Anti-diarrhoeal Activity of Ethanolic Extract of *Celosia argentea* (Linn.)

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Abstract

*Celosia argentea* a medicinal herb belonging to the family Amaranthaceae has been used traditionally in Ayurveda for the treatment of diarrhoea and dysentery. However the claims of ayurveda have to be validated through suitable experiments. So the present study was aimed to evaluate the antidiarrhoeal effect of whole plant of *Celosia argentea* Linn. in wistar rats by using castor oil induced diarrhoea and castor oil induced enteropooling models. Loperamide (2.5 mg/kg body weight) was used as standard drug where as extract was used in a dose of 50, 100 and 200 mg/kg body weight. The extract produced dose related anti-diarrhoeal effect. Results suggest that anti-diarrhoeal effect may be due to action of extract either centrally or may be due to inhibition of PGE₂.

Keywords: *Celosia argentea*; Castor oil; Diarrhoea; PGE₂

Introduction:

Diarrhoea has long been recognized as one of the most important health problems in the developing countries.\(^1\) Worldwide distribution of diarrhoea accounts for more than 5-8 million deaths each year in infants and small children less than 5 year. According to WHO estimation for the year 1998, there were about 7.1 million deaths due to diarrhoea.\(^2\) Secretary diarrhoea is the most dangerous symptom of gastrointestinal problems\(^3\) and is associated with excessive defecation and stool outputs, the stools being of abnormally loose consistency.\(^4\) In developing countries, the majority of people living in rural areas almost exclusively use traditional medicines in treating all sorts of disease including diarrhoea. There are large numbers of epidemiological and experimental evidence pertaining to worldwide acute-diarrhoecal disease, which is one of the principal causes of death in the infants, particularly in malnourished and which is of critical importance in developing countries.\(^1\),\(^2\) It thus becomes important to identify and evaluate commonly available natural drugs

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as alternative to currently used anti-diarrhoeal drugs, which are not completely free from adverse effects. Several studies have evaluated the effectiveness of some traditional medicines in treating diarrhoea, in all different continents. India has a great environmental and biological diversity compared with the rest of the world. A range of medicinal plants with anti-diarrhoeal properties has been widely used by the traditional healers; however, the effectiveness of many of these anti-diarrhoeal traditional medicines has not been scientifically evaluated. *Celosia argentea* has been investigated for many biological activities like laxative, antioxidant, anti-inflammatory, anti diabetic, aphrodisiac, antidyserteric, refrigerant and immunomodulatory activity. Traditionally the dried plant is used as antiscorbutic and seeds are bitter and useful in blood diseases and mouth sores. However detailed investigation of antidiarrhoeal activity of whole plant has not been carried out so far. Therefore in the present communication we reported the antidiarrhoeal activity of whole plant of *Celosia argentea* Linn.

**Materials and Methods:**

- **Plant material:** The whole plant of *Celosia argentea* was collected from Bidar district. The plant was authenticated by Dr. B. S. Sajjan, Associate Professor in Botany in HKESBV Bhoomaraddi, Arts, Science and Commerce, College Bidar of Karnataka state. The plant was identified as *Celosia argentea* L. under a voucher specimen no. Sp.Pl.205.1753 and submitted in Pharmacognosy and Phytochemistry Department. It was dried under shade and then powdered to obtain a coarse powder. This powder was stored in air-tight container and used for further extraction.

- **Preparation of extract:** The powder was extracted successfully with petroleum ether, benzene, chloroform, ethyl acetate, and ethanol using soxhlet apparatus and extract was concentrated under vacuum.

- **Phytochemical Screening**

  Preliminary Phytochemical screening of all the extracts was carried out to know various constituents present as per the standard procedures. The extracts of *Celosia argentea* showed the presence of various phytocomstituents like alkaloids, carbohydrates, glycosides, phytosterols, saponins, tannins, proteins, amino acids and flavonoids.

**Animals:**

Wistar strain albino rats of either sex (150-200g) were approved by Institutional Animal Ethics Committee (Regn. No. - SDCP/IAEC 2011/05) and procured from Institutional Animal House, S.D College of Pharmacy, Barnala. The animals were provided with food (Golden feed) and water ad libitum and maintained at a temperature 22 to 25°C.

**Experimental Design:**

Antidiarrhoeal activity of ethanolic extract of whole plant of *Celosia argentea* Linn was
assessed by castor oil induced diarrhoea and castor oil induced enteropooling models. Before animal study the animals were fasted overnight with free access to water. The animals were deprived of water during experimentation. Each experimental group consisted of six animals housed in separate cages.

Methods

Castor oil-induced diarrhoea

Rats were divided into five groups of six animals each. Diarrhoea was induced by administering castor oil at the dose of 1ml/100g of the body weight orally to rats. Group 1 served as control received normal saline containing 5% tween 80 (1ml/100g of the body weight) orally. Group 2 received standard drug loperamide at the dose of 2.5 mg/kg per orally served as standard and Groups 3, 4, and 5 received ethanolic extract (50, 100, 200 mg/kg per orally) 1 h before castor oil administration. Each animal was placed in an individual cage, the floor of which was lined with filter paper. The filter paper was changed every hour and defecation was noted up to six hours. The percentage of rats that respond to diarrhoea, the latent period, mean of stool frequency, frequency of diarrhoeal drops were recorded, percentage inhibition of wet stool and defecation was evaluated.

\[
\text{% Inhibition of defecation} = \frac{W_C - W_t}{W_C} \times 100
\]

\(W_C\) = Mean weight of defecation in control group

\(W_t\) = Mean weight of defecation in test group

Castor oil-induced enteropooling diarrhoea

Rats were divided into five groups of six animals each. Diarrhoea was induced by administering castor oil at the dose of 1ml/100g of the body weight orally to rats. Group 1 served as control received in normal saline containing 5% tween 80 (1ml/100g of the body weight) orally. Group 2 received standard drug loperamide at the dose of 2.5 mg/kg per orally served as standard and Groups 3, 4, and 5 received ethanolic extract (50, 100, 200 mg/kg per orally) 1 h before castor oil administration. Two hours later rats were sacrificed and whole length of intestine from pylorus to caecum was removed and intestinal fluid was collected in pre weighed tubes (m1) and new weight of the tube was measured as (m2). The difference between m2-m1 was the weight of intestinal fluid. The percentage inhibition of weight of intestinal contents was calculated as

\[
\text{% Inhibition of defecation} = \frac{W_C - W_t}{W_C} \times 100
\]

\(W_C\) = Mean weight of intestinal fluid in control group

\(W_t\) = Mean weight of intestinal fluid in test group

Statistical analysis

Data were analyzed by one-way analysis of variance (ANOVA) and the results were
expressed as mean ± standard deviation. The means were compared using the Dunnett test at P < 0.001.

**Results and Discussion**

**Castor oil induced Diarrhoea**

The use of castor oil induced diarrhoea model in our study is logical because the autacoids and prostaglandins are involved these have been implicated in the causation of diarrhoea in man. [26],[27] The liberation of ricinoleic acid from castor oil results in irritation and inflammation of the intestinal mucosa, leading to release of prostaglandins, which stimulate motility and secretion. [28] The results of the present study showed that the extract of *Celosia argentea* produced a statistically significant reduction in the severity and frequency of diarrhoea produced by castor oil. In this study, loperamide produced a significant reduction in the number of stools.

Ethanol extract of *Celosia argentea* reduced the weight of faeces almost equal to that of standard drug loperamide, when compared to saline control rats. There was increase in latent period with increase in drug dose. The dose of 200mg/kg of ethanolic extract showed that the inhibition percentage of defecation and frequency of wet stool were comparable to those of reference drug at 2.5 mg/kg as tabulated in Table 1.

**Castor oil induced Enteropooling**

Castor oil is also reported to induce diarrhoea by increasing the volume of intestinal content. Thereby prevents the reabsorption of NaCl and H₂O. [29] Probably extract increased the reabsorption of NaCl and water by decreasing intestinal motility. The anti-diarrhoeal activity of the extract may also be due to the presence of denature proteins forming protein tannates, protein tannates make the intestinal mucosa more resistant and reduce secretion. [30]

The secretary diarrhoea is associated with an activation of Cl- channels, causing Cl-efflux from the cell, the efflux of Cl-results in massive secretion of water into the intestinal lumen and profuse watery diarrhoea. [31] The extract may inhibit the secretion of water into the lumen by reverting this mechanism.

The ethanol extract of whole plant of *Celosia argentea* showed 63.79% inhibition of weight of intestinal content at a dose of 200mg/kg compared to that of 64.75% shown by loperamide at the dose of 2mg/kg as shown in Table 2.

**Conclusion**

Diarrhoea results from an imbalance between the absorptive and secretory mechanisms in the intestinal tract, accompanied by hurry, resulting in an excess loss of fluid in the faeces. According to literature survey tannins [6], flavonoids [29], alkaloids [32], saponins, reducing sugars, sterols and terpenes [33] are responsible for the antidiarrhoeal activity. The phytochemical analysis of the extracts showed the presence of alkaloids, saponins, flavonoids, sterols and sugars. These constituents may responsible for the anti-
diarrhoeal activity of *Celosia argentea* extracts. The results indicate that the ethanolic extract of *Celosia argentea* possesses significant anti-diarrhoeal activity due to its inhibitory effect both on gastrointestinal propulsion and fluid secretion. The data obtained are consistent with literature report on antidiarrhoeal activity of *Celosia argentea* using gastrointestinal motility test and castor oil-induced diarrhoea and intraluminal accumulation of fluid in rats. The inhibitory effect of the extract justified the use of the plant as a non-specific antidiarrhoeal agent in folk medicine. Further detailed investigations are underway to determine the exact phytoconstituents which are responsible for the antidiarrhoeal activity.

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**References**


<table>
<thead>
<tr>
<th>Test material</th>
<th>% Respondent</th>
<th>Latent period</th>
<th>Total stool frequency</th>
<th>% inhibition of defecation</th>
<th>Frequency of wet stool</th>
<th>% Inhibition of wet stool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline 1%+C. oil</td>
<td>100</td>
<td>54.8±9.36</td>
<td>9.8±2.58</td>
<td>0</td>
<td>8.6±1.14</td>
<td>0</td>
</tr>
<tr>
<td>Extract + C. oil 50mg/kg</td>
<td>100</td>
<td>83.6±5.31**</td>
<td>6.2±1.48**</td>
<td>36.73</td>
<td>3.8±1.48***</td>
<td>55.81</td>
</tr>
<tr>
<td>100mg/kg</td>
<td>100</td>
<td>92.2±9.62***</td>
<td>4.4±1.14***</td>
<td>55.10</td>
<td>2±1.58***</td>
<td>76.74</td>
</tr>
<tr>
<td>200 mg/kg</td>
<td>95</td>
<td>173.8±18.45***</td>
<td>3.8±0.83***</td>
<td>61.22</td>
<td>1.6±0.54***</td>
<td>81.39</td>
</tr>
<tr>
<td>Loperamide+ C. oil (2.5mg/kg)</td>
<td>80</td>
<td>179.8±11.45***</td>
<td>4±0.70***</td>
<td>59.18</td>
<td>1.4±1.34***</td>
<td>83.72</td>
</tr>
</tbody>
</table>

Values are expressed as mean± SEM from the experiments. **= P<0.01, ***= P<0.001 when compared with castor oil + saline treated group. Number of animals (n) = 6.
Table 2: Effect of test substance at various doses in castor oil enteropooling induced diarrhoea

<table>
<thead>
<tr>
<th>Test material</th>
<th>Weight of intestinal fluid</th>
<th>% inhibition of intraluminal fluid accumulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline1% + Castor oil</td>
<td>2.90±0.15</td>
<td>0</td>
</tr>
<tr>
<td>Extract + Castor oil 50mg/kg</td>
<td>1.96±0.07***</td>
<td>32.41</td>
</tr>
<tr>
<td>100mg/kg</td>
<td>1.16±0.14***</td>
<td>60.00</td>
</tr>
<tr>
<td>200mg/kg</td>
<td>1.05±0.13***</td>
<td>63.79</td>
</tr>
<tr>
<td>Loperamide + Castor oil (2.5mg/kg)</td>
<td>1.022±.08***</td>
<td>64.75</td>
</tr>
</tbody>
</table>

Values are expressed as mean± SEM from the experiments. ***= P<0.001 when compared with castor oil + saline treated group. Number of animals (n) = 6