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Skeletal Muscle Relaxant Activity of Hydroalcoholic Extract of *Tephrosia Purpurea* Leaves in Mice

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A b s t r a c t

The study aimed to investigate the skeletal muscle relaxant activity of hydroalcoholic extract of tephrosiapurpurea using the rotarod apparatus. The hydroalcoholic extract of tephrosia purpurea was evaluated for itsmuscle relaxant potential using the rotarod apparatus in mice. Some of the most popular herbs used to relaxmuscles include chamomile, liquorice, and kava root. The mice are divided into three groups consisting offour animals each. Group 1 served as control, which received distilled water 10mL/kg, group 2 received thestandard drug diazepam, at a dose of 10mg/kg, p.o., group 3 received the hydroalcoholic extract of tephrosiapurpurea orally at a dose of 200mg/kg. (2). The animals are remained on rotarod for 5min at 25rpm or moreafter successive trails were included in the study. After the administration of control, standard, and testmaterial,thefallofftimefrom rotating rod wasnotedafter 30minutes.

Keywords: Tephrosia purpurea, Diazepam, Rotarod, hydroalcoholic extract.

A r t i c l e I n f o

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C o n t e n t s

1. Introduction

Muscle Spasms: Muscle spasms are involuntary contractions of muscle fibres that can cause a sudden, painful tightening of the affected muscle. They can occur in any muscle in the body, but are most commonly experienced in the legs, arms, back, and neck. Muscle spasms can be caused by a variety of factors, including overuse, dehydration, electrolyte imbalances, nerve damage, and certain medical conditions. While muscle spasms are generally not serious, they can be painful and disruptive, affecting a person's ability to perform daily activities. Treatment options for muscle spasms include stretching, massage, heat or cold therapy, over-the-counter pain relievers, and prescription medications. In severe cases, surgical intervention may be necessary. Preventive measures, such as staying hydrated, maintaining a healthy diet, and avoiding overuse of muscles, can also help reduce the frequency and severity of muscle spasms.

Causes of muscle spasms:

Muscle spasms can be caused by a variety of factors, including:

- Overuse or fatigue of muscles
- Dehydration or electrolyte imbalances

- Nerve damage or injury
- Medical conditions such as multiple sclerosis, Parkinson's disease, or spinal cord injuries
- Poor blood circulation
- Certain medications or drug use
- Stress or anxiety
- Mineral deficiencies such as magnesium, potassium, or calcium deficiency
- Infections such as tetanus or Lyme disease
- Certain genetic conditions such as muscular dystrophy or myotonic dystrophy.

Signs and symptoms:

The signs and symptoms of muscle spasms may vary depending on the affected muscle and the underlying cause, but commonly include:

- Sudden, involuntary muscle contractions
- Pain or discomfort in the affected muscle
- Stiffness or tightness in the affected area
- Limited range of motion or difficulty moving the affected muscle
- Muscle weakness or fatigue
- Twitching or jerking of the affected muscle
- Visible muscle contractions or bulging of the muscle
- Cramping or aching in the affected area
- Tingling or numbness in the affected muscle or surrounding area.

Muscle relaxants used commonly:

Spasmolytics are medications used to treat muscle spasms by reducing muscle tone or relaxing muscle contractions. Some common spasmolytics used include: (10)

Baclofen: A muscle relaxant that acts on the central nervous system to reduce muscle spasms and improve muscle control.

Diazepam:

A sedative medication that can also be used to treat muscle spasms by relaxing the muscles and reducing tension.

Tizanidine: A muscle relaxant that works by blocking nerve impulses to the muscles andreducing muscle tone.

Dantrolene:

A medication that directly affects the muscles and can be used to treat muscle spasms caused by neurological conditions.

Methocarbamol: A muscle relaxant that works by suppressing the activity of nerve cells in the spinal cord and brain.

Cyclobenzaprine: A muscle relaxant that works by reducing muscle spasms and improving
muscle tone.

Carisoprodol: A muscle relaxant that works by affecting the central nervous system andreducing muscle tension.

Herbal muscle relaxants:

Some commonly used herbal muscle relaxants include: Valerian root: A plant that is traditionally used to promote relaxation and improve sleep, Valerian root may also have muscle relaxant properties.

Kava: A plant native to the South Pacific, Kava is known for its calming and sedative effects and may also help relieve muscle tension and spasms.

Chamomile: A popular herb used for its calming effects, chamomile may also have muscle relaxant properties and can be consumed as a tea.

Passion flower: A plant traditionally used to treat anxiety and insomnia, Passionflower may also help relieve muscle tension and spasms.

Skullcap: An herb commonly used to promote relaxation and reduce anxiety; Skullcap may also have muscle relaxant properties.

Ashwagandha: An herb used in Ayurvedic medicine to treat a variety of conditions, Ashwagandha may help relieve muscle tension and spasms.

Tephrosia Purpurea: (1)

Species: Tephrosia purpurea
Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fabales
Family: Fabaceae
Genus: Tephrosia
Botanical name: Tephrosia purpurea
Sanskrit name: Sarapunkha
English name: Wild indigo
Family: Fabaceae
Plant parts used: Whole plant, leaves
Plant parts used: Whole plant, leaves

Medicinal Properties of Tephrosia Purpurea:

Tephrosia purpurea is a species of flowering plant in the Fabaceae family, commonly known as wild indigo or purple tephrosia. It is a perennial herb that is found in various parts of the world, including India, Sri Lanka, and Madagascar. Here are some of the properties of Tephrosia pursuers: (4)

Medicinal Properties:

Tephrosia purpurea has traditionally been used in Ayurvedic medicine to treat a variety of conditions, including fever, cough, asthma, and skin diseases. It is also believed to have antifungaland antibacterial properties.

Anticancer Properties:

Studies have shown that Tephrosia purpurea has potential anticancer properties, and may be effective against various types of cancer, including breast, lung, and colon cancer. (3)

Anti-inflammatory Properties:

Tephrosia purpurea is believed to have anti-inflammatory properties, which may help to reduce swelling and inflammation in the body. (6)

Antioxidant Properties:
The plant is rich in antioxidants, which help to protect the body against damage from free radicals and oxidative stress. (5)

Hepatoprotective Properties: Tephrosia purpurea is believed to have hepatoprotective properties, which means it may help to protect the liver from damage caused by toxins and other harmful substances. (7)

Insecticidal Properties: The plant contains rotenoids, which are natural insecticides that can be used to control pests in agriculture and other settings. (8)

2. Materials and Methods

Animals:A total of 20 Swiss albino rats aged 8–10 weeks of either sex weighing about 100–150g was obtained from the Narayana medical college.The animals were fed standard pellet diet and with water ad libitum, and were maintained under standard conditions of temperature, humidity, and light (12 h light/12 h dark cycle).

The experiment complied with the guidelines.
The guidelines for the investigation of experiments in conscious animals were followed in all tests.

Drugs and chemicals:
Diazepam (Lupin Laboratories Ltd., India), 10mg/kg, distilled water was administered in a volume of 10 mL/kg.
The hydroalcoholic extract of tephrosia purpurea was administered orally (p.o.,) in doses of 200 mg/kg. (2)

Phytochemical characterization:
The different extracts were subjected to general phytochemical analysis for the presence of carbohydrates, proteins, amino acids, tannins, phenolics, flavonoids, alkaloids, anthraquinone, glycosides, saponins, and steroidal nucleus using the standard methods.

Instruments used:

- Rotarod apparatus
- Mice cages
- Stopwatch or timer
- Ethanol or other cleaning solution
- Thephrosia purpurea extract or drug solution
- Control solution (e.g., distilled water)
- Syringe or dropper for administration of the drug solution

Collection of the Plant (Tephrosia Purpurea Leaves):

- The study was conducted during the period of MARCH 2023.
- The leaves of Tephrosia Purpurea were obtained from Allur village, Nellore.
- The identification and authentication of the leaves were done at the Department of Botany, Sri Venkateshwara University, Tirupati.
- The leaves were shade dried and powdered.
- The aqueous extract of leaves was prepared using the Soxhlet apparatus in the Department of Pharmacology.
- The extract was dried under vacuum, stored at room temperature.

Selection of dose for pharmacological screening:
The hydro alcoholic extract of tephrosia purpurea was found to be nontoxic up to a dose of 2000 mg/kg and did not cause death, therefore, it was considered to be safe. Hence, one-tenth of this dose, that is, 200 mg/kg body weight was used for elucidation of muscle relaxation activity. (2)

Experimental design:
The animals were divided into three groups of four rats each. The drugs were administered as shown below:

- Group I - Control mice (distilled water 10 mL/kg)
- Group II - standard (diazepam 10 mg/kg)
- Group III - (hydroalcoholic extract of tephrosia purpurea) 200 mg/kg.

The Evaluation of Skeletal Muslce Activity (Motor Coordination): The rats were divided into three groups consisting of four animals each.

Group I:
served as the control, which received distilled water 10 mL/kg, Group II received the standard drug diazepam, at a dose of 10 mg/kg, p.o., Group III received the hydro alcoholic extract of tephrosia purpurea orally at a dose of 200mg/kg. The animals remained on Rotarod (25 rpm) for 5 min or more after successive trials were included in the study.After the administration of control, standard, and test material, the fall off time from the rotating rod was noted after 30 min.The difference in the fall off time from the rotating rod between the control and the treated rats was taken as an index of muscle relaxation.

3. Results and Discussion

Phytochemical Screening Test:
The preliminary phytochemical analysis of the leaf's extracts of tephrosia purpurea showed the presence ofcarbohydrates, phenols, saponins, tannins, and alkaloids but devoid of steroids. The phytochemical results oftephrosia purpurea were in conformity with other studies. All the extracts were stored in a clean glass bottleforfurther pharmacologicalstudies. The study revealed that stroke was more prevalent in the age group above 50-60 years (28%), followed by the age group 60-70 (26%). The social history of the patients revealed that 21% of patients were smokers 8% of patients were alcoholics,11% had a history of both smoking and alcohol and 3% were tobacco users.

Rotarodtest:
For muscle relaxation, in this test, tephrosia purpurea (200 mg/kg) showed highly significant reduction in thetime spent by the animals on the revolving rod when compared to the control ($P < 0.000$). The standard drug(diazepam) also showed a highly significant effect when compared to the control ($P < 0.000$). However, two different doses of tephrosia purpurea (200mg/kgp.o.,) showed adose-dependent increase in muscle relaxation, when compared to the control. Maximum muscle relaxation was observed with 200mg/kg of hydroalcoholic extract of tephrosia purpurea. The result from the Rotarod test showed that the extract significantlyreducedthemotorcoordination ofthetestedanimals.

Discussion:
$P>0.05$ all values are expressed a mean ± SD, SD = Standard Deviation. In recent years, the herbal medicines have been extensively used in various diseases because of their safety profile. Tephrosia purpurea belongs to family

Fabaceae and used against various disorders in indigenous system of medicine, especially for skeletal muscle relaxant. The leaves and are used in the treatment of skeletal muscle relaxation. It has also been reported to have skeletal muscle activity. The major components of it are alkaloids, carbohydrates, tannins, phenols.The objective of the present study was to investigate the effect of hydro alcoholic extracts of the leaves of Tephrosia purpurea on muscle relaxant activity in experimental animals like albino mice. Rotarod for muscle relaxation. The present study showed a dose-dependent increase in muscle relaxation with different doses of hydroalcoholic extract of tephrosia purpurea. Phytochemical analysis of tephrosia purpurea leaves revealed the presence of (alkaloids, tannins, cardiac glycosides, steroids, terpenoids, flavonoids, reducing sugars,). The muscle relaxant activity observed with hydroalcoholic extract of tephrosia purpurea may be due to the presence of flavonoids, alkaloids, and terpenoids in the plant extract. One study on tephrosia purpurea revealed the presence of various compounds such as (alkaloids, saponins, flavones, triterpenoids, steroids, tannins, and amino acids). The results of present study suggest the muscle relaxant activity of hydro alcoholic extract of tephrosia purpurea at the doses of 200 mg/kg. The standard reference drug diazepam, which acts as an anxiolytic (at low doses), anticonvulsant and also produces sedation, and a myorelaxant effect at higher doses. In this case, diazepam at a dose of 10 mg/kg body weight showed a significant lack in motor coordination and muscle relaxant activity in animals and animals treated with the extract showed muscle relaxation and reduced motor activity. These effects of tephrosia purpurea could be due to the interaction of flavones, triterpenoids, steroids with the GABA/ benzodiazepine receptor complex in the brain. In another study in Rotarod motor co- ordination test, tephrosia purpurea at 200 mg/kg, oral., significantly ($P < 0.05–0.01$) reduced the endurance. As the Phyto constituents of tephrosia purpurea leaves are same. Our study is in correlation with our previous study. Moreover, also with another study. However, further extensive phytochemical analysis and research is necessary to identify the exact constituents and elucidation of its possible mechanism of action underlying the myorelaxant activity of tephrosia purpurea extract.

Table1: Drugs Used in stroke patients

S.no	Content	Result
1	alkaloids	+
2	phenols	+
3	carbohydrates	+
4	saponins	+
5	tannins	+
6	steroids	-

Table 2:Control: Distilled Water (10ml/Kg)

S.no	Body weight (g)	Volumeofdistilledwater to beadministered(ml)	Falloftimeinse conds
1	22	0.22	19
2	23	0.23	07
3	22	0.22	11.6
Average-11.6			

Table 3: Standard Diazepam(10mg/Kg)

S.no	Bodyweight(g)	Dose(mg/kg)	Volume of Diazepam to beadministered(ml)	Fallofftimein seconds
1	21	0.084	0.21	04±0.61
2	24	0.096	0.24	02±0.15
3	20	0.080	0.20	02±0.42
Average				2.66

Table 4: Hydro Alcoholic Extract of Tephrosia Purpurea (200mg/Kg)

S.no	Bodyweight(g)	Dose(mg/kg)	Volumeofhydroalcoholic extractof tephrosiapurpureatobe administered(ml)	Fallofftimein seconds
1	22	8.8	0.22	06±0.14
2	27	10.8	0.27	05±1.04
3	21	8.4	0.21	02±0.74
Average				4.33

Table 5: Effect of Hydroalcoholic Extract of Tephrosia Purpurea on Muscle Grip Strength Using Rota Rod Apparatus

Treatment (mg/kg)(oral)	Falloftime(sec)		%decrease
	Before	After	
Diazepam	57.4±3.53	2.66±0.39	95.36±3.17
Tephrosia purpurea8.8mg	63.6±2.94	06±0.14	90.5±2.3
Tephrosia purpurea10.8mg	95.8±1.53	05±1.04	94.7±1.26
Tephrosiapurpurea 8.4mg	37±2.38	02±0.74	94.5±2.18

4. Conclusion

The study suggests that the hydro alcoholic extract of tephrosia purpurea has muscle relaxant action. As the comparison is done with centrally acting benzodiazepine group of drug diazepam, it is assumed that the muscle relaxation and reduced motor activity effects of tephrosia purpurea could be due to the interaction of isoflavonoids of the plant with the GABA/benzodiazepine receptor complex in brain as the presence of muscle relaxation was observed when the extracts are given through oral. Still extensive research is needed to synthesize new molecule with muscle relaxation property from tephrosia purpurea.

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