

Possible anti-diarrhoeal effect of the date palm (*Phoenix Dactylifera L*) spathe aqueous extract in rats

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Abstract:

The date palm (*Phoenix Dactylifera L.*) is known to be one of the oldest cultivated tree in the world. Date palm spathe aqueous extract has claimed to have anti-spasmodic activity. Castor oil-induced diarrhoea, enteropooling and gastrointestinal transit test were elucidated in rats. The results show that aqueous extract significantly reduced both castor-oil induced intestinal transit and frequency of diarrhoea effects. However, the extract did not affect castor oil induced intestinal fluid accumulation. Further studies are needed in regard to isolation of the effective components of these extracts and clarification of its pharmacological mechanisms in the future.

1- Introduction:

The date palm (*Phoenix Dactylifera L.*) is known to be one of the oldest cultivated trees in the world. Its fruit has long been used as a staple food for the native population. The non fruit material is also of great value, as for example, the date palm leaf and the leaflets are utilized for fences, mattings, baskets or hard fans. The fibrous tissue surrounding the base of the date palm leaf is a good material for making ropes and fiber for packing (Dowson, 1982). The hard covering (spathe) of the male and female inflorescences is traditionally used by the people of Al-Ahssa, Saudi Arabia as flavoring material for cold and hot drinks because of its characteristic and desirable fragrance. During the pollination season, the hard envelope left behind is cut into small pieces and soaked in drinking water to improve the flavor of water for immediate consumption during summer season. The farmers sometimes boil the wood cuttings in the farm yard for distillation purposes. The liquid distillate obtained is locally known as Maa Al-liqah or Maa Al-Tiltal, water of the spathe. Small private sectors have been started to commercialize the water of the spathe. It is also believed that the distillate has certain medical uses as it relieves

abdominal gases and pain especially after heavy meal and claimed to have anti-spasmodic activity. The objective of this study was to investigate the possible enteropooling, antidiarrhoeal and intestinal transit time effects of the date-palm spathe extract in rats.

2- Materials and methods:

2-1 Plant materials

2-1.1 Preparation of the extract

During the pollination season, the hard envelopes, spathes left behind were directly purchased from local farm. The spathes were cleaned, air dried, cut into small pieces and pulverized into powder with grinder. About 100 g of the powder was packed into thimble and extracted with water in soxhlet apparatus for 3 h. the water extract yield was 10% w/w which was used for pharmacological screening.

2.2. Animals

Male albino rats weighing between 200 and 250 g, obtained from King Saud University, Saudi Arabia, were used. They were housed in wired cages in the animal house at 24 ± 2 °C and relative humidity 44–56%, light and dark cycles of 12 and 12 h, respectively, for 1 week before and during the experiments. Animals were provided with standard rodent pellet diet and water was allowed *ad libitum*. Spathe aqueous extract in an amount of 3 mg, 6 mg and 12 mg were used.

2.3. Drugs

Castor oil, atropine sulphate, charcoal, *Acacia nilotica* (Arabic gum); were obtained from Sigma, USA.

2.4. Pharmacological studies

2.4.1. Castor oil-induced diarrhoea

Five groups of animals (6 rats each) were housed in separate cages having paper placed below for collection of faecal matters. Diarrhoea was induced by oral administration of castor oil (Co; 1 ml/rat, p.o.) (Awouters *et al.*, 1978). Group 1 served as control and received saline (2 ml/kg i.p.). The second group received atropine sulphate (3 mg/kg i.p.) as standard. Groups 3–5 were given the test extract (12, 6 and 3 mg/kg p.o.) 1 hr before Co. The number of both dry and wet droppings was counted every hour

for 4 h. The mean \pm SE of the stool for 4 h of treated groups was compared with that of control group (saline group).

2.4.2. Castor oil-induced enteropooling

Intra-luminal fluid accumulation was determined by the method of Robert et al., (1976). Five groups of 6 animals each fasted overnight were used. Group 1 served as control and was given saline (2 ml/kg i.p.) followed by Co (1ml p.o.) 1h later. The second group was given atropine sulphate (3 mg/kg i.p.) followed by Co. The last three treated groups were given spathe extract (12, 6 and 3 mg/kg p.o.) 1h before Co. After 2 h the rats were sacrificed. The two ends of intestine were tied with thread. The intestine was removed and weighed. The intestinal content was removed by milking. The intestine was reweighed and the difference between full and empty intestine was calculated

2.4.3. Gastrointestinal transit test

Overnight fasted rats (18 h) were divided into five groups (6 rats each). Spathe extracts (12, 6 and 3 mg/kg p.o.), saline (2 ml/kg i.p.), and atropine sulfate (3 mg/kg i.p.) were given 1h before Co. One ml of marker (10% charcoal suspension in 5% gum acacia, Arabic gum) was given orally 1h after Co. The animals were killed by cervical translocation after 1h of marker administration. The distance traveled by charcoal meal from pylorus to caecum was measured. The result was expressed as a percentage of distance traveled by charcoal meal/total distance from pylorus to caecum (Mascolo et al., 1994).

2.5. Data analysis

Results are expressed as mean \pm S.E.M and presence of significant differences among means of the groups was determined using one way ANOVA with a Tukey-Kramer post-test for significance. Values were considered significant when $P < 0.05$.

3- Results:

3.1. Castor oil-induced diarrhoea

Dactylifera L spathe extract significantly ($P < 0.01$) inhibited the mean number of defecation when compared to saline group, and produced a

dose-dependent (19-42%) inhibition of the severity of diarrhoea induced by castor oil was observed (Table 1).

Table (1)

Effect of date palm spathe extract on castor oil induced diarrhoea in rats

Treatment	Dose (mg/kg p.o.)	Mean of defecation	%inhibition of defecation
Saline	2 ml	12.333±0.71	-----
Atropine sulfate (3 mg/kg i.p.)	----	4.8333±0.31***	61
Spathe extract	12	7.1666±0.4***	42
Spathe extract	6	8.3333±0.42***	32
Spathe extract	3	10±1.0	19

Effect of date palm spathe extract on castor oil-induced diarrhoea in rats. Extract was administered 1 h before castor oil administration. Values are expressed as mean ± SEM from the experiment. * $P < 0.01$, *** $P < 0.0001$ when compared with castor oil and saline treated group.

3.2. Castor oil-induced enteropooling

Dactylifera L spathe extract did not show any significant effect on the intestinal fluid accumulation induced by castor oil when compared with the saline control group. Atropine sulfate, the reference drug, gave a better activity, with 26% of suppressive but non significant effect (Table 2).

Table (2)

Effect of *Phoenix Dactylifera L* spathe extract on castor oil induced enteropooling in rats

Treatment	Dose (mg/kg p.o.)	Mean Wt. intestinal content	%inhibition Wt. intestinal content
Saline	2 ml	2.65±0.3	-----
Atropine sulfate (3 mg/kg i.p.)	----	1.96±0.15	26
Spathe extract	12	2.15±0.12	19
Spathe extract	6	2.45±0.62	7
Spathe extract	3	2.33±0.2	12.2

Effect of date palm spathe extract on castor oil-induced enteropooling in rats. Extract was administered orally 1 h before castor oil administration. Values are expressed as mean ± SEM from the experiments.

3.3. Gastrointestinal transit effect

Phoenix Dactylifera L spathe extract significantly ($P<0.01$) decreased the distance traveled by marker and consequently the percentage of intestinal transit in a dose dependent manner. The three doses of the extract (3, 6, 12 mg/kg) produced 75.32 ± 2.11 , 68.57 ± 3.94 and $54.27\pm 3.54\%$ intestinal transit induced by castor oil, respectively. However, atropine (3 mg/kg, i.p.) exhibited much more marked reduction ($28.64\pm 4.84\%$).

Table (3)

Effect of *Phoenix Dactylifera L* extract on castor oil induced small intestine transit in rats

treatment	Dose (mg/kg p.o.)	Total length of intestine (cm)	Distance traveled by marker (cm)	%intestinal transit
Saline	2 ml	119+0.89	109.66±3.23	92.16±2.61
Atropine sulfate (3 mg/kg i.p.)	----	122.2+5.85	35.6±7.03***	28.64±4.84***
Spathe extract	12	126.14+1.7	66.86±3.54***	54.27±3.54***
Spathe extract	6	119.16+0.83	81.66±4.59***	68.57±3.94***
Spathe extract	3	119.5+0.96	90.0±2.58*	75.32±2.11**

Effect of date palm spathe extract on castor oil-induced small intestine transit in rats. Extract was administered 1 h before castor oil administration. Values are expressed as mean \pm SEM from the experiments. * $P<0.01$, ** $P<0.001$, *** $P<0.0001$ when compared with castor oil and saline treated group.

4- Discussion

The aim of the present study was to assess the effect of an aqueous extract of *Phoenix Dactylifera L* spathe against diarrhoea using experimental diarrhoea models in rats.

The present results show that *Phoenix Dactylifera L* spathe aqueous extract produced a statistically significant reduction in both Co induced intestinal transit and frequency of diarrhoea effects in rat. Consistent with

atropine, It was noted that the extract did not affect castor oil induced intestinal fluid accumulation and the volume of intestinal content.

In this study, atropine and the extract produced a significant reduction in the mean number of defecation and increased intestinal transit time possibly due to its anti-cholinergic effect (Brown and Taylor, 2000). However, they did not inhibit castor oil induced enteropooling. This may suggested that mediators other than acetylcholine are involved in castor oil induced enteropooling. It was suggested that Castor oil and its active metabolite ricinoleic acid produce diarrhoea by diminishing intestinal sodium and cholride absorption (Gaginella and Phillips, 1975; Luderer *et al.*, 1980). An increase in intestinal transit time with atropine could also result from reduction in gastric emptying (Izzo *et al.*, 1999a. 1999b).

The results of this study reveal that the aqueous sapthe extract of *Phoenix Dactylifera L* contains pharmacologically active substance(s) with antidiarrhoeal properties. These properties may explain the rational for the effective use of the plant as an antidiarrhoeal agent in traditional medicine. Further study, however, is necessary to isolate and identify the active ingredients of spathe and their precise mechanism of action.

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References:

1. Awouters, F., Niemegeers, C.J.E., Lenaerts, F.M., Janseen, P.A.J., (1978) Delay of castor oil diarrhoea in rats; a new way to evaluate inhibitors of prostaglandin biosynthesis. *J. Pharma. Pharmacol.*, 30:41-45
2. Brown J.A. and Taylor, P., (2000) Muscarinic receptor agonists and antagonist. In: Hardman, J.G., Limbird, L.E., (Eds), *Goodman and Gilman's The pharmacological Basis of therapeutics 10th Edition*, MacGraw Hill, New York, pp 115-158
3. Dowson, V.H.W. (1982) Date production and protection. UN-FAO Plant Production and Protection Paper 35. Rome.
4. Gaginella TS, Phillips SF. (1975) Ricinoleic acid: current view of an ancient oil. *Digestive Diseases*; 20:1171-1177
5. Izzo, A.A., Mascolo, N., Capasso, R., Germano, M.P., DePasquel, R., Capasso, F., (1999a) Inhibitory effect of cannabinoid agonists on gastric emptying in the rat, *Arch. Pharmacol.*, 360:221-223
6. Izzo, A.A., Mascolo, N., Pinto, L., Capasso, R., Capasso, F., (1999b) The role of cannabinoid receptors in intestinal motility, defecation and diarrhoea in rats. *Eur. J. Pharmacol.* 384, 37e42.
7. Luderer, J. R. Dermers, L. M., Nomides, C. T. and Hayes, A. H. (1980). Mechanism of action of castor oil: a biochemical link to the prostaglandins. In *Advances in Prostaglandin and Thrombosane Research*, Vol. 8, ed. by B. Samuelsson, P. W. Ramwell and R. Paoletti, Raven Press, New York pp 1633-1635.
8. Mascolo, N., Izzo, A.A., Avtore, G., Barboto, F., Capasso, F., (1994) Nitric oxide and castor oil induced diarrhoea, *J. Pharmacol. Exp. Therap.*, 268: 291-295,
9. Robert A., Nezamis, J.E., Lancaster, C., Hanchar, A.J., Klepper, M.S., (1976) Enteropooling assay; a test for diarrhoea produced by prostaglandins, *Prostaglandins*, 11:809-828,

إمكانية منع الإسهال في الفئران بعد حقن المستخلص المائي لأغاريض نخيل التمر

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الملخص :

تعتبر شجرة نخيل التمر من أقدم الأشجار زراعة في العالم. هناك عرف شائع بين الناس والعطارين ان المستخلص المائي لأغاريض النخيل له فوائد في علاج المغص والإسهال. ولتوضيح صحة هذه الادعاءات العلاجية عملت دراسة لبيان تأثير ماء اللقاح علي الجرذان المعالجة بزيت الخروع حيث يمتلك القدرة علي العمل كمسهل ويزيد من الحركة الدودية و كمية السوائل في الأمعاء وهذا مثبت علميا. وبعد إجراء التجارب تبين من نتائج الدراسة أن ماء اللقاح له نتائج ايجابية في التقليل من حدة الإسهال والحركة الدودية للأمعاء. حيث قلل ماء اللقاح إحصائيا وبشكل معنوي من حدة الإسهال والحركة الدودية للأمعاء وهذا يؤيد رأي العطارين ويسنده لكن لم يكن له تأثير علي زيادة كمية السوائل في الأمعاء. تعتبر هذه الدراسة مبدئية وتحتاج إلي دراسات أخرى للتعرف علي المركبات الكيميائية التي يحتوي عليها ماء اللقاح وتأثيرها الدوائي.