

Evaluation of the antidiarrhoeal effect of *Vitellaria paradoxa* Gaertn F (Sapotaceae) stem bark extract

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ABSTRACT

The antidiarrhoeal property of the methanolic stem bark extract of *Vitellaria paradoxa* was studied in mice. The assessment parameters included, castor oil induced diarrhoea, intestinal transit time, enteropooling. The antidiarrhoeal evaluation of the extract showed that it significantly reduced castor oil induced diarrhoea in mice dose dependently (100-400 mg/kg). The methanolic extract of *Vitellaria paradoxa* significantly ($p < 0.05$) increased intestinal transit time of charcoal in mice dose dependently. The extract was also observed to reduce the castor oil induced enteropooling in mice. *Vitellaria paradoxa* methanol stem bark extract may possess antidiarrhoeal property.

Key words: Antidiarrhoeal, Castor-oil, Enteropooling, Transit time, *Vitellaria paradoxa*.

1.0 INTRODUCTION

Diarrhoea is one of the major causes of mortality and morbidity in children, especially under the age of 5 years, in Nigeria and other third world countries. Diarrhoea takes a heavy toll in Nigeria which ranked second with annual infant mortality of 151,700 (UNICEF/WHO, 2009). Each year, some 20 million children suffer an average of 3.5 episodes of diarrhoea. After acute respiratory infections, it is the second leading cause of death among children (Alam *et al.*, 2001). In Nigeria 198 out of a 1,000 children die before they celebrate their 5th birthday, about 5-8 million deaths each year in infants and children below 5 years old are caused by diarrhoea worldwide. The need for newer, more effective, and less expensive antidiarrhoeal drugs has become a paramount issue to tackle this present situation. A number of Nigerian medicinal plants have been used by traditional healers to treat diarrhoea and related complications. However, the effectiveness of many of these antidiarrhoeal traditional medicines has not been scientifically evaluated.

Vitellaria paradoxa Gaertn F of the family sapotaceae is widely distributed in the West African sub-region. The plant is used to treat inflammation, rashes in children, dermatitis, chapping, irritation, ulcer and rheumatism. Leaf decoctions of *Vitellaria paradoxa* are used for the treatment of stomach ache, head ache and as an eye lotion. The paste of the root bark is taken orally to cure jaundice as well as diarrhoea and stomach ache in humans and applied topically to treat chronic sores and girth sores in horses (Mallogo, 1989). Its stem bark decoction is used in a bath to facilitate child birth, encourage lactation after delivery, treatment of leprosy, neutralization of venom of spitting cobra and for gastric problems as well as for diarrhoea and dysentery.

2.0 MATERIALS AND METHODS

2.1 PLANT MATERIAL

The stem bark of *Vitellaria paradoxa* was collected from Zuru in Kebbi state of Nigeria around September 2010 and identified by Mal Muhammad Musa (Ahmadu Bello University; Zaria, Kaduna), and a voucher specimen (NO 900626) was deposited at the herbarium of Botany unit, Department Biological sciences, Faculty of science. Ahmadu Bello University, Zaria, Kaduna.

2.2 Extraction

Shade-dried and powdered stem bark of *V. paradoxa* (560mg) was soxhlet-extracted using methanol. The extract was concentrated by evaporation over water bath to yield a concentrate of ox-blood extract (yield 13.89%).

2.3 Drugs and chemicals

Atropine sulphate and diphenoxylate (standard reference antidiarrhoeal drugs), castor oil (laxative agent), normal saline solution (0.9% NaCl), charcoal meal (5% activated charcoal in 10% tragacanth) and vehicle (distilled water) were used.

2.4 Animals

Swiss albino mice weighing 16.88 ± 0.18 grams of both sexes were obtained from National Veterinary Research Institute, Vom, Plateau state, Nigeria. The animals were housed under standard laboratory conditions 12 h light: dark cycle. The animals were fed with standard diet and water *ad libitum*.

2.5 Effect of *Vitellaria paradoxa* extract on castor oil-induced diarrhoea

The method described by Offiah and Chikwendu (1999) was adopted to study the effect of *V. paradoxa* extract on castor oil-induced diarrhoea. Mice were weighed and grouped into 5 groups (n = 6). Groups 1, 2 and 3 received 100, 200 and 400 mg/kg of the extract of *V. paradoxa* respectively, group 4 and 5 received 5mg/kg of diphenoxylate and 2 ml/kg of normal saline respectively. Each animal was then given 0.2 ml of castor oil orally after 1 hour of treatment and placed in transparent cages to observe for consistency of faecal matter and frequency of defecation for 6 h. Faeces were collected with an absorbent sheet of paper placed beneath the transparent cages. The wet faeces were read at the end of the experiment by lifting up the upper part of the cage containing the sheet of paper and animals. The percent (%) inhibition of defecation was measured using the following formula.

$$\% \text{ Inhibition of defecation} = [(A - B) / A] \times 100$$

A = Mean number of defecation caused by castor oil

B = Mean number of defecation caused by drug or extract

2.6 Effect of *Vitellaria paradoxa* extract on gastrointestinal transit time in mice

This was carried out according to the method outlined by Izzo *et al* (1999) using charcoal meal as a diet marker. The mice were divided into 4 groups of 6 animals each. Groups 1, 2 and 3 received 100, 200 and 400 mg/kg of the extract orally respectively. Group 4 received 3mg/kg of atropine intraperitoneally. Group 5 received normal saline intraperitoneally. Ten minutes after administration, each animal was given 0.5ml of charcoal meal orally (5% activated charcoal in 10% aqueous solution of tragacanth powder). After 30 min, the mice were sacrificed and the distance covered by the charcoal meal in the intestine, from the pylorus to the caecum was measured and expressed as a percentage of distance moved.

2.7 Effect of *Vitellaria paradoxa* extract on castor oil-induced intestinal fluid accumulation

This method described by Robert *et al* (1976) was used for the study. The mice were fasted for 12 h but allowed free access to water. The mice were randomised and placed in 5 cages of 6 rats per cage each. Groups 1, 2 and 3 received 100, 200 and 400 mg/kg of the extract of *V. paradoxa* orally respectively. Group 4 received atropine

3mg/kg intraperitoneally (I.P). Group 5 received 2ml /kg of normal saline. After 1 hour, each mouse was administered 0.2ml of castor oil. The mice were anaesthetised 1h later by inhalation of chloroform. The small intestine from the pylorus to caecum was dissected out and its content expelled into a measuring cylinder to measure the volume of the fluid.

2.8 Statistical analysis

Experimental values were expressed as Mean \pm SEM. Turkey-Kramer multiple comparison tests was carried out for statistical comparison. Statistical significance was considered to be indicated by a p value < 0.05 in all cases.

3.0 RESULTS

Table 1: Effects of methanolic extract of *Vitellaria paradoxa* stem bark on castor oil induced diarrhoea in mice.

Treatment group	Extract dose mg/kg	Mean no of defecation	Percentage protection (%)
Extract + CO	100	8.00 \pm 0.58	11.1
Extract + CO	200	4.83 \pm 0.60	46.3
Extract + CO	400	1.50 \pm 0.55	83
Saline + CO	-	9.00 \pm 0.73	0
Diph + CO	5	0.00	100

No of defecation expressed as Mean \pm SEM, n = 6, F = 60.380, P $<$ 0.001 when compared to negative control.

Diph = Diphenoxylate

CO = Castor oil

Table 2: Effect of *Vitellaria paradoxa* on gastrointestinal transit time in mice.

Treatment dose (mg/kg)	Total length of intestine (cm)	Distance travelled by charcoal	% intestinal travel time
Ext (100)	31.2 \pm 0.94	19.8 \pm 0.72	63.4 \pm 1.48
Ext (200)	30.4 \pm 0.44	16.0 \pm 1.03	52.8 \pm 3.98
Ext (400)	30.6 \pm 0.51	8.90 \pm 0.38	29.10 \pm 1.52
Atp (3)	30.2 \pm 0.51	4.00 \pm 0.21	13.4 \pm 0.83
Saline	32.7 \pm 0.50	21.3 \pm 0.68	67.30 \pm 2.90

Data expressed as mean \pm SEM, n = 6, F=89.725, P $<$ 0.01 when compared with control.

Table 3: Effect of *Vitellaria paradoxa* extract on castor oil induced enteropooling in mice.

Treatment group	Wt of intestinal content (g)	% accumulation of intestinal fluid
Ext (100mg/kg) +CO	3.13±0.17	35.1
Ext (200mg/kg) +CO	1.82±0.13	62.2
Ext (400mg/kg) +CO	0.90±0.13	81.3
Atp (3mg/kg)	0.87±0.18	81.9
Saline +CO	4.82±0.39	0

Weight expressed as mean ± SEM, n = 6, F=41.605, P<0.001 when compared to negative control.

Ext=Extract

CO=Castor oil; Atp =Atropine

4.0 DISCUSSION

In the castor oil-induced diarrhoea experiment, the mice group that did not receive the plant extract showed typical diarrhoeal signs and symptoms such as watery and frequent defecation. The methanolic extract of *V. paradoxa* produced a notable antidiarrhoeal effect in mice (Table 1). All doses of the extract significantly decreased ($p < 0.05$) the total number of wet faeces produced by administration of castor oil (8.00 ± 0.58 at 100 mg/kg, 4.83 ± 0.60 at 200 mg/kg and 1.5 ± 0.55 at 400mg/kg) as compared to the castor oil-treated control group (9.00 ± 0.73) at sixth hour of observation. The percentage of inhibition of castor oil-induced diarrhoea in the extract-treated mice was 11.1%, 46.3% and 83% respectively, at 100, 200 and 400 mg/kg. The effect of the extract was similar to that of the standard drug, Diphenoxylate (5 mg/kg), which produced an inhibition of 100% (Table 1).

The administration of the extract also slowed down the propulsion of charcoal meal through the gastrointestinal tract when compared to the castor oil-treated mice. The percentage inhibition of intestinal length travelled by charcoal meal in the extract pre-treated mice (100, 200 and 400 mg/kg) was 63.4 ± 1.48 , 52.8 ± 3.98 and 29.10 ± 1.52 respectively, while castor oil-treated mice was 67.30 ± 2.90 . Atropine on its part produced a marked decrease in the propulsive movement and the intestinal length travelled by charcoal meal and the percentage inhibition of transit was 13.4 ± 0.83 (Table 2). The average weight of faeces in the control group was 4.82 ± 0.39 g. Treatment with all doses of the extract significantly reduced ($p < 0.05$) the volume of faeces to 3.13 ± 0.17 g, 1.82 ± 0.13 g, and 0.90 ± 0.18 g respectively, at 100, 200 and 400 mg/kg (Table 3).

5.0 CONCLUSION

The extract could have produced its effect by decreased gastrointestinal motility and decreased secretion of fluid and electrolytes.

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