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Potential Nootropic Effects of the Ethanolic Extract of Myristica Fragrans Seeds and Mucuna Pruriens Seed Extract on Scopolamine-Induced Amnesia in Albino Rats

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ABSTRACT:
This study investigates the behavioral effects of Myristica fragrans and Mucuna pruriens extracts in aged mice, emphasizing spatial learning, memory, and anxiety-related behaviors. In the Morris Water Maze, aged mice treated with the extracts showed compromised spatial learning during the acquisition phase, with increased escape latency. In contrast, Piracetam, a cognitive enhancer, demonstrated positive effects on spatial learning. The Elevated Plus Maze revealed potential influences on locomotor activity and anxiety-like behavior, as both extracts altered time spent in the open arms. Piracetam also impacted locomotion, while scopolamine induced changes consistent with cognitive disruption. Exploring exploratory behavior and anxiety levels through entries into open and closed arms, the extracts' effects were evident, with Piracetam maintaining a profile similar to the control. The step-down passive avoidance test highlighted exacerbated memory deficits with extract treatments, contrasting Piracetam's positive impact on memory retention. Scopolamine-induced impairments validated the paradigm. Overall, the findings underscore potential negative impacts of Myristica fragrans and Mucuna pruriens extracts on spatial learning, memory, and anxiety-related behaviors in aged mice, offering valuable insights into their cognitive effects. Piracetam's contrasting positive influence suggests potential cognitive benefits, positioning it as a reference for cognitive enhancement. This comprehensive analysis contributes to our understanding of the complex behavioral outcomes associated with these plant extracts in the context of aging and cognition

Keywords: Myristica fragrans, Mucuna pruriens, Piracetam, Scopolamine, Cognitive function

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Introduction

Nootropics, often referred to as smart drugs or cognitive enhancers, constitute a diverse class of substances designed to enhance various aspects of cognitive function. Coined by Romanian psychologist and chemist Dr. Corneliu E. Giurgea in 1972, the term "nootropic" encompasses compounds believed to improve memory, creativity, motivation, and overall mental performance. Dr. Giurgea outlined criteria for these substances, including their ability to enhance memory and learning, protect the brain, and improve cognitive function under adverse conditions.[1]

One prominent category of nootropics is the racetams, which includes piracetam and aniracetam. These compounds are thought to modulate neurotransmitter systems, leading to enhanced memory and learning. Stimulants like modafinil and caffeine, another category of nootropics, contribute to increased alertness and wakefulness. Adaptogens, such as Rhodiola rosea and Panax ginseng, are natural substances believed to help the body adapt to stress and promote overall well-being.[2]

Cholinergics, which include acetylcholine precursors like alpha-GPC, support the production of the neurotransmitter acetylcholine, essential for memory and learning. Neuropeptides like Noopept are believed to have cognitive-enhancing effects and neuroprotective properties. While some nootropics have shown positive effects in studies, the field is continually evolving, and the universal efficacy and safety of these substances remain subjects of ongoing research. It is crucial for individuals considering the use of nootropics to be informed and cautious, recognizing that the effects of these substances can vary, and their long-term consequences are not fully understood. [3]

Myristica fragrans, commonly known as nutmeg, and Mucuna pruriens, also known as velvet bean, are two herbal plants that have been explored for potential nootropic properties. While research on these plants as nootropics is limited compared to synthetic compounds, there is some evidence suggesting cognitive-enhancing effects. It's important to note that more research is needed to establish their efficacy and safety for cognitive enhancement.

Nutmeg has been traditionally used as a spice, but some studies suggest potential nootropic effects. Nutmeg contains compounds such as myristicin and elemicin, which may have neuroprotective properties. A study published in the "Journal of Medicinal Food" in 2013 investigated the cognitive-enhancing effects of nutmeg extract in mice. The researchers observed improvements in memory and learning in the mice treated with nutmeg extract, suggesting a potential nootropic role.[4]

Mucuna pruriens is known for its high content of levodopa (L-DOPA), a precursor to dopamine, a neurotransmitter associated with mood and cognitive function. A study published in "Pharmacognosy Research" in 2014 investigated the neuroprotective and cognitive-enhancing effects of Mucuna pruriens seed extract in rats. The study found that the extract exhibited significant neuroprotective effects and improved cognitive function.[5]

Material & Methodology

Collection and authentication of plant material:

The selected plant material Myristica fragrans seeds and Mucuna pruriens seed were purchased from local market of Bhopal, (M. P.) India. The specimens were identified and authenticated by the Botanical survey of INDIA, 10, Chatham Lines, Allahabad – 211002 and their herbarium was deposited.

All chemicals and solvents were of analytical grade (AR Grade) and were purchased from Sigma Aldrich, Ranbaxy fine chemicals Ltd., LOBA chemicals Ltd., s.d. fine chemicals Ltd., Spectrochem chemicals.

Acute oral toxicity studies

To find the safe dose of plant extract Myristica fragrans extract and Mucuna pruriens extract, "acute oral toxicity" test performed according with 'OECD-guidelines 423' to find out observable adverse effects. Three groups having six albino Wistar rats were used for experiment. Distilled water was used as a vehicle in the control group. Suspension of prepared extract in distilled water was administered to group II, III respectively with a single dose of 2000 mg/kg through orally using an oral feeding needle. At consecutive hours (i.e, 1, 2, 4, 6 and 24 hours) symptoms of toxicity were recorded if any. The rats were kept under observation for mobility, sensitivity to pain, sound, aggressiveness, and respiration movements for 14 days.[6]

Induction of amnesia

Scopolamine induced in aged-rats (22-24 months old) could non-selectively bind to cholinergic receptors and block the acetylcholine transmission in the brain via, enhancing the Ache activity, and increases oxidative stress which induces amnesia. Alongside, based on the previous reports, a combination of age-related factor, administered with scopolamine depicts the neuropathology, oxidative stress and memory impairment. Scopolamine favours the central cholinergic system's barrier in the animal model and causes informational and new recognition abnormalities. This is depicted Materials and Methods 49 as memory and learning deficit confirmed through in-vivo studies with the models of "spatial learning task", "contextual and cued fear conditioning" as well as "inhibitory avoidance" as per the previous reports.[7]

Hence, scopolamine-induced amnesia in aged rats was selected for present study. By administration of scopolamine 1 mg/kg, through intraperitoneal route for 30days to rats as an inducing agent since, it provokes cognitive impairment in animals.[8]

Grouping of experimental animals and treatment

Total 30 wistar rats were randomly categorized into 5 groups having six in each as shown in table. The scopolamine dissolved in normal saline (1mg/kg, i.p) was induced for 30 days (From day 1 to day 30) to disease and test control groups to provoke amnesia. Test controls such as Piracetam; 3mg/kg, p.o, and Ethanolic extract of Myristica fragrans extract and Mucuna pruriens extract were administered to the respective groups at the therapeutic doses (100 mg/kg, p.o) for 15 days (16th - 30th day of experiment) as represented in schematic diagram 9. Further, behavioural models (MWM, EPM, PAT) were used to assess cognition of rats.

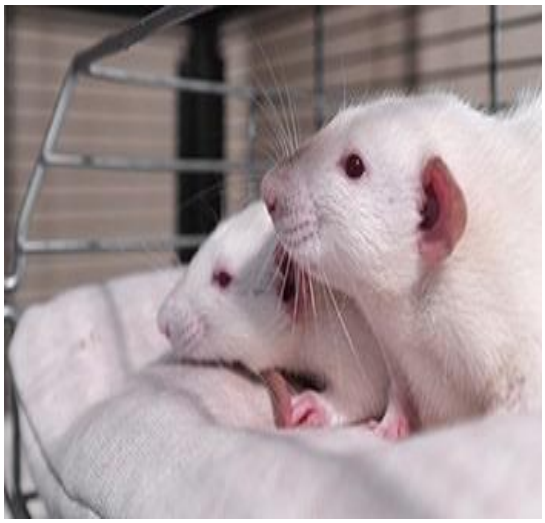


Fig 1: Grouping of experimental animals

Table 1. Grouping of animals for cognitive study

S.No	Group (n=6)	Treatment
1.	Group-I (Control group (placebo))	Normal Control
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control

Behavioral models

The Open Field Apparatus

The Open Field Apparatus is a square or rectangular arena with high walls used to assess animal behavior. The procedure involves pre-test acclimatization, regular handling, and maintaining consistent testing conditions. The setup includes a well-lit arena with a grid on the floor and recording equipment. During the test, animals are placed in the center, and their behaviors (exploration, rearing, grooming, freezing, and defecation/urination) are observed for 5 to 10 minutes. Post-test, animals are removed, and the arena is cleaned to eliminate olfactory cues between trials. The test is commonly used in behavioral research to evaluate anxiety-like behavior and responses to novel environments.[9]

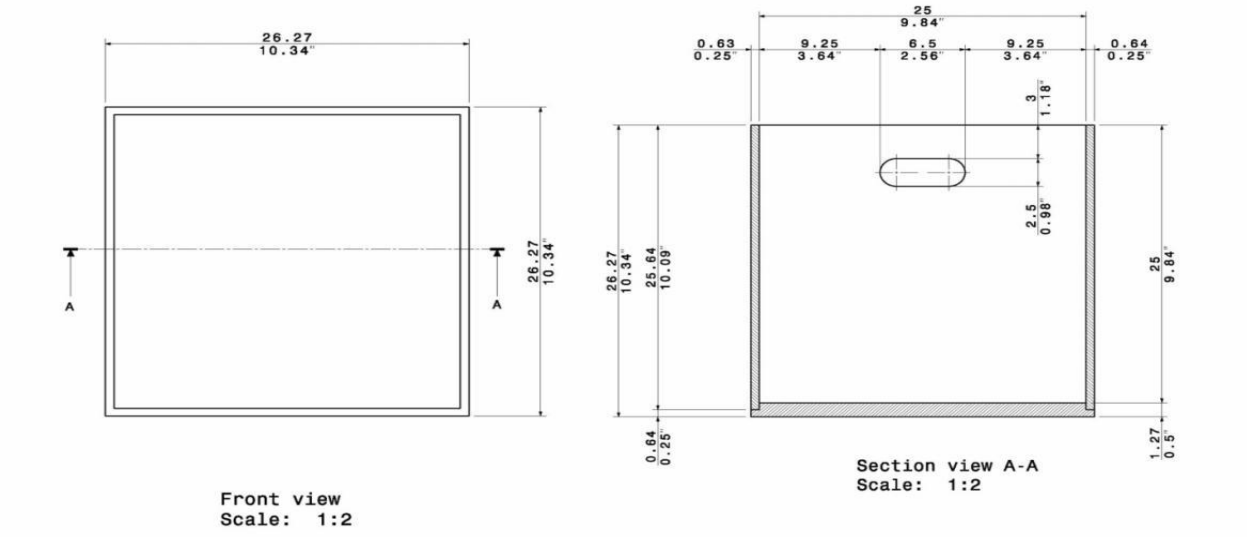
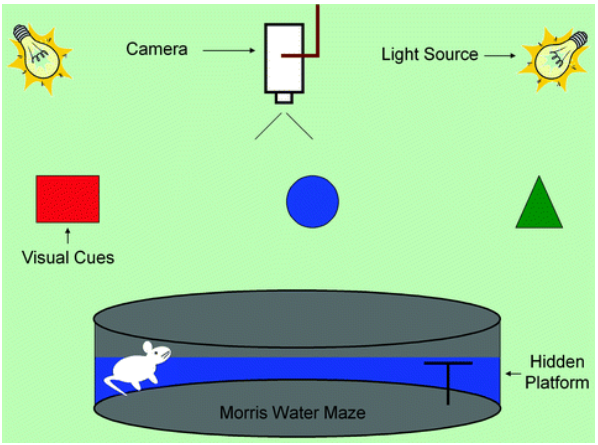


Fig 2. Open Field Test

Morris water maze

The Morris Water Maze (MWM) is a widely used model for assessing spatial learning and memory in rodents. It involves a large circular pool filled with opaque water, hiding a hidden platform. The procedure includes acclimatization and training phases, where animals learn to find the platform using spatial cues. Testing phases include probe trials to measure spatial memory and retention testing to assess memory over time. Parameters measured include latency to find the platform, path length, time in the target quadrant, and the number of platform crossings. The MWM is valuable for studying hippocampus-associated cognitive functions in neuroscience research.[10]

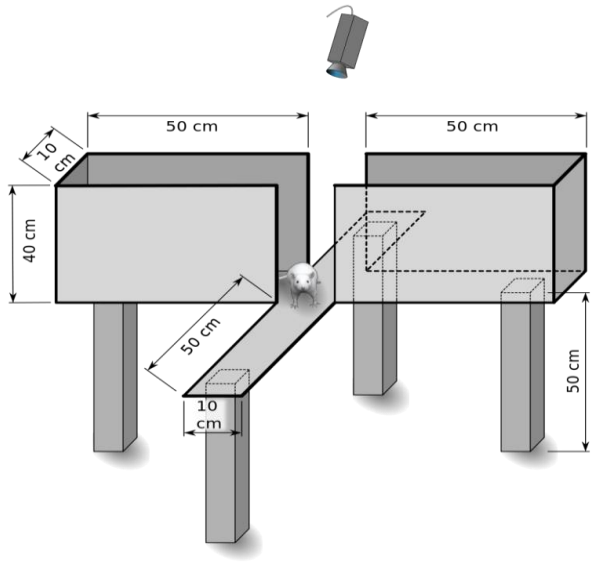


Setup for Morris Water Maze

Elevated Plus Maze

The Morris Water Maze (MWM) is a widely used model for assessing spatial learning and memory in rodents. It involves a large circular pool filled with opaque water, hiding a hidden

platform. The procedure includes acclimatization and training phases, where animals learn to find the platform using spatial cues. Testing phases include probe trials to measure spatial memory and retention testing to assess memory over time. Parameters measured include latency to find the platform, path length, time in the target quadrant, and the number of platform crossings. The MWM is valuable for studying hippocampus-associated cognitive functions in neuroscience research.[11]



Setup for Elevated Plus Maze

Elevated Plus Maze Procedure:

The Elevated Plus Maze (EPM) is a widely utilized method for assessing anxiety-like behavior in rodents. The procedure begins with habituating the animals to the testing room to minimize stress associated with the novel environment. During the test, rodents are placed in the center of the maze, allowing them to freely explore and make choices between open and enclosed arms. The test duration is typically set at around 5 minutes, during which the animal's behavior is carefully observed. Key parameters measured include the time spent in open arms, which indicates reduced anxiety, the number of entries into open arms, reflecting the animal's willingness to explore potentially aversive environments, and the time spent in closed arms, serving as an index of anxiety, given rodents' general preference for enclosed spaces. The EPM provides valuable insights into anxiety-related responses and is a well-established tool in behavioral neuroscience research.[12]

Passive Avoidance Test:

The Passive Avoidance Test is a widely used behavioral assessment in neuroscience and psychology to evaluate learning and memory in rodents, typically rats or mice. The test exploits the animals' natural aversion to well-lit and open spaces. The setup involves a two-chambered box with one illuminated and the other dark, separated by a guillotine door, and an electrifiable floor for delivering mild foot shocks. The procedure includes habituation, a training session where a foot shock is associated with entry into the dark chamber, and a testing session conducted after a retention interval. Parameters measured include acquisition latency (time to enter the dark chamber during training) and retention latency (time to enter during testing), providing insights into memory retention of the aversive experience. The Passive Avoidance Test is a valuable tool for studying cognitive functions and memory processes in rodent models.[13]

RESULT & DISCUSSION

Determination of Acute Toxicity Study as per OECD Guideline:[14]

Acute oral toxicity of extract of Myristica fragrans seeds and Mucuna pruriens seed was carry out using female, mice (18-25g). All the animals were fasted for 3 hours with water ad libitium prior to the experiment. The extracts were administered in dose of 100 mg/kg p.o. to group of mice (n=3) and percentage mortality was noted after 24 h and daily thereafter for total 14 days. The procedure is evaluated for all the plants extract. No lethal effect or mortality was observed in animals throughout the test period following single oral administration at all selected dose levels of all extract.

S.No	Group (n=6)	Treatment	Mortality After 7 days	Mortality after 14 days
1.	Group-I (Control group (placebo))	Normal Control	No mortality	No mortality
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	No mortality	No mortality
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	No mortality	No mortality
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	No mortality	No mortality
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	No mortality	No mortality

Determination of locomotive assessment using morris water maze test: Grouping of animals

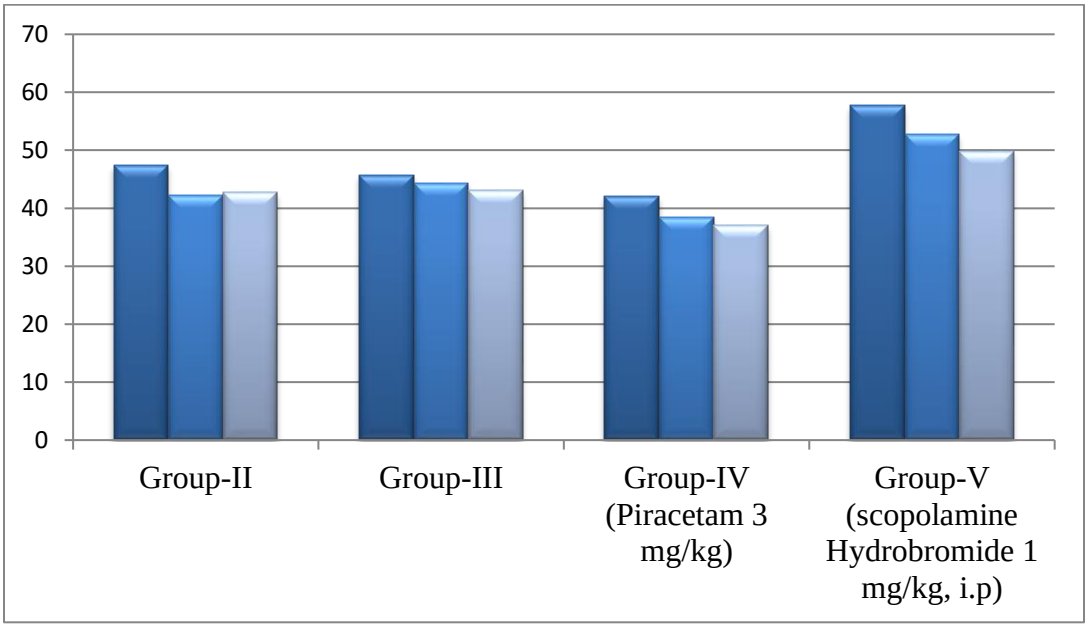
The study assesses the impact of various plant extracts on the acquisition phase of Morris Water Maze (MWM) tests in aged mice, utilizing escape latency as a measure of spatial learning and memory. The control group (Group-I) receiving a placebo shows a typical learning curve, indicating normal cognitive function. However, groups treated with Myristica fragrans extract (Group-II) or Mucuna pruriens extract (Group-III) at 100 mg/kg display elevated escape latencies, suggesting potential adverse effects on spatial memory acquisition. In contrast, the Piracetam-treated group (Group-IV) exhibits a decrease in escape latency across sessions, indicating a positive influence on spatial learning and memory. This aligns with Piracetam's known cognitive-enhancing properties. The disease control group (Group-V) receiving scopolamine hydrobromide (1 mg/kg) shows increased escape latency, indicating induced cognitive deficits. Overall, the findings suggest that Piracetam has a beneficial impact, while Myristica fragrans and Mucuna pruriens extracts may have negative effects on spatial learning in aged mice.

TABLE 5... Effect of different extracts of plants extract on the acquisition phase in MWM tests of the aged mice.

S.No	Group (n=6)	Treatment	Escape Latency (s) session		
			1	2	3
1.	Group-I (Control group (placebo))	Normal Control	39.52	34.97	29.94
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	47.38	42.28	42.75

3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	45.75	44.37	43.08
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	42.05	38.52	37.05
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	57.72	52.75	49.87

Effect of different extracts of plants extract on the acquisition phase in MWM tests of the aged mice.



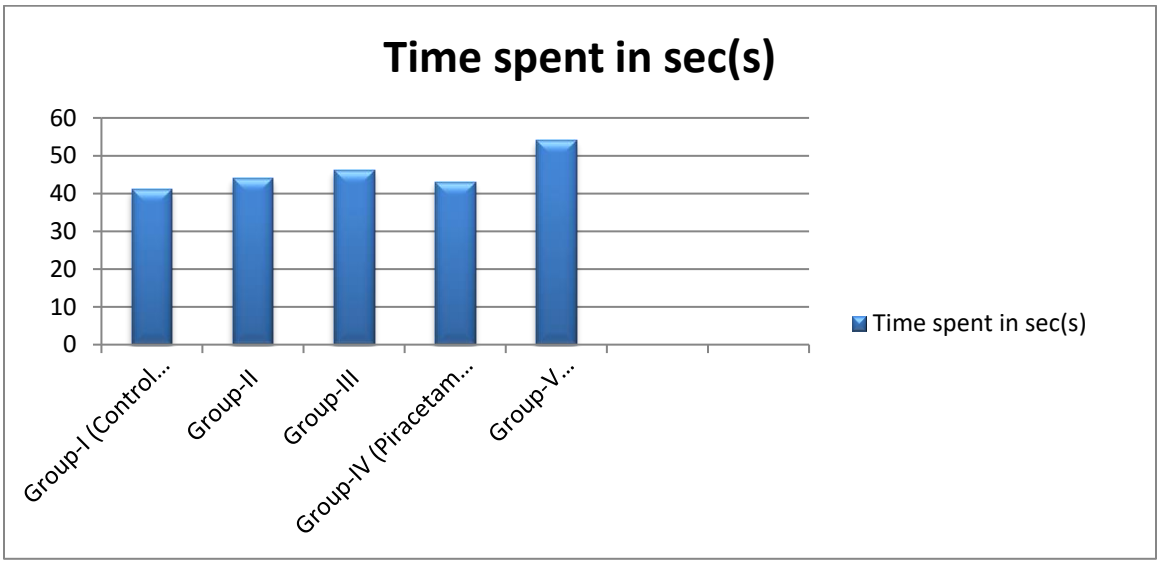
Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed

The evaluation of locomotor activity in mice using the Elevated Plus Maze provides insights into the behavioral effects of Myristica fragrans and Mucuna pruriens seed extracts. The placebo group (Group-I) exhibits a baseline time of 41.05 seconds in the open arms, indicating standard locomotor activity without treatment-induced changes. Group-II, treated with Myristica fragrans extract (100 mg/kg), spends 44.05 seconds in the open arms, potentially suggesting a impact on locomotion and reduced anxiety. Similarly, Group-III, treated with Mucuna pruriens extract (100 mg/kg), shows a time of 46.11 seconds in the open arms, indicating a potential influence on locomotion and reduced anxiety. Group-IV, administered Piracetam (3 mg/kg), known for cognitive enhancement, exhibits a time of 43.06 seconds in the open arms, suggesting an impact on locomotion. Conversely, Group-V, the disease control receiving Scopolamine Hydrobromide (1 mg/kg), spends 54.06 seconds in the open arms, indicating alterations in locomotor activity, likely influenced by the cognitive deficits induced by scopolamine. Overall, the findings suggest potential effects of Myristica fragrans and Mucuna pruriens extracts on locomotion and anxiety-like behavior, with Piracetam and scopolamine also influencing these parameters.

Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed (Time in Open Arms)

S.no	Group	Treatment dose	Time spent in sec(s)
1.	Group-I (Control group (placebo))	Normal Control	41.05
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	44.05
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	46.11
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	43.06
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	54.06

Time in Open Arms



Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed (Time in Open Arms) (Time in Closed Arms)

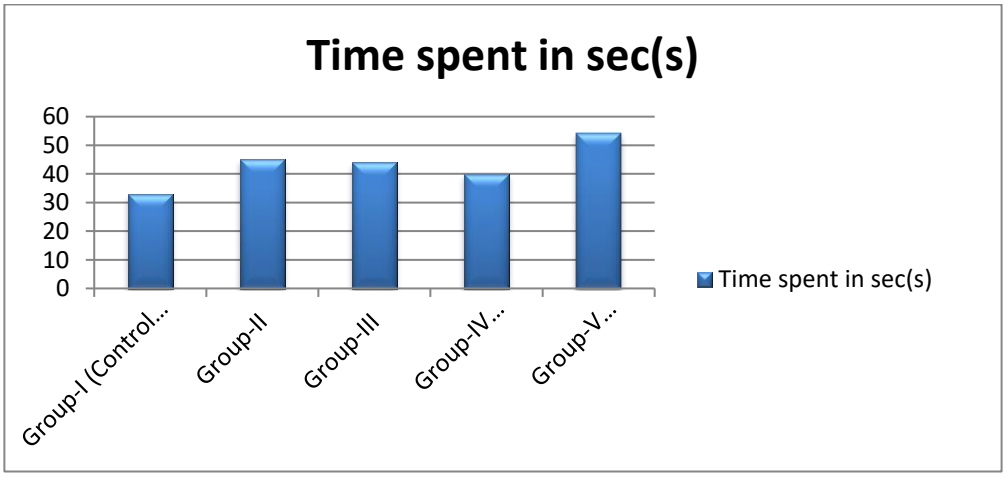
The evaluation of locomotor activity in mice using the Elevated Plus Maze provides valuable insights into the behavioral effects of Myristica fragrans and Mucuna pruriens seed extracts, particularly regarding the time spent in the closed arms. The placebo group (Group-I) exhibits a baseline time of 32.86 seconds in the closed arms, indicating standard locomotor activity without treatment-induced changes. In Group-II (Myristica fragrans extract at 100 mg/kg), the time spent in the closed arms increases to 45.08 seconds, suggesting a potential impact on locomotion and heightened anxiety-like behavior. Similarly, Group-III (Mucuna pruriens extract at 100 mg/kg) shows a time of 44.08 seconds in the closed arms, indicating an influence on locomotion and anxiety-like behavior. Group-IV, administered Piracetam (3 mg/kg), displays a time of 39.99

seconds in the closed arms, suggesting potential alterations in locomotor activity and emphasizing Piracetam's multifaceted effects. Conversely, Group-V, the disease control receiving Scopolamine Hydrobromide (1 mg/kg), spends 54.27 seconds in the closed arms, indicating substantial changes in locomotor activity, aligning with scopolamine's known impact on inducing cognitive deficits and altering behavior. Overall, these findings highlight the potential behavioral effects of Myristica fragrans and Mucuna pruriens extracts on locomotion and anxiety-like behavior, with Piracetam and scopolamine also influencing these parameters.

Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed (Time in Closed Arms)

S.no	Group	Treatment dose	Time spent in sec(s)
1.	Group-I (Control group (placebo))	Normal Control	32.86
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	45.08
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	44.08
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	39.99
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	54.27

Time in Closed Arms



Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed

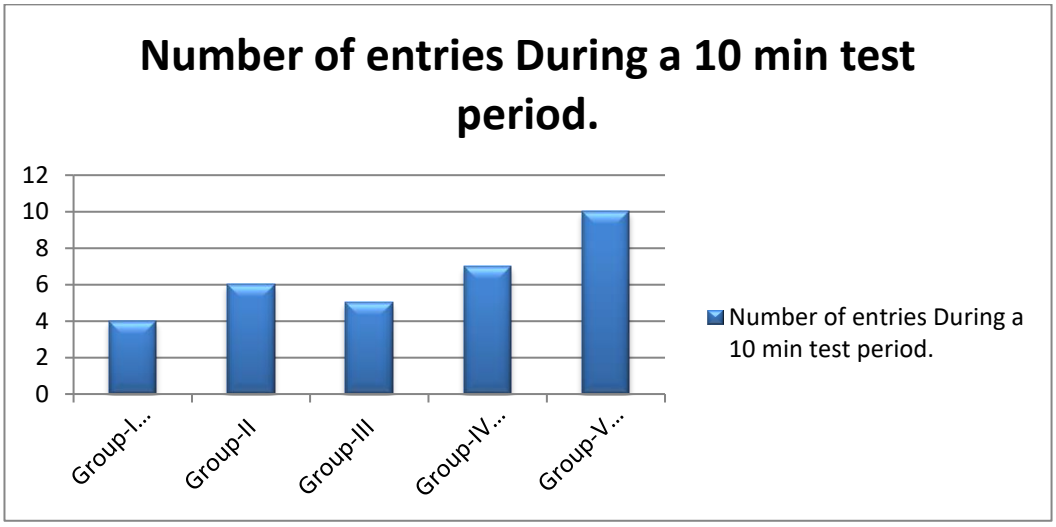
In the Elevated Plus Maze, mice treated with Myristica fragrans extract (Group-II) exhibit increased entries into closed arms, suggesting heightened exploratory behavior and potentially lower anxiety. Mice receiving Mucuna pruriens extract (Group-III) show a moderate level of entries comparable to the control group. Piracetam-treated mice (Group-IV) display

increased entries, aligning with its cognitive-enhancing properties. The disease control group with Scopolamine Hydrobromide (Group-V) exhibits a significant increase in entries, potentially indicating lowered anxiety or hyperactivity induced by scopolamine. Overall, these results highlight diverse behavioral responses to the extracts and drugs in terms of exploratory behavior and anxiety levels.

Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed (Number of Entries in Closed Arms)

S.no	Group	Treatment dose	Number of entries During a 10 min test period.
1.	Group-I (Control group (placebo))	Normal Control	4
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	6
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	5
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	7
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	10

Number of Entries in Closed Arms



Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed (Number of Entries in Open Arms)

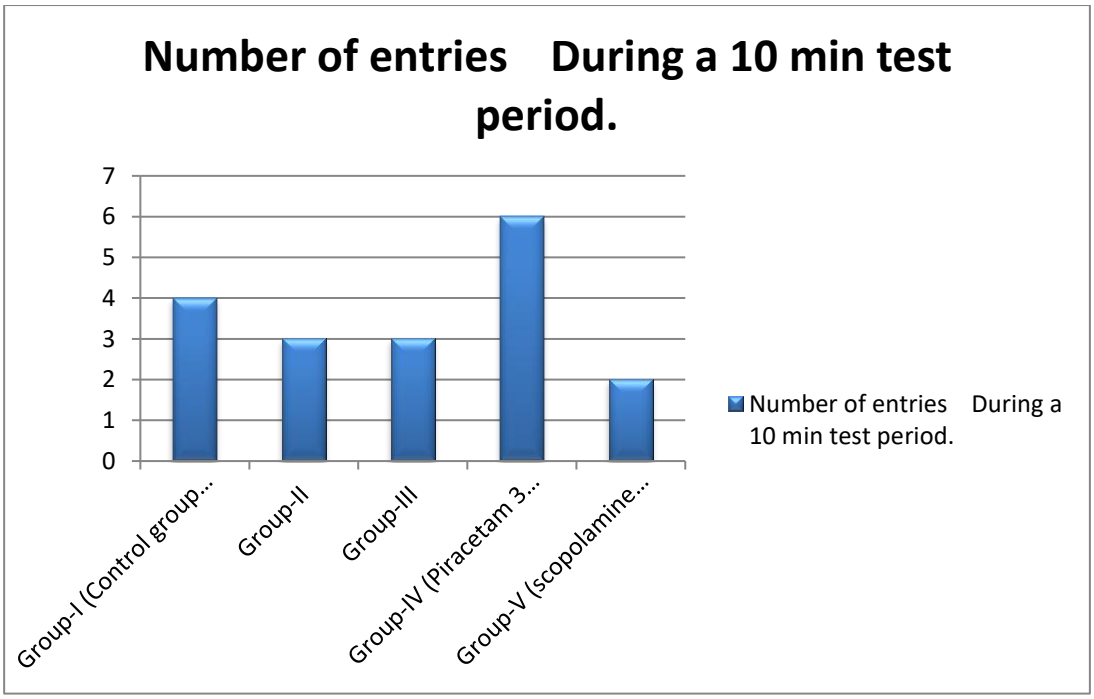
The locomotor assessment in the Elevated Plus Maze reveals insights into the exploratory behavior and anxiety levels of mice exposed to Myristica fragrans and Mucuna pruriens seed extracts. The placebo-treated control group (Group-I) exhibits 4 entries into the open arms, representing a baseline. In Group-II (Myristica fragrans extract at 100 mg/kg), there is a decrease to 3 entries, suggesting reduced exploratory behavior and increased anxiety. Similarly, Group-III (Mucuna pruriens extract at 100 mg/kg) also shows 3 entries, indicating decreased exploration and heightened anxiety.

Conversely, Group-IV (Piracetam at 3 mg/kg) displays an increase with 6 entries, suggesting heightened exploration and potentially lower anxiety, aligning with Piracetam's cognitive-enhancing properties. Group-V (Scopolamine Hydrobromide at 1 mg/kg) exhibits 2 entries, potentially indicating decreased exploration and heightened anxiety, influenced by the sedative or cognitive-disrupting effects of scopolamine. Overall, these results underscore diverse behavioral responses to the extracts and drugs in terms of exploratory behavior and anxiety levels.

Determination of locomotive assessment using Elevated Plus Maze of Myristica fragrans seeds and Mucuna pruriens seed (Number of Entries in Open Arms)

S.no	Group	Treatment dose	Number of entries During a 10 min test period.
1.	Group-I (Control group (placebo))	Normal Control	4
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	3
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	3
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	6
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	2

Number of Entries in Open Arms



Passive Avoidance Test

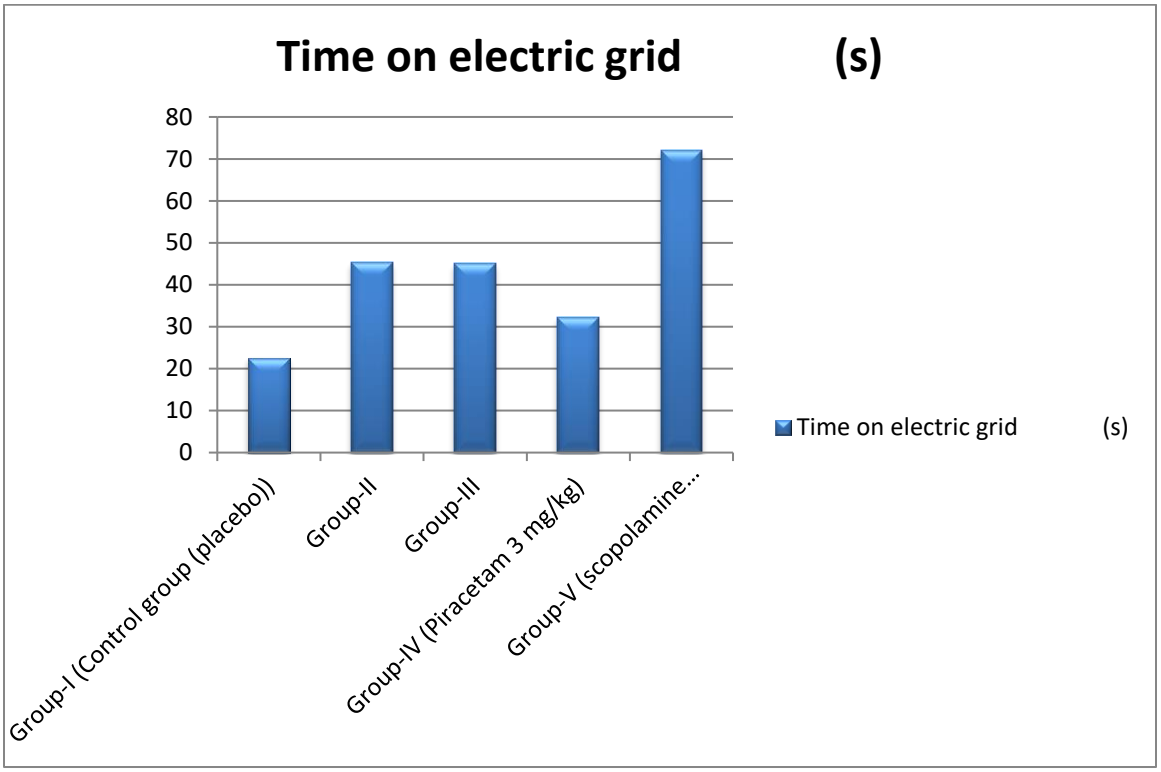
Determination of locomotive assessment using Step-Down Test:

The assessment of memory deficits using the step-down passive avoidance test reveals distinct effects of Myristica fragrans and Mucuna pruriens seed extracts. In the placebo-treated control group (Group-I), animals exhibit a baseline time of 22.56 seconds on the electric grid, indicating normal memory function. Group-II, treated with Myristica fragrans extract (100 mg/kg), shows a significant increase to 45.34 seconds, suggesting a potential exacerbation of memory deficits. Similarly, Group-III, treated with Mucuna pruriens extract (100 mg/kg), displays an extended time of 45.06 seconds, indicating a potential negative impact on memory function comparable to Myristica fragrans extract. In contrast, Group-IV, administered Piracetam (3 mg/kg), exhibits a time of 32.17 seconds, indicating a positive impact on memory retention. Group-V, the disease control receiving Scopolamine Hydrobromide (1 mg/kg), exhibits a significantly prolonged time of 72.05 seconds, aligning with scopolamine's ability to induce memory deficits. These findings highlight potential memory-affecting properties of Myristica fragrans and Mucuna pruriens extracts, with Piracetam demonstrating a positive impact, and scopolamine serving as a valid disease control.

Effect of different extracts Myristica fragrans seeds and Mucuna pruriens seed on memory deficits of the animals in the step-down passive avoidance test.

S.No	Group (n=6)	Treatment	Time on electric grid (s)
1.	Group-I (Control group (placebo))	Normal Control	22.56
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	45.34
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	45.06
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	32.17
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	72.05

Effect of different extracts Myristica fragrans seeds and Mucuna pruriens seed on memory deficits of the animals in the step-down passive avoidance test



Determination of locomotive assessment using Step-Down Test:

The step-down passive avoidance test was employed to assess the impact of Myristica fragrans and Mucuna pruriens seed extracts on memory deficits, with a focus on the time spent in the safety zone as a measure of memory retention. In the placebo-treated control group (Group-I), animals exhibit a baseline time of 220.05 seconds, indicating normal memory function. Group-II, treated with Myristica fragrans extract (100 mg/kg), shows a significant decrease to 175.08 seconds, suggesting a potential exacerbation of memory deficits. Similarly, Group-III, treated with Mucuna pruriens extract (100 mg/kg), displays a decreased time of 180.11 seconds, indicating a potential negative impact on memory function. In contrast, Group-IV, administered Piracetam (3 mg/kg), exhibits an increased time of 205.06 seconds, suggesting a positive impact on memory retention. Group-V, the disease control receiving Scopolamine Hydrobromide (1 mg/kg), exhibits a significantly decreased time of 130.10 seconds, aligning with scopolamine's ability to induce memory deficits and validating its role as a disease control. These findings underscore potential memory-affecting properties of Myristica fragrans and Mucuna pruriens extracts, with Piracetam demonstrating a positive impact, and scopolamine serving as a valid disease control.

Effect of different extracts Myristica fragrans seeds and Mucuna pruriens seed on memory deficits of the animals in the step-down passive avoidance test (Time spent on safety zone)

S.No	Group (n=6)	Treatment	Time on safety zone (s)
1.	Group-I (Control group (placebo))	Normal Control	220.05
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	175.08
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	180.11
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	205.06
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	130.10

Effect of different extracts Myristica fragrans seeds and Mucuna pruriens seed on memory deficits of the animals in the step-down passive avoidance test (Time spent on safety zone)

Open field apparatus test

The open field apparatus test is utilized to assess behavioral responses in animals, including ambulation, center activity, rearing, and fecal dropping. In the placebo-treated control group (Group-I), animals exhibit baseline behaviors, with 30 ambulations, moderate center activity (4), rearing behaviors (2), and minimal fecal droppings (1). Group-II, treated with Myristica fragrans extract (100 mg/kg), shows increased ambulation (34), elevated center activity (5), and

heightened rearing behaviors (5), indicating heightened exploration. Group-III, treated with Mucuna pruriens extract (100 mg/kg), displays increased ambulation (35), center activity (6), and rearing behaviors (5), suggesting increased exploration and alertness. Group-IV, administered Piracetam (3 mg/kg), exhibits increased ambulation (38) and behaviors similar to the control group. In contrast, Group-V, the disease control with Scopolamine Hydrobromide (1 mg/kg), shows higher ambulation (45), increased center activity (7), reduced rearing behaviors (3), and more fecal droppings (3), possibly indicating hyperactivity or heightened anxiety. Overall, these findings reveal the behavioral impact of Myristica fragrans and Mucuna pruriens extracts, Piracetam, and Scopolamine Hydrobromide in the open field test.

Open field apparatus test

Group No	Treatment	Dose (mg/kg)	Ambulation (N)	Activity in Centre (N)	Rearing (N)	Fecal dropping (N)
1.	Group-I (Control group (placebo))	Normal Control	30	5	4	2
2.	Group-II	Myristica fragrans extract treatment 100 mg/kg	34	6	5	1
3.	Group-III	Mucuna pruriens extract treatment 100 mg/kg	35	6	5	1
4.	Group-IV (Piracetam 3 mg/kg)	Standard drug	38	5	4	2
5.	Group-V (scopolamine Hydrobromide 1 mg/kg, i.p)	Disease control	45	7	3	3

Conclusion

In conclusion, the data suggests that Myristica fragrans and Mucuna pruriens extracts, administered at the specified dosage, may have negative impacts on spatial learning and memory in aged mice during the acquisition phase of the Morris Water Maze test. Piracetam, a standard cognitive enhancer, appears to have a positive effect, while scopolamine-induced cognitive deficits are evident in the disease control group.

In terms of locomotor activity and anxiety-like behavior, the extracts from Myristica fragrans and Mucuna pruriens seeds may influence these parameters, as indicated by the time spent in the open arms of the Elevated Plus Maze. Piracetam also shows an impact on locomotion, while scopolamine induces alterations, aligning with its known effects on cognitive function. The assessment of locomotor activity and anxiety-like behavior in the closed arms of the Elevated Plus Maze and the number of entries into the closed arms further supports the potential influence of Myristica fragrans and Mucuna pruriens extracts on exploratory behavior and anxiety levels in mice. Piracetam's effects on locomotion are also noted, while scopolamine induces changes indicative of altered anxiety levels and hyperactivity. The step-down passive avoidance test suggests that Myristica fragrans and Mucuna pruriens extracts may exacerbate memory deficits, evidenced by reduced time spent in the safety zone. In contrast, Piracetam demonstrates a positive impact on memory retention, while scopolamine induces significant memory impairments.

In summary, the data suggests that Myristica fragrans and Mucuna pruriens extracts may negatively impact spatial learning, memory, and anxiety-related behaviors in aged mice. Piracetam, a cognitive enhancer, shows positive effects, while scopolamine induces cognitive deficits as a disease control. The findings contribute to a comprehensive understanding of the behavioral outcomes associated with the administration of these plant extracts.

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Conflict of interest

Authors declared no conflict of interest.

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