of intestine in control and castor oil treated group was considered as the castor oil induced accumulation of intestinal fluid [7].

Gastrointestinal motility by charcoal meal

The animals were divided in to control, positive and test groups of six mice each. Each animal was given orally 0.2 ml of charcoal meal (3% charcoal in 5 % gum acacia). The test groups received the AEMF at doses of 25, 50, 100 mg/kg, po, body weight immediately after charcoal meal administration. The positive control group received atropine sulphate (5 mg/kg, ip), while the control group received distilled water (10 ml/kg, po). After 30 min., the animals were sacrificed and the movement of charcoal from pylorus to caecum was measured. The peristaltic index, which is the distance travelled by charcoal meal to the total length of small intestine expressed in terms of percentage [8].

Statistics

The results of all experiments were reported as mean ± S.E.M. Statistical analysis was carried out using Student's '*t*'-test. A level of significance of $P< 0.05$ was regarded as statistically significant.

RESULTS AND DISCUSSION

Effect of Nutmeg on magnesium sulphate induced diarrhoea

All the mice in control group produced diarrhoea after magnesium sulphate administration during the observation period of 4 h. Pretreatment of mice with the different doses of AEMF caused a significant dose dependent reduction of number of wet stools and total no of stools as shown in Table 1.

Magnesium sulphate produces the diarrhoea by osmotic properties, preventing reabsorption of water ions, leading to increase in the volume of the intestinal content. It promotes the liberation of cholecytokinin from the duodenal mucosa, which increases the secretion and motility of small intestine and thereby prevents the reabsorption of sodium chloride and water [9]. AEMF found to reduce the diarrhoeic condition in this model.

Table 1: Effect of Nutmeg on magnesium sulphate induced diarrhoea in mice.

Group	Dose (mg/kg)	Onset of	diarrhoea (min)	Total numbers of stools	Number of wet stools	% Inhibition
Control		50±1.97		13.50±0.45	11.16±0.36	
AEMF	25	67±2.65		9.50±0.36	7.66±0.42	31.36
AEMF	50	79±3.76		8.16±0.42	6.83±0.47	38.79
AEMF	100	93±3.49		7.33±0.36	5.50±0.36	50.71
Loperamide	2	223±5.82		1.33±0.25	1.00±0.16	91.03

Values are mean ± standard error of mean.
Each value represents average of six determinations.
P < 0.05 vs. control, student's 't' test.

Effect of Nutmeg on small intestinal secretion

Diarrhoea occurs when the bowels secrete more electrolytes and water than they absorb. Castor oil produces permeability changes in the intestinal mucosa membranes to water and electrolytes resulting in fluid and watery luminal content that flows rapidly through small and large intestines [4]. AEMF inhibited the castor oil induced intestinal fluid accumulation as shown in Table 2.

Table 2: Effect of Nutmeg on intraluminal fluid accumulation in mice.

Experimental Group	Dose (mg/kg)	Weight of small intestine (mg)	Castor oil induced intraluminal fluid (mg)	% Inhibition
Normal		1091±21		
Control		1579±31	488±38	
AEMF	25 mg	1414±27	323±30	33.81
AEMF	50 mg	1395±26	304±27	37.70
AEMF	100 mg	1357±24	266±15	45.49
Chlorpromazine	30 mg	1176 ± 21	85 ± 9	82.58

Values are mean ± standard error of mean.
Each value represents average of six determinations.
P < 0.05 vs. control, student's 't' test.

Effect of Nutmeg on small intestinal transit

GI motility describes the contraction of the muscles that mix and propel contents in the gastrointestinal tract. Charcoal meal test in mice is a method used to study the effect of drugs on the motility of intestine [10]. AEMF was found to be the inhibitor of intestinal motility as shown in Table 3.

Table 3: Effect of Nutmeg on intestinal transit in mice

Group	Dose (/kg)	% intestinal transit	% Inhibition
Control		85.53±2.47	
AEMF	25 mg	67.85±2.62	20.67
AEMF	50 mg	58.46±2.31	31.64
AEMF	100 mg	51.35±2.18	39.96
Atropine sulphate	5 mg	34.23 ± 1.16	59.97

Values are mean ± standard error of mean.
Each value represents average of six determinations.
P < 0.05 vs. control, student's 't' test.

CONCLUSION

These results indicate that Nutmeg possesses antidiarrhoeal effect may be due to its antimotility and antiseretory effect. Antimotility and antisecretory effect of Nutmeg may be due to the presence of different phytochemicals. Further study is required to find out the active constituents responsible for its antidiarrhoeal effect.

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