Natural Product Sciences
9(3) : 177-179 (2003)

Evaluation of Antidiarrhoeal Activity of *Aerva* species

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Abstract – The genus *Aerva* is distributed in temperate and tropical Asia and Africa. *Aerva* species, *Aerva lanata* and *Aerva javanica* have been used for antidiarrhoeal activity in Indian traditional medicine. *A.lanata* and *A.javanica* were screened separately for their. anti-diarrhoeal activity and their action on intestinal transit on their vacuum dried ethanolic and aqueous extracts at the dose of 800 mg/kg by standard methods. All the extracts showed significant antidiarrhoeal activity and significantly reduced intestinal transit in charcoal meal test. The results illustrate that the ethanolic and aqueous extracts of *A.lanata* and the ethanolic and aqueous extracts of *A .javanica* have significant antidiarrhoeal activity and the activity may be attributed to its effect on intestinal transit. The present study supports the claim of *Aerva lanata* and *Aerva javanica* as antidiarrhoeal drugs in the Indian system of medicine.
Keywords – *Aerva lanata, Aerva javanica,* antidiarrhoeal activity, intestinal transit

Introduction

Herbal remedies are preferred for a number of ailments in recent years. Organization like the World Health Organization (WHO) and United Nations Childrens Fund (UNICEF) are very much interested in plants to be used for the treatment of childhood diarrhoea. It thus becomes important to identify and evaluate commonly available natural drugs as an alternative to currently used antidiarrhoeal drugs, which are not completely free from adverse effects. *Aerva lanata* (Linn) Juss and *Aerva javanica* (Burm.f) Juss belonging to the family *Amaranthaceae* are used in Indian traditional medicine as antidiarrhoeal drugs. Both the plants are hoary tomentose herb found almost throughout India. *A. lanata* is used to cure diarrhoea, cholera and dysentery in Bihar (Anonymous, 1985). *A. lanata* is used in the treatment of diarrhoea, dysentery, cholera, boils, ear complaints, skin diseases, snakebite, swellings, and white discharge (Jain, 1991). *A. lanata* is used in the treatment of white urine, diarrhoea, cholera, dysentery and snake bite (Perry, 1980). *A. javanica* is also used occasionally in the same category as *A. lanata* (Anonymous, 1994). In Ayurveda, *A. javanica* is known as "Valleyaka" and the root is used as an antidiarrhoeal drug (Yoganarasimhan, 2000). Qualitative tests confirmed the presence of carbohydrates, glycosides, tannins, saponins, alkaloids, flavonoids and phenolic compounds (Geissman, 1995). In the present study the vacuum dried ethanolic and aqueous extracts of *A. lanata* and *A. javanica* were evaluated for their antidiarrhoeal activity by castor-oil induced diarrhoea and study on small intestinal transit.

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Materials and Methods

Plant material – The whole plants of *A. lanata* and *A. javanica* were collected from Chennai (Tamil Nadu). The identification of the plants were authenticated by Dr. Sasikala Ethirajulu, Research Officer, Central Research Institute for Siddha, Chennai.

Extraction – The plants were shade-dried and were coarsely powdered separately and subjected to maceraction process with ethanol and water separately for 24 hours. After exhaustive extraction the ethanolic (EAL) and aqueous (AAL) extracts of *A. lanata* and the ethanolic (EAJ) and aqueous (AAJ) extracts of *A . javanica* were dried at low temperature (55-60°C) using rotary vacuum flash evaporator. The color and yield of the extracts EAL, AAL, EAJ and AAJ were greenish brown (3.4% w/w) dark brown (10.4% w/w), greenish brown (3.6% w/w) and dark brown (8.0 % w/w) respectively.

Animals – Inbred Wistar albino rats of either sex weighing between 180-200 G were used. The animals were kept in separate cages at 25±2°C, relative humidity of 45-55%,

maintained under light and dark cycles of 10 and 14 h respectively. All the animals were acclimatized for a week before the experiment, fed with standard rodent pellet diet (Hindustan Lever Limited) and water *ad libitum*. Food was withdrawn 18-24 h before the experiment. The animals were deprived of water during the experiment. The animals were divided into six groups of 6 animals each. The test groups orally received the extracts.

Antidiarrhoeal study – The antidiarrhoeal activity was studied by castor oil induced diarrhoea method (Awouters *et al.*, 1978, Mujumdar, 1998). The rats were divided into six groups of 6 animals each and were treated as per the following regiment.

Group I-control-1% Carboxy methyl cellulose (CMC) suspended in distilled water.

Group II-Reference standard-Loperamide (5 mg/kg; p.o) (Sunil Bajad, 2001)

Group III-Test 1-EAL (800 mg/kg; p.o)

Group IV-Test 2 AAL (800 mg/kg; p.o).

Group V-Test 3-EAJ (800 mg/kg; p.o)

Group VI-Test 4-AAJ (800 mg/kg; p.o)

Animals in each group received 1 ml of castor- oil by oral route after 30 minutes of drug administration. The animals were placed separately in cages with filter paper, which was changed every hour. All the animals were observed for defaecation upto 4 h. The frequency of defaecations and number of diarrhoeal faeces excreted in the recorded time were scored and compared with control group. The results were expressed in percentage of inhibition (Zaval *et al.*, 1988) (Table 1).

Study on small intestinal transit – The rats were divided into six groups of 6 animals each and were treated as per the following regiment.

Group I-control-1% Carboxy methyl cellulose (CMC) suspended in distilled water.

Group II-Reference standard Loperamide (5 mg/kg; p.o)

Group III-Test 1-EAL (800 mg/kg; p.o)

Table 1. Antidiarrhoeal activity of (EAL), (AAL), (EAJ) and (AAJ) on rats with castor oil induced diarrhea. (Data are mean ± S.E.M., n=6 in each group)

Drug treatment	Mean defaecation in 4 h±S.E.M	Mean number of wet faeces in 4 hrs±S.E.M.	Percentage inhibition
1% CMC	4.5 ± 0.34	4.0 ± 0.52	0
Loperamide 5 mg/kg	0.3 ± 0.21**	0**	100
EAL 800mg/kg	0.5 ± 0.22**	0.2 ± 0.16**	96
AAL 800 mg/kg	3.3 ± 0.21*	2.3 ± 0.33**	42
EAJ 800 mg/kg	1.0 ± 0.52**	0.3 ± 0.21**	92
AAJ 800 mg/kg	1.0 ± 0.45**	0.5 ± 0.34**	88

Significance levels: *P<0.05, **P<0.001 as compared to control (1%CMC).

Table 2. Effect of EAL, AAL, EAJ, and AAJ on small intestinal transit (Data are mean ± S.E.M, n=6 in each group)

Oral Pretreatment	Mean% movement of charcoal meal
1% CMC	91.1 ± 1.43
Loperamide 5 mg/kg	35.4 ± 1.09*
EAL 800 mg/kg	35.8 ± 0.72*
AAL 800 mg/kg	62.6 ± 6.01*
EAJ 800 mg/kg	46.4 ± 2.66*
AAJ 800 mg/kg	55.3 ± 5.06*

Significance level: *P< 0.001 as compared to control (1%CMC).

Group IV-Test 2 AAL (800mg/kg; p.o)

Group V-Test 3 - EAJ (800 mg/kg; p.o).

Group VI-Test 4-AAJ (800mg/kg; p.o)

Half an hour after treatment individual animals were administered orally with 1 ml of charcoal meal (3% de-activated charcoal in 10% aqueous tragacanth). Half an hour after charcoal meal rats were sacrificed and the intestinal distance moved by charcoal meal from pylorus to caecum was measured and expressed as percentage of the distance moved (Mujumdar, 1998), (Table 2).

Statistical analysis – Results were expressed as mean ±SEM. Analysis of variance was used and the significance of difference between means was determined by Dunetts test and results were recorded as significant when P<0.05.

Results and Discussion

It was observed that all the extracts EAL, AAL, EAJ and AAJ significantly inhibited castor oil induced diarrhoea and the inhibition was 96%, 41.75%, 91.75% and 87.5% respectively. The standard drug loperamide (5 mg/kg) produced an inhibition of 100%. All the extracts EAL, AAL, EAJ, AAJ and loperamide (5 mg/kg) significantly decreased the propulsion of the charcoal meal through the gastro intestinal transit when compared with the control (1% CMC). In this study, the ethanolic and aqueous extracts of *A. lanata* and ethanolic and aqueous extracts of *A. javanica* in the dose of 800 mg/kg given orally exhibited significant antidiarrhoeal activity against castor oil induced diarrhoea. The anionic surfactant castor oil executes its antidiarrhoeal action through its metabolite ricinoleate, It is stool wetting and softening agent altering the intestinal permeability by increasing the water and electrolyte secretion (Goodman and Gilman, 1996). Both the species of *Aerva* showed the presence of tannins which by forming protein tannates cause an astringent action resulting in antidiarrhoeal activity. All the extracts EAL, AAL, EAJ and AAJ have shown significant antidiarrhoeal activity and reduction of small intestinal transit. However the antidiarrhoeal activity

and the reduction of small intestinal transit were less significant with the aqueous extract of *A.lanata* (AAL) alone. This may be because of added actions through inhibition of prostaglandins (Tripathi, 2001) to modify the fluid dynamics of gastrointestinal mucosal cells or a direct antimicrobial action on the common diarrhoeal pathogens in EAL, EAJ and AAJ. Loperamide reduces intestinal motility and also reduces intestinal secretions which also may be responsible for its antidiarrhoeal effect to some extent (Goodman and Gilman,1996). This study supports the use of *Aerva lanata* and *Aerva javanica* as antidiarrhoeals as per the traditional claims. Ethanolic extracts of both the plants are more effective than aqueous extracts. Aqueoua extract of *Aerva lanata* is the least active with significant antimotility effect on the intestine. Future studies on the intricacies of the pharmacological activity including the antimicrobial will throw more light on this activity.

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(Accepted August 21, 2003)