Proceeding S.Z.P.G.M.I. Vol: 24(2): pp. 97-102, 2010.

Evaluation of Anti-inflammatory Activity of *Mucuna pruriens* Linn. Seeds

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ABSTRACT

Inflammation is associated with pathophysiology of various clinical conditions like arthritis, gout and cancer. Numbers of drugs are being used to treat inflammation but they are partly effective and have significant adverse effect profile. *Mucuna pruriens* is traditionally used to relieve fever, pain and inflammation. **Purpose of the study:** To evaluate the anti-inflammatory activity of Mucuna pruriens Linn. seed powder. **Materials and Methods**: This study has been carried out in five groups of albino mice, having eight animals each. Three different doses of Mucuna pruriens Linn seed powder has been given to three groups and anti-inflammatory activity has been compared with the other two groups, standard and control. Carrageenan-induced paw edema has been used to evaluate the anti-inflammatory activity and decrease in paw edema after 1-, 2-, 3-, and 4-hours have been interpreted as anti-inflammatory activity. **Results**: Mucuna pruriens Linn seed powder showed significant anti-inflammatory activity in all three groups as depicted by decrease in edema after 1-, 2-, 3-, and 4-hours ($p < 0.05$).**Conclusion**: Mucuna pruriens seed powder showed significant anti-inflammatory activity in all three groups of mice and activity increases with increasing the dose of seed powder.

Key words: Mucuna pruriens Linn., Anti-inflammatory drugs, Carrageenan-induced paw edema.

INTRODUCTION

Inflammation is a complex process that occurs as a response to trauma, heat, chemicals, bacteria or other phenomenon and is mediated by a variety of electrically charged signal molecules produced locally by mast cells, nerve endings and platelets[1]. Inflammation is characterized by heat, redness, swelling, pain and loss of function. Although inflammation is a part of defense mechanism of body but it has the potential to become harmful and uncontrolled at times like in rheumatoid arthritis and many other autoimmune inflammatory conditions.

Currently the drugs like NSAIDS, corticosteroids, immunosuppressive agents and opioids have been used to control the symptoms of inflammation and pain. The use of these drugs will produce certain side effects like respiratory depression, sedation, constipation, tolerance, spasm, gastrointestinal disturbances, renal and hepatic damage, bone marrow depression, suppression of response to infection or injury, osteoporosis and development of cushing's syndrome etc.[2]. In addition to this unfavorable side effect profile, efficacy of these drugs is partial as well. Therefore, the development of newer and more powerful anti-inflammatory drugs with lesser side effects is necessary[3]. The research into plants with alleged folkloric use as pain reliever anti-inflammatory agents should therefore be viewed as a fruitful and logical strategy in the search for new analgesic and anti-inflammatory drugs[4].

Many medicines of plant origin had been used since long time without adverse effects. It is therefore essential that effort should be made to introduce new medicinal plants to develop cheaper

drugs. Plants still represent a large untapped source of structurally novel compounds that might serve as lead for the development of novel drugs.

Mucuna pruriens is plant of family Leguminoseae[5]. Traditionally Mucuna had been used in painful conditions, fever, dysmennorrhea and joint inflammations. Reviewing the accumulated data, especially pertaining to its anti-inflammatory action, no study has been documented so far. So to evaluate its role the present study has been conducted.

Purpose of the study

To evaluate the anti-inflammatory activity of Mucuna pruriens Linn. Seeds and to note any adverse effects of the plant.

MATERIALS AND METHODS

Materials required:

a. Seeds of Mucuna pruriens Linn. have been purchased from a herbal dealer in Faisalabad. The plant seeds have been identified and authenticated from the Herbarium maintained by the department of Botany, University of Agriculture, Faisalabad. They have been kept at normal room temperature.
b. Aspirin (Manufactured by RECKITT BENCKISER, Pakistan Ltd.) purchased from local pharmacy.
c. Carrageenan (Manufactured by Sigma, USA) purchased from local scientific store.
1. **Animals required:** Wister albino mice of either sex weighing 20-25 gm have been used. Total 40 animals have been used. They have been housed in standard polypropylene cages and kept under controlled room temperature (25+10°C; relative humidity 60-70%) and fed with standard laboratory diet with water ad libitum.

Grouping and Drug Administration

Forty animals have been divided in 5 groups. Group I (control) received gum tragacanth solution (1 ml/kg/p.o.). Group II (standard) got Aspirin 100mg/kg/p.o. Group III, IV and V received 1, 2 and 3 gm seed powder per kg/p.o.

Anti-inflammatory activity

Carrageenan-induced mice paw edema

Three different doses of seed powder have been given to the Group III, IV and V and animals of Group I got gum tragacanth solution while of Group II have got Aspirin. One hour later, the anti-inflammatory activity has been determined by using Carrageenan-induced paw edema[6,7]. Fifty microlitres of 1% suspension of Carrageenan in saline has been prepared and injected into the plantar surface of the right hind paw of mice and site of injection has been marked. Antero-posterior diameter of the paw has been measured immediately after the injection of Carrageenan and after 1-, 2-, 3, and 4- hours intervals by Vernier calipers at the marked sites. The difference between the basal value and that measured at different time intervals has been noted in millimeters and this difference has been recorded as amount of edema (inflammation) developed after Carrageenan injection.

Adverse effects

The animals have been observed for any change in their dietary intake, motor activity and any change in awareness for a period of week.

Statistical analysis

Duncan's multiple range test (ANOVA) at $P < 0.05$ has been used.

RESULTS

To determine the anti-inflammatory activity, the antero-posterior diameter of paw has been measured in mm just after the Carrageenan injection (basal value). The development of edema has been calculated by measuring the difference between the antero-posterior diameter of paw after 1-, 2-, 3-, and 4-hours from the basal value of that animal.

DISCUSSION

Inflammation is associated with patho-physiology of various clinical conditions like arthritis, gout, muscular pain cancer and vascular diseases. A number of drugs and natural products are being used to treat relief of symptoms from

Table 1: Edema development (mm) in mice after 1 hour.

No. of animal	Group I (Control)	Group II (Standard)	Group III (seeds1g/kg)	Group IV (seeds 2g/kg)	Group V (seeds 3 g/kg)
1	0.65	0.2	0.55	0.45	0.45
2	0.75	0.1	0.5	0.5	0.45
3	0.55	0.2	0.6	0.6	0.2
4	0.7	0.2	0.7	0.45	0.25
5	0.7	0.15	0.45	0,45	0.5
6	0.6	0.25	0.5	0.65	0.5
7	0.75	0.2	0.65	0.45	0.55
8	0.7	0.2	0.55	0.5	0.15

Table 2: Edema development (mm) in mice after 2 hours.

No. of animal	Group I (Control)	Group II (Standard)	Group III (seeds1g/kg)	Group IV (seeds2g/kg)	Group V (seeds3g/kg)
1	1.3	0.35	1.05	0.8	0.8
2	1.4	0.3	0.9	0.9	0.9
3	1.25	0.4	1.1	1.1	0.45
4	1.35	0.35	1.15	0.8	0.45
5	1.1	0.4	0.8	0.6	0.6
6	1.3	0.5	1.1	0.8	0.80
7	1.3	0.35	1.05	0.8	1
8	1.3	0.45	0.8	0.95	0.3

Table 3: Edema development (mm) in mice after 3 hours.

No. of animal	Group I (Control)	Group II (Standard)	Group III (seeds1g/kg)	Group IV (seeds2g/kg)	Group V (seeds3g/kg)
1	1.85	0.65	1.3	1.15	0.9
2	2	0.45	1.15	1.2	0.95
3	1.8	0.45	1.4	1.3	0.8
4	1.6	0.6	1.5	0.9	0.8
5	1.85	0.6	1.15	0.85	1
6	2.05	0.7	1.5	1.15	1.2
7	1.85	0.6	1.3	1.15	1.35
8	1.85	0.6	1.15	1.5	0.45

Table 4: Edema development (mm) in mice after 4 hours.

No. of animal	Group I (Control)	Group II (Standard)	Group III (seeds1g/kg)	Group IV (seeds2g/kg)	Group V (seeds3g/kg)
1	2.1	0.75	1.35	1.2	0.95
2	2.15	0.6	1.15	1.35	1.05
3	2	0.65	1.65	1.5	0.85
4	1.95	0.8	1.7	0.95	1
5	1.9	0.75	1.2	0.9	1.15
6	2.1	0.85	1.65	1.25	1.4
7	1.85	0.8	1.45	1.35	1.55
8	2.1	0.8	1.15	1.65	0.7

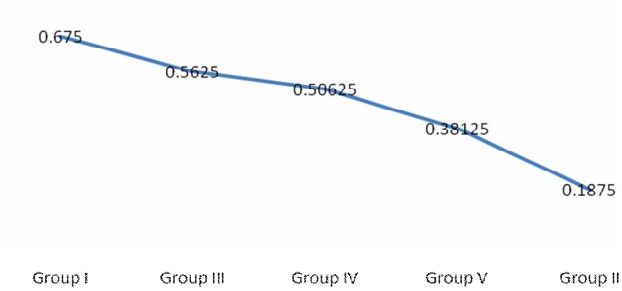

Fig. 1: Mean edema values after 1 hour in all groups of mice.

Table 5: Anti-inflammatory activity of drugs after 1 hour:

Group	Mean edema value (mm) ± S.D*	Comparison
I (control)	0.675 ± 0.07	a
III (seeds 1 g/kg)	0.5625 ± 0.08	b
IV (seeds 2 gm/kg)	0.50625 ± 0.07	b
V (seeds 3 g/kg)	0.38125 ± 0.15	c
II (standard)	0.1875 ± 0.04	d

Standard error (SE) = 0.0315
*Standard deviation
The mean values showing same letters are statistically similar ($P < 0.05$)

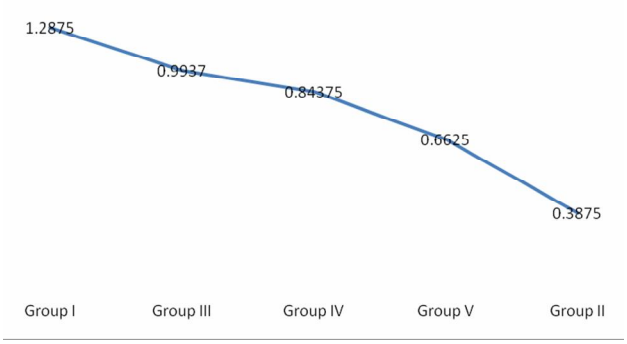

Fig. 2: Mean edema values after 2 hour in all groups of mice.

inflammation[8]. As mentioned earlier, Mucuna pruriens is known to contain a number of different constituents like flavonoids, alkaloids, saponins, tannins, in addition to its major constituent L-dopa. The plant has been used in the past for the treatment of dysmennorrhea, fever, spasms and muscular pains[9] and so tested for its anti-inflammatory activity and to investigate the traditional use of the

Table 6: Anti-inflammatory activity of drugs after 2 hours:

Group	Mean edema value (mm) ± S.D*	Comparison
I (control)	1.2875 ± 0.08	a
III (seeds 1 g/kg)	0.9937 ± 0.13	bc
IV (seeds 2 gm/kg)	0.84375 ± 0.14	c
V (seeds 3 g/kg)	0.6625 ± 0.24	d
II (standard)	0.3875 ± 0.06	e

Standard error (SE) = 0.0509
*Standard deviation
The mean values showing same letters are statistically similar ($P < 0.05$)

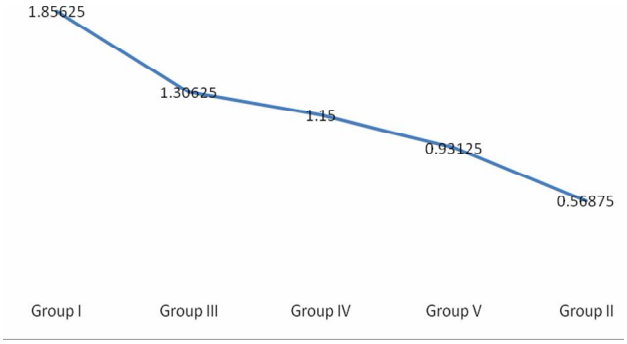

Fig. 3: Mean edema values after 3 hour in all groups of mice.

Table 7: Anti-inflammatory activity of drugs after 3 hours:

Group	Mean edema value (mm) ± S.D*	Comparison
I (control)	1.85625 ± 0.13	a
III (seeds 1 g/kg)	1.30625 ± 0.14	b
IV (seeds 2 gm/kg)	1.15 ± 0.20	b
V (seeds 3 g/kg)	0.93125 ± 0.27	c
II (standard)	0.56875 ± 0.09	d

Standard error (SE) = 0.0645
*Standard deviation
The mean values showing same letters are statistically similar ($P < 0.05$)

plant for pain and fever. The results of our present investigation indicate that seed powder of Mucuna pruriens possess significant anti-inflammatory activity as highlighted by the results of our study, the p values < 0.005 for seed powder in a dosage of 2g/kg and 3g/kg starting from 1st hour to the 4th hour. Seed powder in dose of 1g/kg showed activity

at 3rd and 4th hours only with p values < 0.005 and 0.01 respectively.

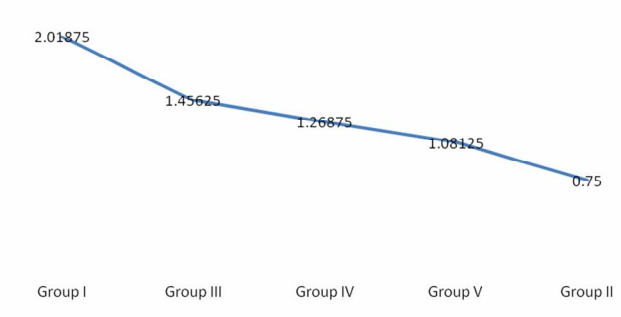

Fig. 4: Mean edema values after 4 hour in all groups of mice.

Table 8: Anti-inflammatory activity of drugs after 4 hours:

Group	Mean edema value (mm) ± S.D*	Comparison
I (control)	2.01875 ± 0.10	a
III (seeds 1 g/kg)	1.45625 ± 0.20	b
IV (seeds 2 gm/kg)	1.26875 ± 0.25	bc
V (seeds 3 g/kg)	1.08125 ± 0.28	c
II (standard)	0.75 ± 0.08	d

Standard error (SE) = 0.07135
*Standard deviation
The mean values showing same letters are statistically similar (P < 0.05)

Carrageenan induced acute inflammation is one of the most suitable test procedures to screen anti-inflammatory agents. Development of Carrageenan induced edema is biphasic; the first phase is attributed to the release of histamine, 5-HT and kinins, while second phase is related to the release of prostaglandins[10]. Our results revealed that administration of seed powder inhibited the edema starting from the first hour and during all phases of inflammation, which is probably inhibition of different aspects and chemical mediators of inflammation.

The significant anti-inflammatory activities of seed powder justify the traditional use of this plant for inflammatory conditions and validate the claim of being used for the said purpose in folklore medicine. On the basis of our study, it can be concluded that whole seed powder of Mucuna pruriens plant possess anti-inflammatory property which is mediated by inhibition of prostaglandin synthesis as well as central mechanisms which may be of potential benefit for the management of inflammatory disorders. In our study we did not observe any adverse effects of the plant which indicates safety of the plant if used as potential future medicine.

These studies are valuable for identifying lead compounds for anti-inflammatory drugs, keeping in mind the side effects of non-steroidal anti-inflammatory drugs and corticosteroids. Animal data is valuable for developing cost effective and efficacious anti-inflammatory agents. This further supports the correlation of reverse pharmacology with Ayurvedic drug actions[11]. Pharmacodynamic studies should be undertaken to establish the mechanism of action of the plant.

CONCLUSION

On the basis of our study it can be concluded that Mucuna pruriens Linn seeds possess significant anti-inflammatory activity which increases with increments in dose of seed powder. We did not observe any adverse effects including mutagenicity of the seeds. In the light of our study, there is a scope of further work on plant with possibility to isolate the pure drug which may be more potent and free of adverse effects.

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