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Original Article

# Evaluation of Analgesic Activity of Aqueous extract of Asparagus racemosus (AEAR) Using Hot Plate Method in Swiss albino Mice

**Shubhendra Bharadwaj[1], Raj Kumar Goel[2], Monica Sharma[3]**

*[1]Junior Resident, Department of Pharmacology, L.L.R.M. Medical College, Meerut, UP.*
*[2,3]Department of Pharmacology, Lala Lajpat Rai Memorial Medical College, Meerut, Uttar Pradesh, India*

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**Corresponding Author:**

**Shubhendra Bharadwaj**
Junior Resident, Department of Pharmacology, L.L.R.M. Medical College, Meerut, UP.

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## ABSTRACT

**Background:** Eddy's hot plate method is a commonly used scientific method for experimental evaluation of central analgesic activity of any new drug. The present study conducted to explore the analgesic activity of Aqueous extract of *Asparagus racemosus* (AEAR) in Swiss albino mice.
**Methods:** Swiss albino mice were divided into four groups (n=6). Group I were administered normal saline (1ml/100g), Group II received tramadol (10 mg/kg) on the day of experiment, Group III and IV were given AEAR 250 mg/kg and 500 mg/kg respectively. The mice were observed and reaction time was recorded before before treatment and at 30, 60 and 90 minutes after treatment using Eddy's hot plate analgesiometer. The data collected was analysed using one – way ANOVA followed by post hoc tukey test.
**Results:** Group treated with tramadol produced significant increase in reaction time with peak effect at 60 minutes mark ($p<0.001$ vs control). AEAR produced a dose dependent increase in reaction latency, with maximum effect observed at 60 and 90 minutes ($p <0.05$ vs control)
**Conclusion:** The aqueous extract of *Asparagus racemosus* exhibits significant centrally mediated analgesic activity evaluated in Eddy's hot plate model.

***Keywords****: Asparagus racemosus, Tramadol, Eddy's Hot plate analgesiometer, Swiss albino mice, analgesia.*

## INTRODUCTION

Human condition along with all its complexities is most often accompanied by pain, an unpleasant sensory and emotional experience almost exclusively associated with actual or potential tissue damage. Analgesic agents acting centrally modulate spinal and supraspinal pathways thereby exhibiting analgesia[1]. Eddy's hot plate analgesiometer model for assessment of centrally acting analgesic agents is a widely accepted and sensitive method. The continual exploration of plant based novel analgesic agents for a basis of improved safety profiles as compared to existing treatments. *Asparagus racemosus* has been traditionally used in ayurvedic medicine for centuries, however its medicinal potential has not been scientifically validated. The present study aims to evaluate the analgesic potential of the aqueous extract of the same plant using hot plate method[2].

## MATERIALS AND METHODS

### Ethics approval

This was an experimental study conducted on albino rats, in Department of Pharmacology, LLRM Medical College, Meerut (U.P) from October 2024 to September 2025. The study was commenced after getting approval from Institutional Animal Ethics Committee (Approval letter No. IAEC/LLRM/2024/02 dated – 21/08/2024) of Lala Lajpat Rai Memorial Medical College, Meerut, India, registered under CCSEA India (Registration- 819/GO/ReRcBiBt/ S/04/CPCSEA). As per OECD guidelines, doses of aqueous extract of *Asparagus racemosus* to be used in the study were calculated on the basis of previously documented LD50 on rats (OECD-423)[3].

**Experimental animals**
Healthy Swiss albino mice of either sex weighing 20-35 grams were obtained from CCSEA approved Central Animal House of LLRM Medical College, Meerut. The selected mice were housed in polypropylene cages under controlled conditions of temperature ($25_oC$) with alternating periods of light and darkness of 12 hours each. The mice were provided unrestricted access to a standard pellet diet and tap water ad libitum. After one week of acclimatization, the animals were rendered suitable for study. Pregnant female mice were not included in the study.

**Methods of Extract Preparation**
*Asparagus racemosus* - To form the aqueous extract from *Asparagus racemosus*, the roots were cleaned and dried completely in the laboratory. Subsequently, the dried roots were finely ground into powder form, followed by extraction utilizing 200g of root extract in 750ml distilled water. The resultant mixture was circulated in a Soxhlet apparatus at 65°C temperature for 16h until homogeneity was achieved. Further, the solution was carefully filtered and dried for 48 hours under ambient conditions, forming a solid extract. For utilization in the study, the extract was dissolved in distilled water when needed[4].

**Analgesic effect**
Eddy's Hot Plate Method (Eddy and Leimbach, 1944) has been adapted by several researchers. Each experimental group comprised of six albino mice of either sex, weighing between 20 and 35 grams. Analgesic response was assessed using a commercially available hot plate apparatus equipped with an electrically heated surface, maintained at a constant temperature of 55–56°C. Each mice were individually placed on the hot plate, and the latency to a nociceptive response—such as paw licking or jumping—was measured using a stopwatch. Baseline reaction times were recorded prior to administration of the test or reference substance. Subsequent measurements were taken at 30, 60, and 90 minutes following administration, which was carried out either orally or via intraperitoneal injection[5].

**Experimental study design**
Swiss albino mice were divided into four groups, each group comprising of six mice.
**Group 1** - The experimental animals of this group (Control group) were given 0.9% NaCl solution in an oral dose of 1ml/100gm b.w. for 21 days[6].
**Group II** - In addition to pellet diet and tap water *ad libitum* the experimental animals of this group were given Tramadol in a single oral dose of 10mg/kg b.w. on the day of the experiment[7].
**Groups III –** This group were given an aqueous extract of *Asparagus racemosus* (AEAR) per orally in a dose of 250mg/kg for 21 days consecutively.
**Groups IV** - This group were given an aqueous extract of *Asparagus racemosus* (AEAR) per orally in a dose of 500mg/kg for 21 days consecutively.

On 22nd day analgesic activity was explored by Eddy's hot plate method. Mice were placed on the surface of "Eddy's Hot Plate" in which temperature was maintained at 55-56ºC and observed for either paw licking or jumping reaction. The reaction time was taken as the interval from the instant the animal reached the hot plate until the moment the animal licked its feet or jumped out. The reaction time was recorded using stopwatch before and after treatment with different drugs.

Statistical analysis was performed using one-way analysis of variance (ANOVA), followed by Dunnett's post hoc test to identify significant differences between groups. Statistical significance was assumed when the p -value was less than 0.05. All comparisons between test groups, standard drug treatments, and the control group were made at corresponding time intervals using SPSS software (Version 20).

**RESULTS & DISCUSSIONS**
The analgesic activity was evaluated by Eddy's hot plate, measuring the percentage increase in mean reaction time as compared with the control group (treated with normal saline) set as 100% reaction time. The reaction time before and after drug administration, at intervals of 30, 60 and 90 minutes was observed (Table I, Figure 1). Group 1 (1ml/100gm of normal saline) exhibited no significant increase in the reaction time to noxious stimuli induced by the hot plate throughout the 90-minute study period. The results revealed that Tramadol (10 mg/kg,P.O.), significantly increased the pain latency at two points (60 and 90 minutes). A statistically significant prolongation ($p<0.001$) in reaction time was noted at 60 minutes after oral administration of AEAR at doses of 250mg/kg and 500mg/kg respectively, with sustained effect of AEAR 500 mg/kg till 90 mins point ($p<0.05$).

**Table I: Analgesic Activity**
Effects of Tramadol, Aqueous extracts of *Asparagus racemosus* (AEAR) on algesia induced by hot plate method in albino mice (n=6)

| Group (Drugs) | Dose | Reaction time (Seconds) Mean ± SD |
|---|---|---|

| | (mg/kg, oral) | Before treatment | After treatment | | |
|---|---|---|---|---|---|
| | | | 30 mins | 60 mins | 90 mins |
| Group 1 Control | 1ml/100g | 11.73(±)0.83 | 14.51(±)2.4 | 7.1(±)2.1 | 10.41(±)2.28 |
| Group 2 Tramadol | 10mg/kg | 11.65(±)0.9 | 15.21(±)2.7 | 20.83(±)2.9** | 12.67(±)0.61* |
| Group 3 AEAR-250 | 250 | 11.68 (±) 1.1 | 15.34(±)5.2 | 17.5(±)2.6** | 13.75(±)2.67 |
| Group 4 AEAR-500 | 500 | 12.16(±)1.5 | 17.81(±)5.4 | 15.5(±)1.03** | 12.54(±)4.83* |

Data are expressed as mean ± SE, with six animals per group (n = 6).
*p<0.05 significant in comparison to control
**p<0.001 significant in comparison to control

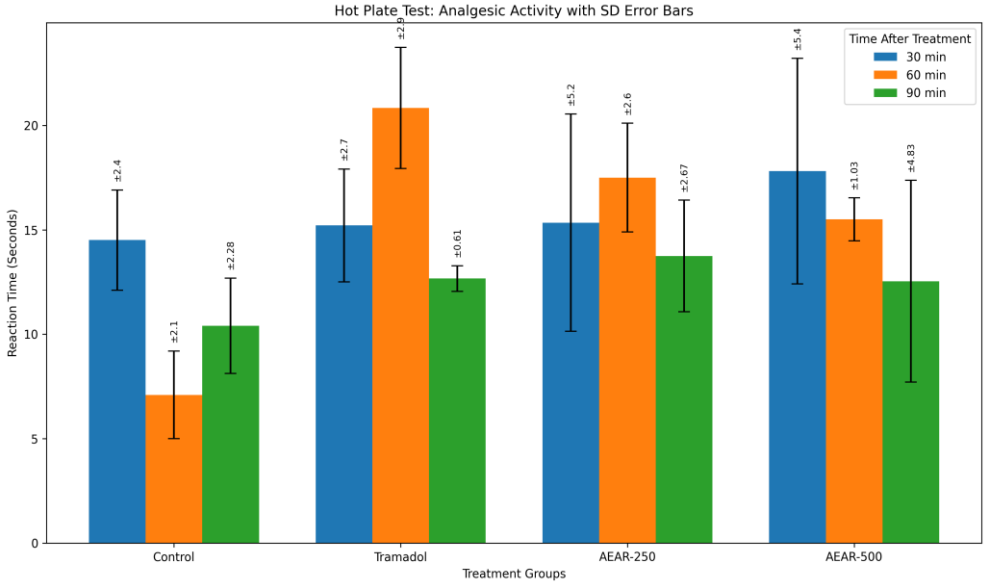


**Figure I:** Bar graph representation of mean values for different treatment groups analgesic activity – Eddy's hot plate method

## DISCUSSIONS

*Asparagus racemosus* (Shatavari), a medicinal plant of the family Liliaceae, is widely used in Ayurvedic medicine for its diverse therapeutic properties. The roots contain important phytoconstituents including steroidal saponins (Shatavarin I–IV), flavonoids, alkaloids, and phenolic compounds, which contribute to its pharmacological activities. Traditionally, it has been used in the management of neurological and gastrointestinal disorders, ulcers, and inflammatory conditions. Scientific studies have demonstrated its antioxidant, immunomodulatory, antidiabetic, antiulcer, hepatoprotective, antibacterial, antidepressant, and hypolipidemic activities, supporting its extensive therapeutic potential[2].

Pain is an unpleasant sensation associated with actual or potential tissue injury and involves both physical and emotional components. Depending on its origin, pain may be classified as somatic, visceral, referred, neuropathic, or cancer-related pain. The sensation of pain occurs due to the release of chemical mediators such as prostaglandins and serotonin, which stimulate nociceptors in response to harmful stimuli. These impulses are then carried to the brain through nociceptive fibers, mainly Aδ and C fibers. Pain may be acute, serving as a protective warning signal, or chronic, where it persists for a prolonged period and is commonly seen in conditions such as arthritis and cancer[1].

Analgesics are drugs used to relieve pain without causing loss of consciousness. Based on their site of action, they are broadly divided into centrally acting and peripherally acting analgesics. Centrally acting analgesics act on the central nervous system by increasing the pain threshold and modifying pain perception, whereas peripherally acting analgesics reduce pain by inhibiting the formation and transmission of pain signals at peripheral tissues[8].

Tramadol is a centrally acting analgesic with a dual mode of action. It acts as a weak agonist at μ-opioid receptors and inhibits the reuptake of norepinephrine and serotonin. This increases the availability of these neurotransmitters in the synaptic cleft and enhances the descending inhibitory pathways involved in pain control. Due to this combined mechanism, tramadol provides effective analgesia with comparatively fewer opioid-related adverse effects[9].

evaluation of analgesic activity using Eddy's hot plate method, which assesses centrally mediated analgesia, revealed that AEAR significantly increased reaction time at both doses, indicating central analgesic activity. This suggests that

*Asparagus racemosus* may act through inhibition or modulation central mechanisms involved in pain pathways. Observations reported by Battu GR *et al* (2010)[10] and Gupta M *et al* (2008)[11] were also consistent with this study who demonstrated central analgesic activity of *Asparagus racemosus* along with adaptogenic and neuroprotective effects, indicating possible modulation of central neurotransmitter pathways.

## CONCLUSIONS

In the present study, the aqueous extract of Asparagus racemosus demonstrated significant analgesic activity in established animal models of pain using Eddy's hot plate method in albino rats, indicating centrally mediated analgesic effects. The findings suggest that *Asparagus racemosus* possesses promising therapeutic potential as a natural analgesic agent.

The study also provides scope for further investigation using different dose levels, durations of treatment, and various extract preparations to better understand its pharmacological profile. Future research may focus on the isolation and characterization of specific phytochemicals responsible for the observed analgesic and neuroprotective activities. Although several bioactive constituents of *Asparagus racemosus* have already been identified, their composition may vary depending on plant variety, environmental conditions, and extraction methods. Therefore, further studies may help identify more potent bioactive compounds with enhanced therapeutic potential.

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**Abbreviations**: AEAR – Aqueous extract of *Asparagus racemosus*

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**Conflicts of interest:** None declared

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