



EFFECT OF *CURCUMA ANGUSTIFOLIA* RHIZOME POWDER ON INTESTINAL MOTILITY AGAINST CASTOR OIL INDUCED DIARRHEA IN RATS

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ABSTRACT

Curcuma angustifolia (CA) rhizome powder is used traditionally as diet during the episodes of diarrhea in developing countries. Objective of the present study is to evaluate the efficacy of the CA rhizome powder to decrease intestinal motility in castor oil induced diarrhea in albino rats. Five groups of animals, Control group, Standard group, Test I, Test II and Test III groups were used for the study. Diarrhea was induced in by oral administration of castor oil (2 ml/kg body wt.) to all the rats of all five groups. Drug administration to each group was done as follows; Control group-sterile water, Standard group- Tab. Loperamide (3mg/kg b.wt.), Test I- 200 mg/Kg b.wt CA rhizome powder, Test II- 400 mg/Kg b.wt CA rhizome powder, Test III- 600 mg/Kg b.wt CA rhizome powder. Parameters studied were ,1.Number of loose stools, 2.Percentage inhibition of castor-oil induced diarrhea and 3.Distance traveled by the charcoal marker in the intestine.The data were analysed by one way ANOVA followed by Bonferroni's post hoc test using SPSS 16.0. Results shows that the castor oil induced increased intestinal motility was significantly inhibited ($p < 0.05$) in the Test III group when compared to control group.This study substantiate the use of CA rhizome powder as dietary supplement in conditions of gastro- intestinal irritability

KEY WORDS: *Curcuma angustifolia*, Intestinal motility, loose stools, castor oil.



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INTRODUCTION

Increase in intestinal motility is a common problem faced by majority of the people all over the world in various conditions like food poisoning, infectious diarrhoea, dysentery, irritable bowel disease.¹ In such people, loose or liquid bowel occurs three or more times per day.² Irritable bowel causes malnourishment due to decreasing intestinal absorption. Diarrhoea is the leading causes of death in developing countries especially among children. In modern science increase in intestinal motility is a symptom in many of gastrointestinal disorders but in traditional practices such as in Ayurveda, condition diarrhoea is considered as separate disease entity.³ Since ancient times, different plants with medicinal values have been administered orally in the form of extractions to deal with altered bowel conditions. Even now people living in rural areas depend on traditional medicine and folk medicines to treat many ailments including diarrhoea. *Curcuma angustifolia* (CA) (Family: Zingiberaceae), is a perennial plant that distributes over Central Himalaya, Bihar, West Bengal, Maharashtra and South India. It is known as the East Indian Arrowroot in English.⁴ Studies have proved that the aqueous extract leaves of this herb is having antimicrobial property against *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albican* and *Candida non-albican*.⁵ It also contains 27.07% of starch and volatile oils.⁶⁻⁷ According to ancient Indian literatures rhizome powder of *Curcuma angustifolia* is nutritive value.⁸ It is non-irritating diet in certain chronic diseases such as convalescence from fever, in irritations of the alimentary canal, pulmonary organs, or of the urinary apparatus. It is well suited for infants to supply the place of breast-milk or for a short time after having weaned them.⁸ It may be given in the form of jelly, variously seasoned with sugar, lemon-juice, fruit jellies, essences, or aromatics. Its jelly has no particular taste, and is less liable to become acid in the stomach, and is generally preferred by young infants. This rhizome powder is the main ingredient in biscuits, cakes, pudding, jellies and face powder. The rhizomes are used externally as well as internally. It may also promote healing of stomach ulcers. It internally benefits in diarrhoea, dysentery, colitis.⁹⁻¹¹ But no scientific data available to prove the effect of *Curcuma angustifolia* (CA) rhizome powder on intestinal motility. We hypothesize that *Curcuma angustifolia* (CA) rhizome powder has the property of decreasing intestinal motility

OBJECTIVES

To evaluate the effect of the *Curcuma angustifolia* (CA) rhizome powder administration on intestinal motility in castor oil induced diarrhoea in albino rats.

MATERIALS AND METHODS

Experimental animals

Inbred male albino rats of Wistar strain weighing between 150- 200 gm were used for the study. The experimental protocol was approved by Institutional Animal Ethics Committee (IAEC/KMC/97/2011-2012) and animals were maintained under standard environmental condition of temperature 23±2C, humidity

50± 5% and 10 -14 hours light and dark cycle respectively in an animal house approved by Committee for Purpose of Control and Supervision on Experiments on Animals. The animals were provided with standard rat feed and water ad libitum.

STUDY DESIGN

Animals were divided into five groups and each group was containing 6 rats. All the rats of all five groups were administered with castor oil at a dose of 2ml to induce diarrhoea

Groups and treatment administered

Control: (administered with sterile water)

Standard: (Tab. Loperamide 3mg/kg b.wt)¹²

Test I: (CA rhizome powder 200mg/ kg b.wt)

Test II: (CA rhizome powder 400mg/ kg b.wt)

Test III: (CA rhizome powder 600mg/ kg b.wt)

Sources for the drugs administered in the study

Castor oil, Tab. Loperamide, ORS powder were purchased from drug house Manipal and *Curcuma angustifolia* rhizome powder (commercially available) was used. Dosage of CA root powder was decided after acute toxicity study. All the drugs were administered orally.

Acute toxicity study (LD₅₀)

Different doses of CA root powder from 100 to 1500 mg/kg body wt, were administered by oral route to groups of albino rats. After 24 h mortality rate was recorded. Rats were observed for fourteen days keeping them with their regular feed and water. No deaths or behavioural change were observed for a period of 14 days.¹³ Toxicity studies conducted as per internationally accepted protocol drawn under OECD No 420 guidelines

Preparation of sample solution

Preparation was done based on folk practices. Rhizome powder was dissolved in sterile water (hot water) to get different doses of 200,400,600mg/kg b. wt and thick past was prepared. Rats were fed once the paste was cooled

CASTOR OIL INDUCED DIARRHEA MODEL

Rats were fasted for 18 h but allowed free access of water. With the help of intra-gastric feeding needle, Castor oil at a dose of 2ml was administered orally to all five groups of animals for the induction of diarrhoea. 30 minutes later Control group was administered with sterile water, Standard group was administered with standard drug Loperamide (3 mg/kg b.wt), Test I, Test II, Test III were received CA rhizome powder at doses of 200,400, 600mg/kg b.wt. CA powder was mixed with hot sterile water and was fed to the animals after cooling. Animals of all groups were then placed separately in individual cages lined with filter paper and observed for 6 hours. The total number of dry and wet faeces excreted was recorded within a period of six hour. The results were compared between test and control groups. After completion of the procedure all the rats were supplemented with ORS to prevent dehydration.

Percentage inhibition of Castor-oil induced diarrhoea

Percentage of inhibition of diarrhoea was calculated by considering total number of diarrheal faeces of the control group as 100%.¹³⁻¹⁴

$$\% \text{ inhibition of diarrhoea} = \frac{\text{Mean no. of defecation caused by castor oil} - \text{Mean no. of defecation after drug was given}}{\text{Mean no. of defecation caused by castor oil}} \times 100\%$$

Gastrointestinal motility test (small intestinal transit)

This test was performed according to the method described in past studies using charcoal as a diet marker. Animals were divided into five groups of six rats in each and fasted for 18 h before test. All groups received castor oil to produce loose stools. After 30 minutes, Control group received sterile water 2mL/kg body weight, orally); Standard group received standard drug Loperamide 3 mg/kg b.wt, orally and Test I, Test II, Test III received three different doses, 200 mg/kg b. wt., 400mg/Kg b.wt,600mg/Kg b.wt of CA rhizome powder. After 1 hour of drug administration, all animals received 1 mL of charcoal meal (10% charcoal suspension in 5% gum acacia) orally. One hour later, all animals were sacrificed, and the distance covered by the charcoal meal in the intestine from the pylorus to the caecum was measured and expressed as percentage of distance moved.¹⁵

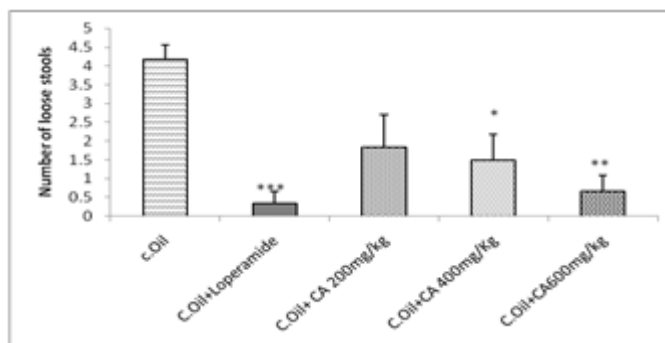
Statistical analysis

Data was analysed by one way ANOVA followed by Bonferroni's post hoc test using SPSS, p<0.05 was considered as significant. Results were expressed as Mean ± SD.

RESULTS

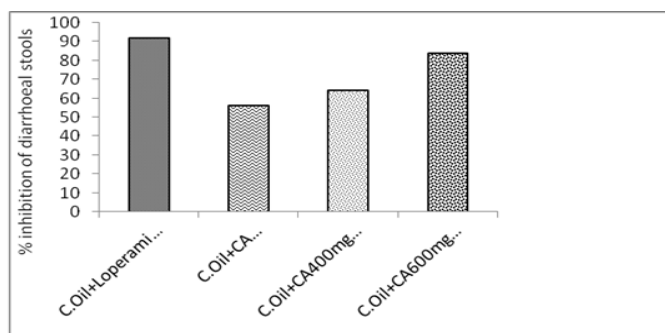
After administration of castor oil, diarrhoea was clinically apparent in all the animals of control group, for the next 6hrs. Number of loose stools were markedly reduced (p<0.001) in Loperamide (3mg/kg p.o) treated group. A reduction (p<0.05) in the number of defecations over six hours was also achieved with CA rhizome powder at the dose of 200 mg/kg b.wt. Significant decrease (p<0.01) in number of defecation at the dosage of 400mg and 600mg/kg b.wt was seen.

Graph 1
Number of loose stools collected from each group



[n=6, p<0.05 significant. (C.Oil group refers to castor oil administered to control group), C.Oil vs C.Oil+Loperamide ***p<0.001, C.Oil vs C.Oil + CA 400mg/kg * p<0.05, C.Oil vs C.Oil+CA 600mg/kg **p<0.01]

Graph 2
Percentage inhibition of diarrheal stools



[n=6, (C.Oil refers to castor oil) percentage inhibition was more in C.Oil+Loperamide and C.Oil+CA600mg/kg, Percentage inhibition in control group is zero]

When we compared the percentage inhibition, we observed the inhibition for motility of small intestine was significantly more in Loperamide treated group and Test group III 600mg/kg b. wt CA rhizome powder treated group.

Graph 3
Effect of CA rhizome powder on small intestinal transit

Groups		Total length of intestine(cm)	Distance travelled by the marker(cm)
Control	C. Oil+ Distilled water	100.33 ± 2.1	95 ± 4.06
Standard	C. oil+ Loperamide	99.10 ± 1.1	39.33 ± 2.5***
Test I	C.Oil + CA rhizome powder 200mg/kg	98.21± 3.3	68.83± 5.7
Test II	C.Oil + CA rhizome powder 400mg/kg	99.33 ± 2.0	60.33 ± 3.3
Test III	C.Oil + CA rhizome powder 600mg/kg	98.24 ± 1.1	49 ± 5.6**

[n=6, (C.Oil refers to castor oil), p<0.05 is significant. C.Oil vs C.Oil+Loperamide
***p<0.001, C.Oil vs C.Oil+ CA 600mg/kg ** p<0.01]

When we observed for the distance travelled by the marker, it was significantly shorter in distance ($p < 0.001$), in Loperamide treated group when compared to control group also significant decrease ($p < 0.01$) in distance was also found in 600 mg/kg CA rhizome powder treated group was observed when compared to control group

DISCUSSION

Bowel irritability causes imbalance between absorption and secretory functions in the intestine. It causes loss of fluid through by passing loose stools and leads to dehydration, electrolyte disturbances, salt imbalance which can lead to malnourishment and death.¹⁶ To prevent the complications faced by the people following bowel irritability or after diarrhoea, the investigations were undertaken for more effective agents with lesser side effect. This will be an important field of active research. In the present study CA rhizome powder use to treat irritable bowels based on traditional methods. The results of this study proves that CA rhizome powder decreases the number loose stools at the dosage of 200mg and 400mg/ kg body weight and best results are shown in 600mg/kg body weight when compared to that of other two groups. This shows that CA rhizome powder probably inhibits the mechanisms due to which castor induces bowel irritability. Castor oil induces diarrhoea due to various mechanisms. It is proved that the castor oil contains Ricinoleic acid which stimulates peristaltic activity by releasing endogenous prostaglandin.¹⁷ Castor oil causes changes in the electrolyte permeability of the intestinal mucosa. It also inhibits Na, K⁺ ATPase pump activity, preventing the reabsorption of water but exact mechanism due to which castor oil induce diarrhoea is yet to be studied.¹⁸⁻²⁰ CA

REFERENCES

1. Camilleri M, Malagelada JR. Abnormal intestinal motility in diabetics with the gastroparesis syndrome. Euro j of cli inv.1984 Dec; 14(6):420-27.
2. World Health Organisation. Dialogue on diarrhoea.1995.
3. Basu BD, Kirtikar KR, Basu K. Indian medicinal plants. 2nd ed. Dehra Dun India: Bishen Singh Mahendra Pal Singh; 1991.
4. Joseph B, Mini Priya R. Review on nutritional, medicinal and pharmacological properties of Guava. Int J Pharma Bio Sci. 2011; 2(1): 53-69
5. Shukla SK, Sushmitha S, Vijaya K, Mishra SK. In vitro propagation of tikhur (*Curcuma angustifolia*), a starch yielding plant. Indian J. Biotechnol. 2007 Apr;6: 274-76.
6. Doble B, Dwivedi S, Dubey K and Joshi H. Pharmacognostical and antimicrobial activity of leaf of *Curcuma angustifolia*. International journal of drug discovery and herbal research.2011; 1(2):46-9.
7. Srivastava AK, Srivastava SK, Syamsundar KV. Volatile composition of *Curcuma angustifolia* Roxb. rhizome from central and southern India. Flavour Fragr J. 2006 Jan; 21: 423–26.
8. Sharma A. Traditional processing of shotti(*Curcuma angustifolia* Roxb.) - A rhizome based ethnic weaning food; Indian journal of traditional knowledge. 2012 Jan; 11(1): 154-5.
9. Chottopadhyay I, Biswas K, Bandyopadhyay U, Banerjee RK. Turmeric and Curcumin: Biological

rhizome powder decreases intestinal motility by inhibiting any one of the mechanisms of castor oil that induces diarrhoea. CA rhizome powder contains the starch as its major ingredient which can delay the gastric emptying by creating hyperosmolar environment in the intestine. This is possible due to greater inhibitory feedback created by glucose in the duodenum.²¹ It was observed that most of fruits decreases the motility as they are rich in dietary fibers. It could be the same reason as CA rhizome also contains the high in dietary fibers which swelling by absorbing water from intestine and holds the water with it decreases water loss in stools.²² Further studies are required to prove the exact mechanism of action which is responsible for its effect and the active principle that is responsible for in decreasing intestinal motility.

CONCLUSION

This study justifies the wide spread use of CA rhizome powder by the people for the treatment of gastrointestinal irritability and in diseases associated with diarrhoea. Thus, further research is required to study the phytochemicals and mechanism of action to prove the antidiarrheal activity of this plant.

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CONFLICT OF INTEREST

Conflict of interest declared none.

- and medicinal applications. Current science 87(1): 44-53, (2004).
10. Rajeevkumar P, Rajeev R, Anilkumar N. Studies on *Curcuma angustifolia* Starch as a Pharmaceutical Excipient. Int J Pharmtech Res. 2010 Oct; 2(4): 2456-60.
 11. Upwar N, Patel R, Waseem NV. Evaluation of antidiarrheal activity of root of *Clitoria Ternatea* Linn. Int. J Pharm Sci Rev Res. 2010 Jan; 5(1):131-4.
 12. Tripathi KD. Essentials of Medical Pharmacology. 6th ed. India: Jaypee Brothers Medical Pub; 2010.
 13. Ezekwesili CN, Obiora KA, Ugwu O P. Evaluation of Anti-Diarrhoeal Property of Crude Aqueous Extract of *Ocimum gratissimum* L. In Rats. Nigerian Society for Experimental Biology. 2004; 16(2): 122-31.
 14. Rao HJ , Lakshmi P. Anti-diarrhoeal activity of *Ziziphus Jujuba* leaf extract in rats , Int J Pharma Bio Sci, 2012; 3(1) : 532-8
 15. Omodamiro O D, Ibeh R C. Evaluation of antidiarrhoeal activities of leaf and fruit of *Psidium guajava* L. (Myrtaceae) in experimental animal model. Peak Journal of Medicinal Plant Research. 2014 Nov; 2(5): 58-62.
 16. Guerrant RL, Schorling JB, McAuliffe JF, de Souza MA. Diarrhea as a cause and an effect of malnutrition: diarrhea prevents catch-up growth and malnutrition increases diarrhea frequency and duration. Am J Trop Med Hyg. 1992 Jul; 47(1):28-35.
 17. Ammon PJ, Thomas, Philips S. Effects of oleic and ricinoleic acids net jejunal water and electrolyte movement, perfusion studies in man. Journal of Clinical investigation. 1974 Feb; 53: 374- 9.
 18. Watson WC, Gordon R. Studies on the digestion absorption and metabolism of castor oil. Biochem. Pharma. 1962 mar; 11: 229-36.
 19. Galvez J, Zarzuelo A, Crespo ME, Lorente MD, Ocete MA, Jimenez J. Antidiarrhoeal activity of *Euphorbia hirta* extract and isolation of an active flavonoid constituent. Planta Med. 1993 Aug; 59(4): 333- 6.
 20. Pierce NF, Carpenter CCJ, Ellior H, Greenough WB. Effect of prostaglandin, theophyllin and cholera toxin upon transmucosal water and electrolyte movement in canine jejunum. Gastroenterology. 1971 Jan; 60(1): 22-32.
 21. Moukarzel AA, Sabri MT. Gastric Physiology and Functions: Effects of Fruit Juices. J Am Coll Nutr. 1996 Oct; 15(5):18s-25s
 22. Akomolafe RO, Adeosun IO, Ayoka AO, Elujoba AA, Iwalewa EO. An in vitro study of the effects of *Cassia podocarpa* fruit on the intestinal motility of rats. Phytomedicine. 2004 Feb; 11(2-3):49-53