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Research Article

Anti-diarrhoeal potential of the aqueous root extract of *Ziziphus abyssinica* A. Rich.

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Abstract: The aqueous root extract of *Ziziphus abyssinica* A. Rich. has been used in traditional medicine amongst Sokoto state indigenes in Northwest Nigeria for the treatment of diarrhoea. The study was conducted to evaluate the anti-diarrhoeal potential of this plant's root and to justify its use in traditional medicine for the treatment of diarrhoea. The anti-diarrhoeal studies were evaluated (oral doses of 200, 400 and 600 mg/kg and Loperamide as the standard drug) using the castor oil-induced and the gastrointestinal motility models in Wistar rats. The result showed a significant ($p<0.05$) and dose dependent inhibitory activity against the castor oil-induced diarrhoea and reduction in gastrointestinal motility in charcoal meal test in rats. Based on the findings, the aqueous root extract of this plant may possess anti-diarrhoeal properties and validates its use in traditional medicine for the treatment of diarrhoea.
Keywords: *Ziziphus abyssinica*, Anti-diarrhoea, Traditional medicine, Castor oil-induced model, Gastrointestinal motility model, Wistar rats

INTRODUCTION

Diarrhoea is one of the most important health problems in the developing countries **[1]** and is characterised by an increase in frequency and production of watery stool **[2]**. Worldwide, the prevalence of diarrhoea is high and accounts for more than 5-8 million deaths each year in infants and children less than 5 year **[3]**. Diarrhoea prevalence among children in North eastern Nigeria was estimated to be as high as 22% **[4]**.

In the developing countries, a lot of the people depend on traditional medicine in treating all kinds of diseases including diarrhoea **[5]**. Ethnobotanical survey of the medicinal plants used amongst the Sokoto indigenes for the treatment of diarrhoea indicates that a good number of them have not been validated for this purpose including *Ziziphus abyssinica* **[6]**.

Ziziphus abyssinica A. Rich. Family Rhamnaceae, commonly called Catch thorn and 'Magaria' in Hausa language of Nigeria, is a spiny shrub or tree up to 4 m high that grows in the Sahel and drier part of tropical Africa. The herbalists in the northern community in Nigeria utilise the decoction of the root in the treatment of many ailments including mental disorders, diarrhoea and abdominal ulcer **[7]**. Previous studies on this plant revealed its antibacterial and antioxidant properties **[8]**. The phytochemical, acute toxicity and antiulcer properties of this plant have also been evaluated **[9]**.

The use of this plant for the treatment of diarrhoea has continued without proper scientific basis for this pharmacological property. The aim of the present study was to evaluate the anti-diarrhoeal properties of the aqueous extract of *Ziziphus abyssinica* using Castor oil-induced and Gastrointestinal motility anti-diarrhoeal models in wistar rats.

MATERIALS AND METHODS

Plant Material

The roots of *Z. abyssinica* were collected behind the Medicinal garden of the Department of Pharmacognosy and Ethnopharmacy, Usmanu Danfodiyo University, Sokoto in August, 2012. The plant was authenticated by Mr. Halilu Mshelia, the taxonomist of above mentioned department and was stored in the herbarium of the same department with a voucher number Pcg/UDUS/Rham/001.

Preparation of plant material

The roots of *Z. abyssinica* was washed with distilled water, cut into smaller sizes, air dried under the shade to constant weight and pulverised mechanically to a fine powder. 180 g of powdered root were subjected to maceration with 1000 ml of distilled water for 24 hours. The filtrate was evaporated to dryness in a hot water bath.

Animals

Wistar rats of both sexes (180-200 g) were obtained in different cages from Mike Ugwah animal house in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. The rats were housed in standard cages and allowed to acclimatise for 1 week before the commencement of the study. Standard commercial chow and water were provided *ad libitium* for the animals. Housing conditions were maintained at 25 ± 2^0C at 12 h day/ night cycles. They were fasted for at least 18 hours prior to the experiments but allowed free access to drinking water. The study was approved by the Animal Research Ethical Committee, Usmanu Danfodiyo University, Sokoto. The care and handling of the animals were according to the established public health guidelines in Guide for Care and Use of Laboratory Animals, 2011 **[10]**.

Drugs and Chemicals

Castor oil (Bell Sons and Co., England), Charcoal meal (10% activated charcoal in 100 ml of 5% aqueous gum acacia), Loperamide (Janssen, England).

Castor oil-induced diarrhoea

The Castor oil-induced diarrhoea was conducted according to the method of Havagiray et al. 2004 **[11]**. Five groups A- E (n= 5) of wistar rats were fasted for 18 h. Groups A-C received oral doses of extract of *Z. abyssinica* at doses of 200, 400 and 600 mg/kg body weight was administered orally to groups A-C respectively while groups D and E received normal saline (NaCl 0.9%) and Loperamide (2.5 mg/kg) respectively. After 1 h of drug pre-treatment, each animal was fed orally with 1 ml of castor oil. The animals were kept in separate metabolic cages with a plain sheet of paper placed on the floor to collect their droppings. They were observed every hour for 4 h after castor oil administration. The total number of diarrhoea faeces was noted. The total diarrhoeal faeces for the control group were considered to be 100%. The results were expressed as a percentage of diarrhoea inhibition.

Percentage of diarrhoea inhibition = $(T_0 – T_1 / T_0) * 100$

T_0 = number of wet faeces in Normal saline group

T_1 = number of wet faeces in test group

Gastrointestinal motility Tests

Rats were fasted for 18 h divided into five groups (n= 5). Groups 1-3 received oral doses of 200, 400 and 600 mg/kg of the extract. Group 4 received Loperamide and served as the positive control, while group 5 received distilled water as the negative control. One ml of charcoal meal (10% charcoal suspension in 5% gum acacia) was administered orally 30 minutes after the treatment. The rats were sacrificed after 1h and the distance travelled by charcoal meal from the pylorus was measured and expressed as percentage of the total length of the intestine from the pylorus to caecum.

Statistical analysis

Statistical analysis was performed by one-way analysis of variance (ANOVA) followed by Dunnett's *t*-test for multiple comparisons. The difference was considered significant at $p<0.05$.

RESULTS AND DISCUSSION

In the castor oil-induced diarrhoea experiment, the extract treated rats showed a dose dependent reduction in the production of diarrhoea faeces while the normal saline untreated group showed a significantly higher frequency in the passage of diarrhoea faeces. The Loperamide group was similar to the 600 mg/kg extract group. Treatment with *Z. abyssinica* significantly ($p<0.05$) increased the percentage inhibition of diarrhoea (Fig 1). Castor oil has been known to induce diarrhoea by increasing peristalsis, reducing the small intestine transit time and bringing about a rise in permeability of water and electrolytes in the intestinal mucosal membrane thereby resulting in hypersecretion of intestinal contents **[12, 13]**. *Z. abyssinica* successfully inhibited the number of diarrhoea faeces produced comparable to that of the standard drug loperamide. Loperamide acts by increasing small intestinal and mouth-to-caecum transit times and is used for the treatment of diarrhoea. The pharmacological activity of loperamide is therefore due to its antimotility and antisecretory properties **[14]**. It is likely that the extract may share similar mechanism as Loperamide in its antimotility and antisecretory properties.

In the Gastrointestinal motility experiment, there was also a dose dependent reduction in the length of the intestine travelled by the charcoal meal. The percentage inhibition in all the doses was significantly ($p<0.05$) higher when compared with the negative control group (Fig 2). Again, Loperamide and *Z. abyssinica* exhibited antimotility properties by reducing the distance travelled by the charcoal meal in the intestine significantly. This further buttresses the fact that *Z. abyssinica* may possess antimotility properties.

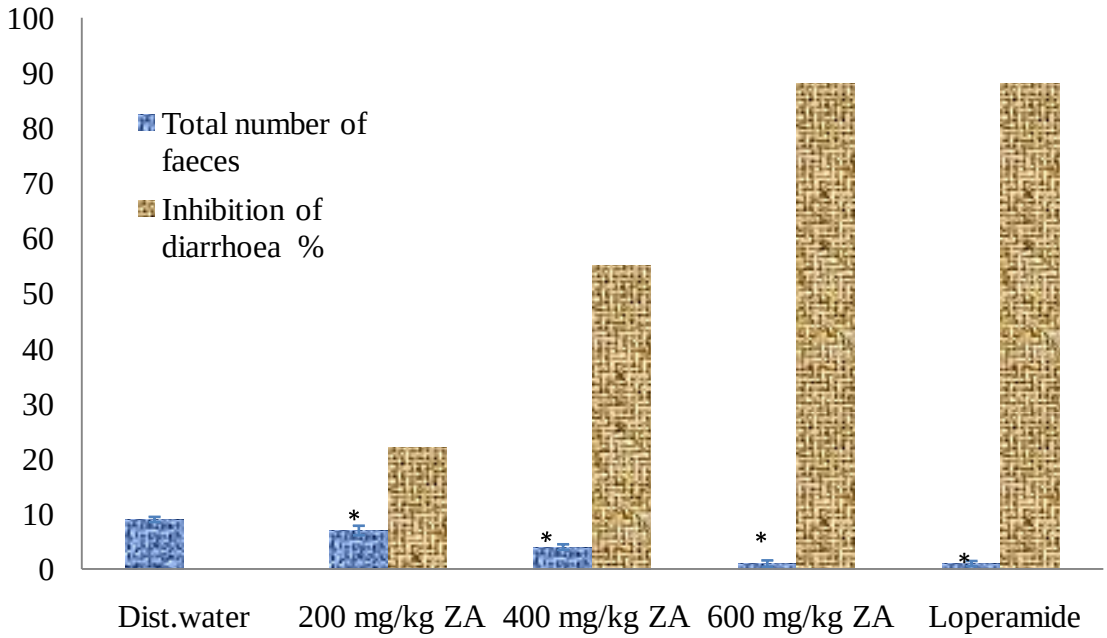

Figure 1 Effect of *Ziziphus abyssinica* (ZA) on castor oil-induced diarrhoea. Data presented as inhibition of diarrhoea mean% and mean total number of faeces ± SEM, n= 5 for all groups. *p<0.05 compared to the Distilled water untreated group.

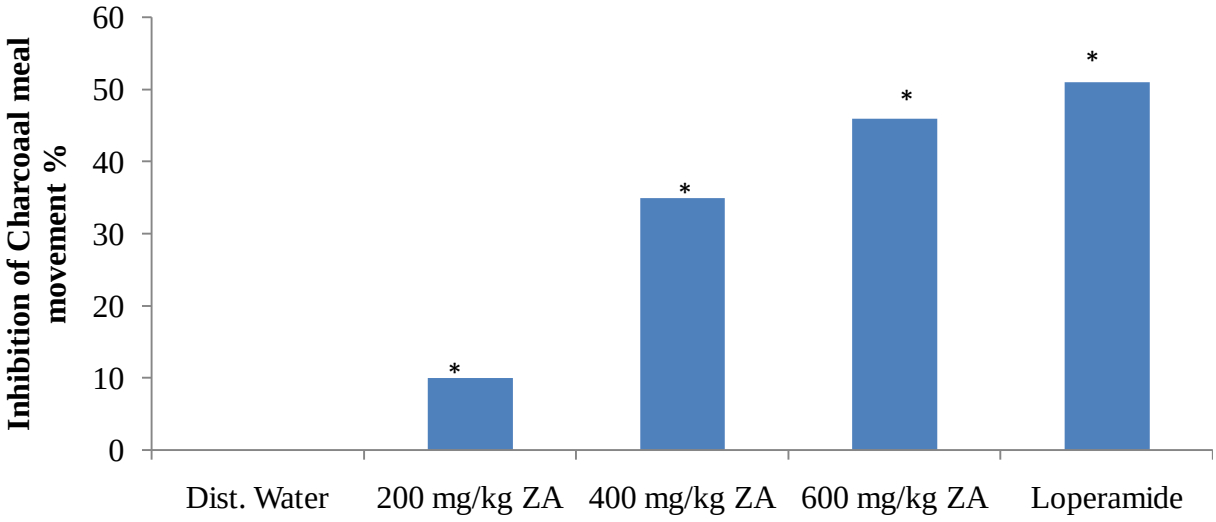

Figure 2 Inhibitory effect of *Ziziphus abyssinica* (ZA) on gastrointestinal motility. Data presented as mean% ± SEM, n= 5 for all groups. *p<0.05 compared to the distilled water control group.

A number of plants exhibit their antidiarrhoeal properties through their antimicrobial activities **[15, 16, 17, 18],** blocking the prostaglandins and congeners (eicosanoids) **[19]** and through their phytochemical constituents **[20, 21]**. *Z. abyssinica* has been shown in previous studies to possess activity against *Staphylococcus aureus* **[22, 23]** which is one of the microorganisms that is implicated in diarrhoea. Phytochemical studies in our previous study reveal the presence of Tannins, Alkaloids, Saponins, Glycosides and Steroids in *Z. abyssinica*. These phytochemical constituents possess antidiarrhoeal properties **[24, 25]**. Hence our extract could also be acting through these mechanisms.

However, more studies are required to evaluate the exact mechanism of action of this plant and possibly to determine the active compound responsible for the antidiarrhoeal properties.

CONCLUSION

The aqueous extract of *Z. abyssinica* possesses anti-diarrhoeal activities. This result validates its folk use in the treatment of diarrhoea.

References

1. Snyder JD and Merson MH; The magnitude of the global problem of acute diarrhoea disease: A review of active surveillance of data, Bull WHO, 1982; 60: 605-613.
2. Farthings MJG; Novel targets for the control of secretory diarrhoea, Gut, 2002; 50: 15-18.
3. Venkatesan N, Thiyagarajan V, Narayanan S, Arul A, Raja S, Kumar SGV, Rajarajan T and Perianayagam JB; Anti-diarrhoeal potential of *asparagus racemosus* wild root extracts in laboratory animals, Journal of Pharmacy and Pharmaceutical Sciences, 2005; 8(1): 39-45.
4. Das AK, Manda SC, Berneree S, Das J, Saha BP and Pal M; Studies on Antidiarrhoeal activity of *Punica granathum* seed extract in rats, Journal of Ethnopharmacology, 1999; 69: 205-208.
5. Lin J, Puckree T and Mvelase TP; Anti-diarrhoeal evaluation of some medicinal plants used by Zulu traditional healers, Journal of Ethnopharmacology, 2002; 79: 53–56.
6. Etuk EU, Ugwah MO, Ajagbonna OP and Onyeyili PA; Ethnobotanical survey and preliminary evaluation of medicinal plants with antidiarrhoea properties in Sokoto state, Nigeria, Journal of Medicinal Plants Research, 2009; 3(10): 763-766.
7. Zailani SB and Ahmed AH; Some Medicinal Plants used as Traditional recipes for some disorders among Northern communities in Nigeria, in: Odugbemi T ed.: A textbook of medicinal Plants from Nigeria, 2008: 55-65.
8. Nyaberi MO, Onyango CA, Mathooko FM, Maina JM, Makobe M and Mwaura F; Evaluation of phytochemical, antioxidant and antibacterial activity of edible fruit extracts of Ziziphus abyssinica A. Rich., Journal of Animal & Plant Sciences, 2010; 6: 623- 629.
9. Ugwah MO, Etuk EU, Bello SO, Aliero AA and Ugwah-Oguejiofor CJ; Comparative studies of anti-ulcerogenic activities of three Nigerian medicinal plants: A preliminary evaluation, Journal of Medicinal Plant Research, 2013; 7(9): 490-495.
10. Guide for the Care and Use of Laboratory Animals; The National academies press eighth edition, 2011.
11. Havagiray RC, Ramesh C and Sadhna K; Studies on Antidiarrhoeal activity of *Calotropis gigantea* r. br in experimental animals, Journal of Pharmacy and Pharmaceutical Sciences, 2004; 7(1): 70-75.
12. Capasso F, Mascolo N, Izzo AA and Gaginella TS; Dissociation of castor oil induced diarrhoea and intestinal mucosal injury in rat: effect of NG-nitro-L-arginine methyl ester, British Journal of Pharmacology, 1994; 113: 1127-1130.
13. Kutchai HC; The gastrointestinal system: Gastrointestinal regulation and motility. In: Berne RM, Levy MN, Koeppen BM, Stanton BA eds: Physiology Fifth edition, Mosby, Missouri, USA, 2004: 559.
14. Couper IM; Opioid action on intestine: The importance of intestinal mucosa, Life Sciences, 1987; 41: 917–925.
15. Macauder PJ; Flavonoids effect on acetylcholine, prostaglandins E and antigen mediated muscular contraction, Progress in Clinical and Biological Research, 1986; 213: 489–492.
16. Capasso F, Pinto A, Mascolo N, Autore G and Franco MP; Effects of flavonoids on PGE2 and LTD induced contractions on guinea pig isolated ileum, Pharmacological Research Communications, 1988; 20: 201–202.
17. Ilyas M, Haruna AK and Ilyas N; Plant constituents with antidiarrhoeal properties, Bulletin of Science Association of Nigeria, 1995; 10: 5–12.
18. DiCarlo G, Autore G and Izzo A; Inhibition of intestinal motility and the secretion by flavonoids in mice and in rats: structural activity relationship, Journal of Pharmacy and Pharmacology, 1993; 45: 1054–1059.
19. Christopher S, William A and Dubios RN; Prostaglandin endoperoxide synthase. Why two isomers?, American Journal of Physiology 1996; 270: G392–G400.
20. Boominathan R, Devi BP, Dewanjee S and Mandal SC; Studies on antidiarrheal activity of *Ionodium suffruticosam* ging. (Violaceae) extract in rats, Phytotherapeutics, 2005; 10: 375-380.
21. Dahiru D, Sini JM and John Africa L; Antidiarrheal activity of *Ziziphus mauritiana* root extracts in rodents, African Journal of Biotechnology, 2006; 5(10): 941-945.
22. Nyaberi MO, Onyango CA, Mathooko FM, Maina JM, Makobe M and Mwaura F; Evaluation of phytochemical, antioxidant and antibacterial activity of edible fruit extracts of *Ziziphus abyssinica* A. Rich, Journal of Animal & Plant Sciences, 2010; 6(2): 623-629.
23. Gundidza M and Sibanda M; Antimicrobial activities of *Ziziphus abyssinica* and *Berchemia discolour*, The Central African Journal of Medicine, 1991; 37(3): 80-83.
24. Longanga-Otshudi A, Vercruysse A and Foriers A; Contribution to the Ethnobotanical, Phytochemical and Pharmacological Studies of Traditionally used Medicinal Plants in the Treatment of Dysentery and Diarrhea in Lomela area, Democratic Republic of Congo

(DRC), Journal of Ethnopharmacology, 2000; 71(3): 411-423.

25. Al-Rehaily AJ, El-Tahir KEH, Mossa JS and Rafatullah S; Pharmacological studies of various extract from hexane extract of *Ticlea nobilis* in rodents. Natural Product Science, 2001; 7: 76-82.