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Antidiarrhoeal Activity of Methanolic Stem Bark Extract of *Sarcocephalus latifolius* in Castor Oil-Induced Diarrhoeal Albino Rats

Maryam Usman Ahmed[1], Diowato Titus[2], Ruqayya Isa[3]
[1,3]Adamawa State University, Mubi, Nigeria
[2]Adamawa State College of Health, Michika, Adamawa State, Nigeria
umaruisaac@gmail.com

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Abstract

Diarrhoea remains one of the leading causes of death among children in developing countries characterized by frequent passing of watery faeces. This study evaluates the antidiarrhoeal activities of *Sarcocephalus latifolius* in castor oil-induced diarrhoeal albino rats. Thirty (30) albino rats were divided into six groups of five rats each. Except group 1 (control group) which received distilled water, all groups received 0.5 mL castor oil to induce diarrhoea. Group 2 received loperamide 3 mg/kg b. wt. Group 3, 4, 5, and 6 received 100, 200, 300, and 400 mg/kg b. wt. respectively of the methanolic stem bark extract of *Sarcocephalus latifolius*. Total diarrhoeic faeces, stool inhibition, intestinal fluid accumulation, and intestinal transit was determined to evaluate the antidiarrhoeal effect of the extract. Total diarrhoeal faeces, intestinal content and intestinal transit reflects significant ($p<0.05$) decrease with increase in the dose of the extract, group 4 which received high dose (400 mg/kg b. wt.) shows no significant difference when compared with group 2 which received loperamide. Percentage inhibition increases with increase in dose. Methanolic stem bark extract of *S. latifolius* possess antidiarrhoeal effect on castor oil-induced diarrhoea.

Keywords: Antidiarrhoeal, Activity, Methanolic, Stem Bark, Extract, Sarcocephalus latifolius, Castor, Diarrhoeal, Albino Rats

INTRODUCTION

Diarrhoeal disease is one of the leading causes of mortality and morbidity especially among children, resulting in a major health care problem in developing countries (Afroz *et al*., 2006). It is an increase in the frequency, volume and water content of stool accounting for 9% of deaths amongst children (Baldi *et al*., 2009, UNICEF, 2016). It is most common in developing countries due to improper hygiene practices, lack of improved sanitation facilities and lack of good water (Bitew *et al*., 2017; Yaya *et al*., 2018). With increasing recognition of herbal medicine as an alternative form of health care, use of herbal remedies and indeed natural products for healthcare delivery has been on the increase in recent times. Hundreds of indigenous plant extracts are used as traditional medicine which is still the first point of healthcare in sub-Saharan Africa for many people (Arzu *et al*, 2013; Bolaji *et al*., 2018).

Sarcocephalus latifolius is a shrub or a small tree found mostly in humid areas across the austral and tropical regions of Africa (Arbonnier, 2009) with many medicinal uses (Badiaga, 2011). The specie *Sacocepalus latifolius* (sm.) E.A. Bruce is a multi-stemmed small tree with glossy, rounded-ovate leaves with interesting flower and large red ball fruit native to Africa and Asia (Gidado *et al*., 2005) and are distributed widely in the forest and tropical forest of west Africa (Haudecoeur *et al*., 2018; Abdulfatai *et al*., 2019). S latifolius in English as the African Peach, in the areas where it grows is known by different natives. in Nigeria, it is known as Mbmmanu or Ubulu inu, Egbesi, Tafashiya by Igbo, Yoruba and Hausa tribes respectively (Orwa, 2009; Abdulfatai *et al*., 2019) and it is used locally in treating prolonged menstrual flow, debility, leprosy, stomach aches, fever, hypertension, malaria, jaundice, dysentery, epilepsy, mouth odor, tooth decay, malaria and diseases of central nervous system (Amos *et al*., 2005; Bum *et al*., 2009; Abbah *et al*., 2010; Ene *et al*., 2018). Various parts of the of *S. latifolius* extracts has been reported to have a number of medicinal activities including antimalaria, antimicrobial, antioxidant, antibacterial, anthelminthic and antiplasmodial activities (Asase *et al*., 2009; Abbah *et al*., 2010; Ene *et al*., 2018; Iloamaeke *et al*., 2018; Iteku *et al*., 2021). This study evaluates the antidiarrhoeal activity of *S. latifolius* on castor-oil induced diarrhoea.

MATERIALS AND METHODS

Collection of plant material and preparation

Fresh stems of *S. latifolius* plant were collected from vimtim village of Mubi North Local Government Area, Adamawa State. The plant material was identified and authenticated taxonomically by a taxonomist in Department of Botany, Adamawa State University, Mubi.

Experimental animals

Experimental albino rats of both sexes weighing about 120 - 160 g obtained from the Nigeria Institute for Trypanosomiasis Research, Vom Plateau State, Nigeria were for the study, used. At room temperature, the animals were housed in a well-ventilated wired cage for one week to get acclimatizaed before the initiation of the experiment where a maintained 12 h light/dark cycle was ensured and given standard laboratory diet with free access to drinking water. An ethical clearance for conducting the experiment on research animals was secured from the University Ethical Committee prior to the initiation of the experiment.

Extraction of the plant material

The collected *S. latifolius* stem barks were thoroughly washed, peeled, and air dried for four weeks under shed at room temperature and later pulverized into powdered form. The powdered plant material was soaked in methanol and allowed to stand at room temperature where it was stirred every 24 h in order to soften and break the cell wall of the plant to release the soluble phytoconstituents for a period of three (3) days after which the mixture was pressed and strained by filtration, and the solvent was evaporated to dryness using a water bath and crucible at 50^0c (Abdullahi and Mainul, 2020). The dried powdered extract was thereafter reconstituted in water to obtain the administered doses of 100, 200, 300 and 400 mg/kg body weight.

Phytochemical analysis

Phytochemical analysis was carried out on the methanolic stem bark extract of *S. latifolius* using the methods described by Banu and Catherine (2015).

Castor oil-induced diarrhoea in albino rats

The method described by Arise *et al.* (2016) was used. All the rats of both sexes were screened and selected for the experiment. Thirty (30) rats were fasted for 24 hours and divided into six groups of five rats each. The animals were divided into control, positive

control and test groups. Diarrhea was induced by administering 0.5 ml of castor oil orally to rats. The control group received only distilled water (10 ml/kg, po); the positive control group received loperamide (3 mg/kg, po); test group received the methanolic stem bark extract of *S. latifolius* at doses of 100, 200, 300 mg/kg, and 400 mg/kg, b. wt, po, 1 hour after castor oil administration. After 4 hours, the parameters observed were: total number of faecal outputs, and number of wet faeces.

Gastro-intestinal motility in rats

30 rats were randomly selected and divided in to six groups of five rats each. The animals were divided in to control, positive control and test groups. The positive control group received the standard drug, Loperamide, while test groups (3, 4, 5, & 6) received the methanolic stem bark extract of *S. latifolius* at doses of 100, 200, 300, and 400 mg/kg po, body weight. 1 hour after the treatment, each group received 0.5 ml of 5% charcoal suspension in distilled water orally. 30 minutes later the rats were sacrificed and the small intestine of each rat was isolated. The intestinal transit by the charcoal meal from the pylorus towards the caesium was assessed, and the percent of the intestinal distance travelled by the charcoal meal and percentage inhibition of the intestinal transit was determined.

Castor oil induced enteropooling in rats

30 rats were overnight fasted and divided into six groups of five animals each. Group 1 which received distilled water (1 ml/100 kg body weight) served as the negative control group. Group 2 received standard drug, Loperamide (3 mg/kg po) and groups 3, 4, 5, and 6 the methanolic stem bark extract of *S. latifolius* doses of 100, 200, 300, and 400mg/kg body weight po, respectively, 30 minutes before the oral administration of castor oil (1 ml). Two hours later, the rats were sacrificed; the small intestine was removed after tying the ends with threads and weighed. The intestinal content was collected by milking into a graduated cylinder and their volume was measured. The intestine was reweighed and the difference between the full and empty was calculated.

Statistical Analysis

The computation of the mean and statistical analysis was done using SPSS software version 23.0 Data is expressed as the mean ± S.D for the six groups of five animals. It was statistically analyzed with one-way analysis of variance (ANOVA) and Duncan Multiple

Range Test (DMRT). For all the tests, results with p values < 0.05 was considered to be significant

RESULTS

Phytochemical components of methanolic stem bark extract of *S. latifolius* are presented in Table 1. Phytochemicals tested included alkaloids, flavonoids, saponins, tannins, steroids and reducing sugar. The result disclosed the presence of all the phytochemicals tested for except for steroids. Table 2 shows the effects of methanolic stem bark extract of *S. latifolius* on castor oil-induced diarrhoea in albino rats. There was a significant ($p<0.05$) decrease in the total number of diarrhoeal faeces in groups that received the extracts when compared to the control group in a dose dependent manner and as well the group that received standard drug, loperamide, showed a significant different when compared with the groups that received the extract. Table 3 shows the effect of *S. latifolius* methanolic stem bark extract on the intestinal fluid accumulation in albino rats. The result revealed a significant ($p<0.05$) decrease in the volume of the intestinal content of the albino rats in groups that received the extracts when compared with the control group. There was no significant difference observed in the group (group 2) that received standard drug, loperamide and group 3 and 4 that received high doses of 300 and 400 mg/kg b.wt respectively of the extract. Percentage inhibition in the volume intestinal content of groups treated with the extracts also increased in a dose dependent manner. Table 4 shows the effect of the methanolic stem bark extract of *S. latifolius* on the intestinal transit. Significant ($p<0.05$) decrease in a dose dependent manner was observed in groups treated with the methanolic stem bark extracts when compared with the control group and as well when compared with the group the received the standard drug, loperamide. Percentage inhibition in the intestinal transit increases as dose increase, however, the group treated with the standard drug, loperamide, has the highest percentage of inhibition.

Table 1. Qualitative phytochemical analysis of methanolic stembark extract of *S. latifolius*.

Phytochemical	**Inference**
Saponin	+
Flavonoids	+
Alkaloids	+
Tannins	+
Steroids	-
Reducing sugar	+

Key: + = present, - = absent

Table 2. Effect of methanolic stem bark extract of *S. latifolus* on castor oil-induced diarrhoea in Albino rats.

Groups	Total number of faeces	Total number of diarrhoeic faeces
1. Control	7.75 ± 86^{b}	5.50 ± 1.29^{c}
2. Loperamide 3 mg/kg b. wt	1.75 ± 0.81^{a}	0.50 ± 0.57^{a}
3. Extract 100 mg/kg b. wt	6.76 ± 0.95^{b}	4.50 ± 0.57^{de}
4. Extract 200 mg/kg b. wt	5.75 ± 0.95^{b}	3.50 ± 0.57^{cd}
5. Extract 300 mg/kg b. wt	5.25 ± 0.50^{b}	3.25 ± 0.50^{c}
6. Extract 400 mg/kg b. wt	4.50 ± 0.57^{ab}	1.75 ± 0.50^{b}

All values are expressed as mean ± S.D (n=5). Different superscripts doe the column indicates that they are significantly different at ($p<0.05$).

Table 3. effect of metanolic stem bark extract of *S. latifolius* on intestinal fluid accumulation in rats

Group	Volume of intestinal content (cm^3)	% inhibition of the volume of intestinal content
1. Control	3.52 ± 0.12^{d}	0
2. Loperamide 3mg/kg b. wt	1.25 ± 0.23^{a}	64.53
3. Extract 100 mg/kg b. wt	3.00 ± 0.24^{c}	14.85
4. Extract 200 mg/kg b. wt	2.02 ± 0.40^{b}	42.85
5. Extract 300 mg/kg b. wt	1.40 ± 0.40^{a}	53.19
6. Extract 400 mg/kg b. wt	1.47 ± 0.09^{a}	58.09

All values are expressed as mean ± S.D (n=5). Different superscripts doe the column indicates that they are significantly different at ($p<0.05$).

Table 4. Effect of methanolic stem bark extract of *S. latifolius* on intestinal transit in rats

Group	Intestinal transit of charcoal meal (cm^3)	% inhibition of intestinal transit
1. Control	12.17 ± 2.06^{e}	0
2. Loperamide 3mg.kg b. wt	2.37 ± 0.38^{a}	80.49
3. Extract 100 mg/kg b. wt	9.05 ± 0.38^{d}	25.66
4. Extract 200 mg/kg b. wt	6.90 ± 0.63^{c}	43.32
5. Extract 300 mg/kg b. wt	4.32 ± 1.01^{b}	64.47
6. Extract 400 mg/kg b. wt	2.80 ± 0.47^{ab}	77.00

All values are expressed as mean ± S.D (n=5). Different superscripts down the column indicates that they are significantly different at ($p<0.05$).

DISCUSSION

The occurrence of diarrhoea is as a result of imbalances between the secretory and absorptive mechanisms in the intestinal tract accompanied by the increase in the stool frequency leading to excessive loss of fluid in the faeces (Singh *et al.*, 2023). In some of the cases of diarrhoea, the secretory component predominates, while in others, diarrhoea is characterized by hypermotility (Choudhary, 2012). Hydrolysis of castor oil produces recinolic acid (Asrie *et al.*, 2016) responsible for the diarrhoeal induction property of castor oil (Okere *et al.*, 2015). Recinoliec acid act by stimulating the release of endogenous prostaglandin which contributes to the pathophysiological functions in the gastrointestinal tract (Galvez *et al.*, 1991; Owolabi *et al.*, 2016). This release of prostaglandins is a major cause of arachidonic induced diarrhoea which is characterized by an increase in intestinal transit time and an increase in wet faeces (Okere *et al.*, 2015). The phytochemicals assayed for were found to be present except for the steroids which was absent. This indicate that *S. latifolius* stem bark has medicinal properties. The significant decrease in the total number of diarrhoeal faeces in the test groups and the positive control group indicates that they have active effect on castor oil induced diarrhoea in rats. Loperamide which acts by increasing the colonic phasic segmenting activities by inhibiting presynaptic nerves in the sub-mucosal and myenteric plexuses thereby leading to fecal water absorption and reducing the frequency of defecation was used in this study as a positive control (McQuaid, 2018). The decreased total diarrhoeal faeces reveal the antidiarrhoeal effects of the extract. However, the standard drug, Loperamide is more effective against the castor oil-induced diarrhoea than the highest dose of the extract used in this study as it shows a significant decrease when compared to the group that received the highest dose (400 mg/kg b.wt.) of the extract. The volume of the intestinal fluid content reduction in the castor oil-induced enteropooling observed may indicate the inhibitory potential of the *S latifolius* stem bark extract against the action of recinoliec acid and subsequent peristalsis or the extract might have increased water and electrolyte reabsorption and reduced the mucosal secretion as well as depleting the castor oil-induced enteropooling. The mechanism involved seems to be associated with dual effects on gastrointestinal motility as well as on water and

electrolyte transport, decreasing Na^+ and K^+ absorption across the intestinal mucosa. Thus, the observed significant decrease in the intestinal transit in a dose dependent manner. The antidiarrhoeal effect produced by the *S. latifolius* stem bark extract is due to the bioactive component present in the extract. This is especially true for flavonoids as it has been reported to inhibit prostaglandins and autacoids release leading to reduction of motility and secretion induced by castor oil (Veiga *et al.*, 2001). Therefore, it is most likely that these bioactive components either in combination or single, contributed to the antidiarrhoeal activities exhibited by the extracts. These findings provided a scientific support for the traditional use of this plant in the treatment of diarrheal diseases.

CONCLUSION

Sarcocephalus latifolius methanolic stem bark extract was found to be effective in reducing diarrhoea in castor oil-induced diarrhoeal albino rats. This suggests that the extract possess antidiarrhoeal properties for effective treatment of diarrhoea and can therefore be effective in the management of diarrhoea.

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