Laxative Activity of Spray Dried Aqueous Seed Extract of *Linum usitatissimum* (Linaceae)

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Summary

Aqueous extract of *Linum usitatissimum* Linn, (Linaceae) was evaluated for laxative activity in rats at three dose levels (12.5, 25, 50 mg/kg). Healthy Wister rats were divided into 4 groups of 6 animals each. First group served as control, second group served as standard (*Senna*) while 3 and 4 groups were treated with aqueous extract of *Linum usitatissimum* (12.5 and 25 mg/kg body weight) respectively. The laxative activity was determined based on the weight of the faecal matter at time interval of 8 and 16th h. Gastrointestinal motility was studied by using charcoal meal method. Both the studies showed increase in laxative activity and gastrointestinal motility at 25 mg/kg dose of *L. usitatissimum.*

Key words: *Linum usitatissimum,* Laxative activity, *Senna,* Gastrointestinal motility

Introduction

Constipation is defined as a condition of the bowels in which the feces are dry and hard, making evacuation difficult and infrequent (1). Constipation is a common symptom, and as many as one in eight people take laxatives at least once each month (2,3). Constipation may be idiopathic or may be caused by various identifiable disease processes (4).

Laxatives are agents that add bulk to intestinal contents, which retain water within the bowel lumen by virtue of their osmotic effect, or that stimulate intestinal secretion or motility, thereby, increasing the frequency and ease of defecation (4). Many types of laxatives have been developed, including bulking agents such psyllium and dietary fiber; osmotic agents such as magnesium sulfate and sorbitol; stimulants such as decussates, bisacodyl and anthraquinone; lubricating agents such as mineral oil. Extracts from the roots, bark and dried leaves of buckthorn, Senna, cascara, aloe, frangula and rhubarb contain anthraquinone derivatives, and are used as herbal laxative preparations (5).

Linum usitatissimum Linn belongs family Linaceae; enjoy a wide reputation worldwide for their variety of medicinal uses. It is an annual herb native to Egypt, cultivated worldwide, particularly in India, Bengal, Bihar (6,7). Therapeutic uses of the seeds of *L. usitatisisimum* (Linseed) can be traced back to ancient Roman medicine. Pliny the Elder cited 30 remedies using flax seed, including mild laxative and a poultice topically for local inflammation (8). Linseed is bulk forming laxatives and demulcent (9) and antidiabetic agent (10). The seeds are official in the Chinese pharmacopoeia for constipation and dry itching of skin (11). Flaxseeds are used for inflammation, abscesses as a poultice and in relief of pain in American conventional medicine (12), and as an emollient in modern veterinary medicine (13). In Germany whole or freshly crushed Flax seeds are used as laxative internally and externally as a hot moist cataplasm or poultice to reduce inflammation (14). Though in United States, it is used in the same way as in Germany, the American consumers are more inclined to take flaxseed as a component of health foods or neutraceutical products (15). In India, traditionally the seeds are used as cardiotonic, diuretic, laxative and anti-gonorrheal, etc., oil of the seeds finds its use in veterinary practice as a laxative for horses and cattle (16).The Ayurvedic pharmacopoeia specially approves its external uses as poultice for boils and buncles and its internal use as a demulcent and laxative (17). The reported chemical

constituents are omega-3- fatty acid, which is useful in inflammation and autoimmune diseases (18). In spite of rich traditional and ethnomedicinal evidences in support of laxative activity of linseed, no scientific proof is available to substantiate the claim. The laxative activity was therefore undertaken to study the effect of aqueous extract of linseed.

Materials and Methods

Plant material:

The dried seeds of *L. usitatissimum* were purchased from Abhirami Botanicals, Trissur Kerala (India), and were authenticated by Dr. Rajan, Botanist, Government Arts College, Ootacamund, Tamilnadu.

Preparation of extract:

The seed of *L. usitatissimum* (2 kg) were coarsely powdered and extracted in a pilot scale extraction unit (Sieco Engineers Pvt., L.t.d) using water as a solvent and the aqueous extract was filtered and filtrate was concentrated under low pressure using pilot scale concentrator (Sieco Engineers). The concentrated extract was spray dried at 160 °C inlet and 90 °C outlet temperature using 1.5-µ pressure automizer (Hemraj Enterprises, Mumbai).

Animals:

Wister rats weighing about 150-200 g Swiss albino mice weighing 20-25 g of either sex were acclimatized to the experimental room temperature 23 ± 2 °C, controlled humidity conditions (50-55%) and 12 h light and12 h dark cycle. They were caged with a maximum of two animals in each polypropylene cage and were fed with standard food pellets (Kamadenu Enterprises, Bangalore) and water *ad libitum*. The study was conducted after obtaining ethical committee clearance from the institutional animal ethical committee.

Toxicity studies

A limit test at one dose level of 2000 mg/kg body weight of ethanol extract of *I. obscura* was administered orally to three mice and the animals were observed for 6 h continuously for behavioral changes and thereafter daily for 14 days for mortality (3).

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Laxative activity:

The laxative activity was performed according to Capasso et al. (14,15), on rats of either sex, fasted for 12 h before the experiment, but with water provided *ad libitum.* The animals were divided into 5 groups of six animals each. The first group of animals, serving as control, received normal saline (25 ml/kg); the second group serving as reference, received aqueous extract of *Senna* (30 mg/kg) while third, fourth and fifth groups received aqueous extract of seeds of *L. usitatissimum* at doses of 12.5, 25 and 50 mg/kg respectively. Immediately after administration of dose, the animals were isolated and housed separately in polypropylene cages suitable for collection of feces. After 8 h of drug administration the feces were collected and weighed. Thereafter, food and water were given to all animals and faecal outputs were again weighed after a period of 16h.

Gastrointestinal motility:

The test was performed according Akah et al. 1998 (16), with slight modification in mice. The animals were fasted for 24 h prior to the experiment, but water provided *ad libitum*. The animals were divided into three groups of six animals each. The first group received normal saline (0.1 ml/kg), while second and third groups received aqueous extracts of Senna (30 mg/kg) and linseed (25 mg/kg) orally. After 40 min, 0.2 ml of 10 % charcoal suspension in 5% acacia solution was administered to each animal orally. The animals were sacrificed after 20 min of administration of charcoal meal, and abdomen was cut opened. The small intestines were dissected out and placed on a clean surface. The distance traveled by the charcoal meal from the pylorus end was measured along with the entire length of the small intestine. The percentage distance traveled by the charcoal meal along the small intestine was then estimated for the extract, control and the standard.

Statistical analysis:

The Data were expressed as mean±SEM. The differences were compared using one-way ANOVA followed by Dunnett's test using PRISM software (version 4). The results were considered significant when $p<0.05$.

Results

Acute toxicity studies:

The oral administration of spray dried aqueous extract of *L. usitatissimum* caused neither any behavioral changes nor mortality up to 2000 mg/kg. So the LD_{50} of *L. usitatissimum* was thus found to be more than 2000 mg/kg.

Laxative activity:

The laxative activity of *L. usitatissimum* is shown in table 1. *L. usitatissimum* at 25 mg/kg showing significant laxative activity compared 12.5 and 50 mg/kg dose. At 25 mg/kg increases faecal output than 50 mg/kg. The effect was comparable with reference standard (*Senna*).

Table 1: Laxative activity of spray dried aqueous extract of *L. usitatissimum* in rats

Treatment	Dose (mg/kg p.o)	Mean length of gastrointestinal tract	Mean distance traveled by marker	Percentage Distance traveled
Control	-	45.3 ±1.8	23.5±1.1	52.0±2.6
Senna	30	45.52±1.73	32.35±1.37	71.7±4.6**
L. usitatissimum	25	48.2±1.48	32.6±2.29	67.6±2.8*

Mean±. S.E.M. (n=6), **P<0.01 Vs control (Normal saline), Dunnett's test

Gastrointestinal motility:

L. usitatissimum 25 mg/kg dose was selected for the study of gastrointestinal motility in mice. The result of spray-dried extract of linseed is shown in table 2. Results indicate significant effect *L. usitatissimum* (25 mg/kg) on gastrointestinal motility. The results were comparable with standard (*Senna*).

Table 2: Effect of spray dried aqueous extract of *L. usitatissimum* on gastrointestinal motility in mice

Treatment	Dose	Faecal out put (gm)	
	(mg/kg, p.o)	8h	8-16 h
Control	-	0.0866± 0.054	1.168± 0.0019
Senna	30	0.934 ± 0.10**	1.86 ±0.060**
L. usitatissimum	12.5	0.267 ±0.01	1.05±0.058**
	25	1.06 ±0.04**	1.68 ±0.054**
	50	0.681±0.043**	1.34±0.039**

Mean±. S.E.M.; (n=6); *P<0.05, **P<0.01 as compared with control (Normal saline) Dunnett's test

Discussion

When spray dried extract of *L. usitatissimum* 25 mg/kg of body weight was produced a similar response as that of *Senna*. Suggesting that linseed also induced laxation at dose of gastrointestinal motility was assessed by calculating the percentage of distance traveled by charcoal meal through small intestine after administration of extracts. The intestinal motility is stimulated because of irritant action of sennosides present in Senna thereby justifying action of *Senna* motility. The spray dried extract of *L. usitatissimum* at 25 mg/kg body weight also showed similar and comparable motility as that of *Senna*. The mechanism of action for this activity of *L. usitatissimum* extract is not clear. However linseed being a known bulk forming drug due its mucilage content might have induced peristalsis due stretching refluxes.

Senna known laxative, contain anthraquinone glycoside sennoside (A, B, C and D), which are gastric irritants (17). Upon administration to healthy rats induced laxation. Thus it may be concluded that spray dried Linseed extract is better alternative. The possible mechanism of action of linseed may be, by the retention of intraluminal fluid (17), as the extract forms fine hydrophilic colloid. Linseed is mucilaginous drug containing 3 – 10 % of mucilage (18). The aqueous extract was also rich in mucilage, which may be responsible for laxation. Since mucilage forms a protective layer on intestinal mucous, the mucous membrane protected.

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