**Research Article**

# Exploring the Potent Antidiarrheal Properties of *Capparis Zeylanica* Leaf Extracts

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**Abstract**:

Diarrheal diseases remain a significant global health concern, particularly in regions with limited access to healthcare and safe drinking water. The search for effective, affordable, and sustainable treatments for diarrhea continues to be a priority in the field of medical research. *Capparis zeylanica,* a plant widely distributed in tropical and subtropical regions, has been traditionally used for its medicinal properties. This study investigates the Antidiarrheal potential of *Capparis zeylanica* leaf extracts, aiming to provide scientific validation for its traditional use. The present study investigated the potential antidiarrheal effects of methanolic leaf extract derived from *Capparis zeylanica* (Capparidaceae) using a

castor oil-induced diarrhea model and the small intestine transit method in mice. In comparison to loperamide (2 mg/kg/bw), the ethanolic extract of C. zeylanica (administered at doses of 100, 200, and 400 mg/kg body weight) demonstrated a noteworthy reduction in the severity of diarrhea. The level of protection observed in animals treated with the extract and experiencing diarrhea was compared to those treated with castor oil and loperamide. Notably, the antidiarrheal activity exhibited a dose-dependent response. Additionally, when assessed for its impact on intestinal transit, the extract displayed a substantial decrease in intestinal motility. These results indicate that the ethanolic extract effectively mitigated diarrhea in mice, accompanied by a reduction in stool weight. Further investigation into safety profile of these extracts is warranted to support their development as a viable therapeutic option for diarrheal diseases.

**Keywords**: *Capparis zeylanica*, Antidiarrheal, Leaf extracts, enteric pathogens, Traditional medicine

**Introduction**:

Diarrheal diseases remain a significant global public health challenge, particularly in regions with limited access to healthcare resources and safe drinking water. According to the World Health Organization (WHO), diarrhea is a leading cause of morbidity and mortality, particularly among children under five years of age, accounting for approximately 1.6 million deaths annually worldwide (1). In addition to its impact on mortality, diarrhea places a substantial economic burden on affected individuals and healthcare systems (2).

The treatment of diarrhea typically involves rehydration and, in some cases, the use of antimicrobial agents. However, the emergence of antimicrobial resistance and the limited availability of healthcare facilities in resource-constrained settings underscore the importance of exploring alternative, cost-effective, and sustainable approaches to managing this prevalent condition (3,4).

Traditional medicine has long been a source of remedies for various ailments, including diarrhea. In this context, Capparis zeylanica, a plant widely distributed in tropical and subtropical regions, has a history of traditional use for its medicinal properties. While it has

been utilized by local communities for its potential antidiarrheal effects, there is a paucity of scientific evidence validating its efficacy (5).

This study aims to bridge the gap between traditional knowledge and scientific validation by investigating the antidiarrheal properties of *Capparis zeylanica* leaf extracts. By employing a multidisciplinary approach that includes in vitro assays against enteric pathogens and in vivo experiments using animal models, we seek to elucidate the potential mechanisms underlying its antidiarrheal effects (6).

This research holds the promise of contributing to the development of affordable and accessible solutions for the management of diarrhea, particularly in regions where diarrhea-related morbidity and mortality rates remain high. The study of traditional medicinal plants like Capparis zeylanica represents a valuable avenue for discovering new therapeutic options and addressing global health challenges (7).

## 2.0 Material and Methods

### 2.1 Plant Material

The fresh leaves of *C. zeylanica* (Capparidaceae), collected at the flowering stage in the month of March and were authenticated by the renowned botanist. A voucher specimen was deposited in the departmental herbarium. Leaves were dried in shade for 25 days and then powdered to get a coarse powder. This powder was stored in air-tight container and used for further successive extraction.

### 2.2 Preparation of Crude Extract

The dried and powdered plant material was Soxhlet's extracted with ethanol. The extraction was carried out for 24 h at room temperature with mild shaking. The extract was filtered and concentrated at 45°C, and the weight of the residue was recorded. The percentage yield of ethanolic extract was found to be 38.40% w/w and was used for further studies.

### 2.3 Animals

Albino mice of either sex weighing between 20-30g were procured from central animal house for experimental purpose. The animals were acclimatized to laboratory conditions for 7 days. The animals were supplied with commercially available standard diet from. Water was allowed *ad libitum* under hygienic conditions. All animal studies were

performed in accordance to guideline of CPCSEA and Institutional Animal Ethical Committee (IAEC) guidelines.

**2.4 Acute Toxicity Study**

The acute toxicity assessment of *Capparis zeylanica* leaf extracts was conducted using albino mice of both sexes, weighing between 20-25 grams, and maintained under standardized conditions. Prior to the experiments, the animals underwent a 3-hour fasting period. They were then administered a single dose of alcoholic leaf extract from C. zeylanica and monitored for mortality over a 48-hour study period, which is considered as a short-term toxicity evaluation. Subsequently, in accordance with the guidelines outlined in OECD No. 425 (Acute Oral Toxicity: Up-and-Down Procedure), the subsequent dosages were determined based on the initial short-term toxicity profile. Specifically, doses equivalent to 1/20, 1/10, and 1/5 of the LD50 (lethal dose for 50% of the tested animals) were selected and categorized as low, medium, and high doses, respectively (8).

**2.5 Castor Oil-induced Diarrhea**

Twenty-four mice underwent an 18-hour fasting period and were subsequently divided into five groups, each comprising six animals. All groups received an oral dose of 0.4 ml of castor oil. Thirty minutes after the administration of castor oil, the first group (referred to as the control group) was given a vehicle solution consisting of 0.5% Tween 80 in distilled water. The second group was administered the reference drug loperamide at a dosage of 2 mg/kg body weight. The third, fourth, and fifth groups received doses of 100, 200, and 400 mg/kg body weight, respectively, of the ethanolic extract of *Capparis zeylanica* (ECZ). Subsequently, the mice were individually housed.

To evaluate the severity of diarrhea, assessments were conducted at hourly intervals over a span of 6 hours. The total weight of feces was documented within a 24-hour period and compared to that of the control group. The total number of diarrhea episodes in the control group served as the baseline, representing 100%. The results were then expressed as the percentage of diarrhea inhibition (9,10).

**2.6 Small Intestinal Transit**

The animals were divided into five groups, each comprising six mice. They were orally administered 1 ml of a charcoal meal, consisting of 5% activated charcoal suspended in

physiological saline, 60 minutes after receiving an oral dose of either drugs or a vehicle solution. In specific detail:

- Group I was given physiological saline at a dose of 10 ml/kg.
- Groups II, III, and IV received different doses of the ethanolic extract of *Capparis zeylanica* (ECZ) at 100 mg/kg, 200 mg/kg, and 400 mg/kg, respectively.
- Group V was administered atropine sulfate at a standard dosage of 0.1 mg/kg.

After a 30-minute interval, the animals were humanely euthanized using cervical dislocation. Subsequently, the intestines were carefully removed without stretching and placed lengthwise on moist filter paper. For each animal, the length of the intestine, measured from the pyloric sphincter to the cecum, was recorded. Additionally, the distance traveled by the charcoal meal, expressed as a percentage of the total intestine length, was evaluated. Group means were calculated and compared, and the results were expressed as the percentage of inhibition (11-50).

**2.7 Statistical Analysis**

All the experimental results were expressed as mean± S.E.M. Data were analyzed by analysis of variance (ANOVA) followed by Dunnett's test.

**3.0 Result and Discussion**

The preliminary phytochemical screening of the ethanolic extract of Capparis zeylanica (ECZ) revealed a rich diversity of bioactive compounds, including alkaloids, flavonoids, carbohydrates, glycosides, tannins, terpenoids, and phenols. Notably, the absence of fixed oils and steroids suggests a distinct phytochemical profile for ECZ, consistent with its traditional medicinal use. These phytochemicals are known to possess various biological activities and may contribute to the observed antidiarrheal effects (12, 13). An essential aspect of evaluating the safety of any potential therapeutic agent is the determination of its toxicity. In this study, the median lethal dose (LD50) of ECZ was found to be greater than 2000 mg/kg body weight. This finding suggests that ECZ possesses a relatively low acute toxicity profile, providing a safety margin for potential therapeutic use (14). Castor oil-induced diarrhea is primarily attributed to ricinolic acid, an active metabolite that stimulates peristaltic activity in the small intestine, leading to changes in electrolyte permeability and the release of endogenous prostaglandins (15). The higher dose of

ethanol extract of C. zeylanica demonstrated significant dose-dependent antidiarrheal activity in this study, akin to the standard drug loperamide (2 mg/kg). Several mechanisms could underlie ECZ's antidiarrheal effects. The presence of tannins, sterols, triterpenes, and reducing sugars in ECZ may contribute to its antidiarrheal mechanism of action. Tannins, for instance, have been associated with reducing intestinal secretion, potentially by forming protein tannates that enhance mucosal resistance (16). ECZ may influence intestinal motility, as evidenced by a decrease in intestinal transit observed in the charcoal meal test. A reduction in motility could promote the reabsorption of water and electrolytes from the gastrointestinal tract, contributing to its antidiarrheal efficacy. Loperamide, a standard antidiarrheal drug, is known to regulate gastrointestinal function and slow down transit in the small intestine, which aligns with its observed antidiarrheal effect in this study (17-19). The administration of ECZ at varying doses (100, 200, and 400 mg/kg) resulted in significant protection against diarrhea, with the highest dose (400 mg/kg) demonstrating the most substantial effect. These findings underscore the dose-dependent nature of ECZ's antidiarrheal activity and highlight its potential as a therapeutic agent for managing diarrhea. The observation that ECZ reduced small intestine transit, as indicated by the mean distance traveled by charcoal, suggests that it may enhance the absorption of water and electrolytes from the gastrointestinal tract. Notably, the effect at 400 mg/kg was comparable to that of the standard drug atropine sulfate, a known regulator of intestinal motility. In conclusion, this study provides compelling evidence of the pharmacologically active substances within *Capparis zeylanica* responsible for its antidiarrheal properties.

**Table 1: Effect of ECZ on castor oil-induced diarrhea**

| Treatment (Oral) | Dose | Weight of stool | % Protection |
|---|---|---|---|
| **Control** | 2 ml/kg | 1.178±0.442* | - |
| **Standard** | 2 mg/kg | 0.289±0.274** | 77.34 |
| **ECZ** | 100 mg/kg | 0.498±0.0254** | 55.83 |
| **ECZ** | 200 mg/kg | 0.312±0.0124** | 68.12 |
| **ECZ** | 400 mg/kg | 0.411±0.0244** | 71.23 |

**P<0.01 and *P<0.05 statistically (Mean±Sem) significant from control group.

**Table 2: Effect of ECZ on small intestinal transit method**

| Treatment (Oral) | Dose | Mean distance travelled by charcoal as % total length of small intestine (cm) | % Reduction |
|---|---|---|---|
| **Control** | 2 ml/kg | 85.24±1.872 | - |
| **Standard** | 0.1 mg/kg | 14.267±2.454 | 80.45 |
| **ECZ** | 100 mg/kg | 38.57±1.254* | 51.63 |
| **ECZ** | 200 mg/kg | 32.485±1.012* | 63.21 |
| **ECZ** | 400 mg/kg | 22.512±1.134* | 74.08 |

**P<0.01 and *P<0.05 statistically (Mean±Sem) significant from control group.

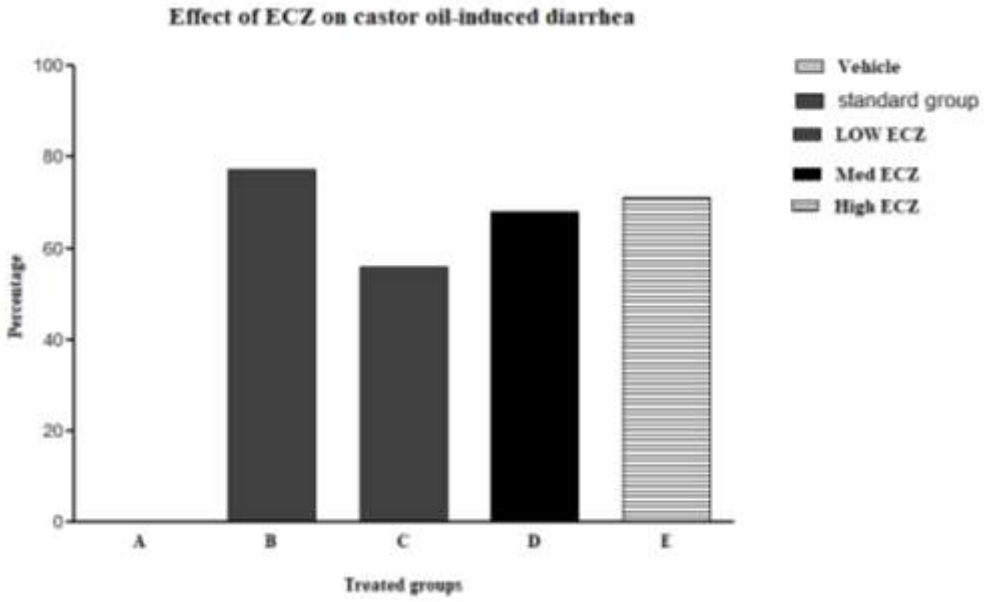


**Fig 01: Effect of ECZ on castor oil induced diarrhea**

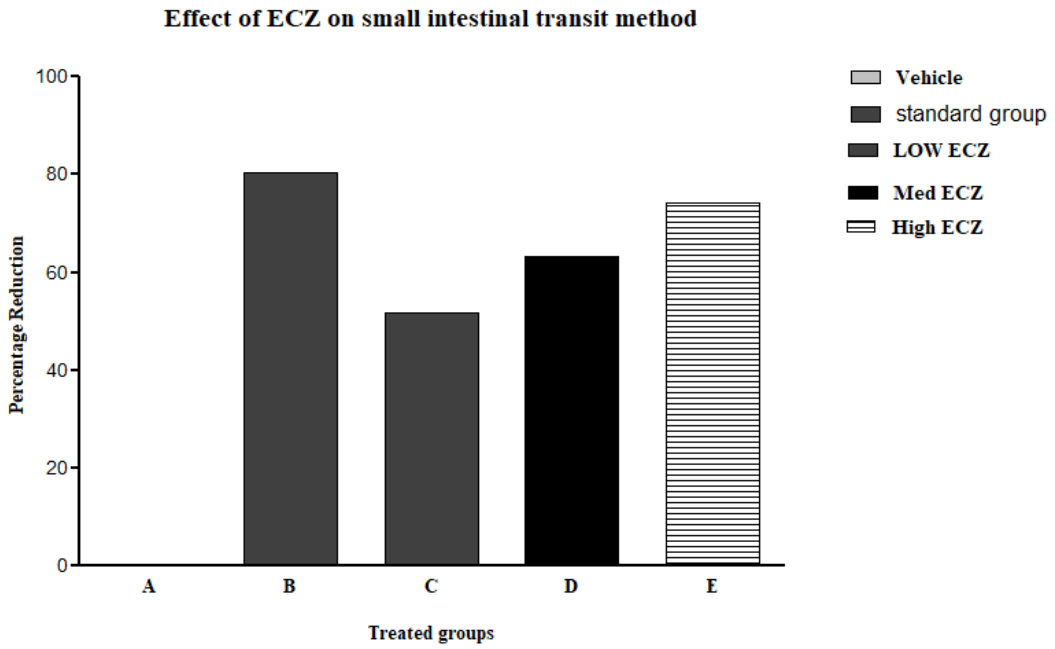


**Fig 02: Effect of ECZ on small intestine transit method**

**4.0 Conclusion:** These findings support its traditional use as an effective antidiarrheal remedy. Further research is warranted to isolate and characterize the specific molecules responsible for ECZ's antidiarrheal activity, potentially paving the way for the development of novel therapeutic agents for diarrheal conditions.

**5.0 Source of Support:** Nil

**6.0 Conflict of Interest:** Nil.

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