



NEUROPROTECTIVE EFFECT OF ABELMOSHIOUS ESCULENTUS

Physiology

Shabina Komath Chenoly Assistant Professor, Department of Physiology, Vydehi Institute of Medical Sciences and Research centre, Bangalore

Shankarappa C Professor, Department of Physiology, Vydehi Institute of Medical Sciences and Research centre, Bangalore

Venkata Bharat kumar Pinnelli Professor, Department of Biochemistry, Vydehi Institute of Medical Sciences and Research centre, Bangalore

ABSTRACT

Background: Aluminum is a neurotoxic substance that can lead to neurodegenerative diseases. our research aimed to explore how *Abelmoschous esculentus* affects aluminum chloride (AlCl₃)-induced memory loss in swiss albino mice **Methods:** The study involved extracting *A. esculentus* L. pod powder using ethanol to evaluate its dementia in activity in experimental mice with Aluminum chloride induced memory loss. The mice were divided into five groups: the positive control group, negative control group, animals treated with the *A. esculentus* extract and exposure to aluminium chloride, animals exposed to aluminium chloride followed by *A. esculentus* extract treatment and donepezil, and mice groups administered with Aluminium chloride and donepezil. **Results:** The results from the RAM data indicated that administering AlCl₃ at a dose of 200 mg/kg/bodywt, for a duration of 45days led to a noticeable decline in spatial learning abilities in mice. **Conclusion:** Our findings indicate that *Abelmoschous esculentus* shows promise as a viable treatment option for conditions related memory impairment.

KEYWORDS

INTRODUCTION

Maintaining a balance of metal ions in the body is crucial for normal cognitive function[1]. When this balance is disrupted, it can play a significant role in the progression various neurodegenerative diseases. Aluminum, commonly found in household products, has been associated with various bone, blood, and brain disorders when excessively used [2]. Previous studies have identified aluminum as a major risk factor for the development of amyotrophic lateral sclerosis, dementia, Parkinsonism, and Alzheimer's diseases [3].

Alzheimer's disease (AD) is currently incurable, and no treatment exists that can halt the disease's progression [4,5,6]. The cholinergic hypothesis suggests that memory loss and cognitive impairment in AD are caused by a decrease in cholinergic function [7,8]. The current approach to AD treatment involves using acetylcholinesterase inhibitors (AChEi) to enhance cholinergic transmission in the synaptic cleft. Some AChEi drugs, such as galantamine, rivastigmine, and donepezil, are used to modestly improve cognitive and functional abilities [9]. Although these medications do not slow the disease's progression, they provide some benefits [10]. Since rivastigmine and galantamine are derived from natural sources, further investigation into naturally occurring compounds may lead to the discovery of more effective AChEi alternatives

In a study conducted by Shabina in 2023, it was discovered that administering *Abelmoschous esculentus* (okra) supplements to mice experiencing chronic stress resulted in restoring the memory. The primary aim of this research was to examine how the simultaneous use of *Abelmoschous esculentus* (okra) and aluminum chloride in mice could potentially offer protection against spatial working memory deficits caused by aluminum chloride.

MATERIALS AND METHODS

Experimental design:

- Mice were categorized into Five groups and each group contained six animals (n=6).
- Group 1 mice were maintained as a control group.
- Group 2 mice given aluminium chloride.
- Group 3 mice were orally given ethanol extract of Okra pods (200mg/kg/bwt) by dissolved in sterile water followed by the administration of Aluminium chloride.
- Group 4 mice were given standard drug Donepezil (2mg/kg/bwt).
- Group 5 mice were orally administered with Donepezil (2mg/kg/bwt) and ethanolic extract of *Abelmoschous esculentus* (200mg/kg/bwt).
- Mice were given regular oral doses of both Donepezil and ethanol extract for a period of 45 days. The mice were then assessed for

their working memory and reference memory.

Radial Arm maze

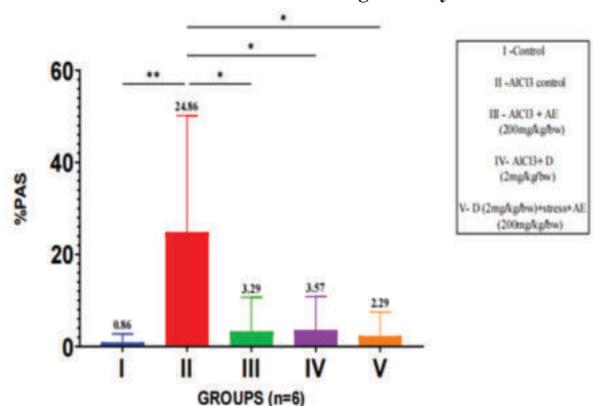
In this study, researchers evaluated the working memory and reference memory of mice using a wooden platform apparatus [11]. The platform had 1-8 arms, each measuring 12 cm wide and 48 cm long, raised 50 cm above the floor, with eight arms radiating from a central area of 32 cm in diameter. At the end of three arms, food cups containing Kelloggs (choco chips) were placed permanently. Before conducting the RAM (Radial Arm Maze) test, the mice were given access to food. During the trail training phase, the mice were placed at the center of the RAM and allowed to eat the food placed at the end of the arm platform.

During the 8-day test, we evaluated the mice's working memory and reference memory using a Radial Arm Maze (RAM). The mice were positioned in the center of the maze, facing one of the arms. Throughout the training phase, the mice encountered four arms out of the eight, specifically arms two, three, six, and eight, that were baited with food. In this context, reference memory was assessed by recording the instances when the mice entered arms that were not baited with food. On the other hand, working memory was evaluated by monitoring the mice's entry into arms that already contained food and had been baited before during the training.

In summary, the experiment aimed to understand the mice's ability to remember the correct arms with food (reference memory) and their ability to recall recently visited baited arms (working memory)

RESULTS

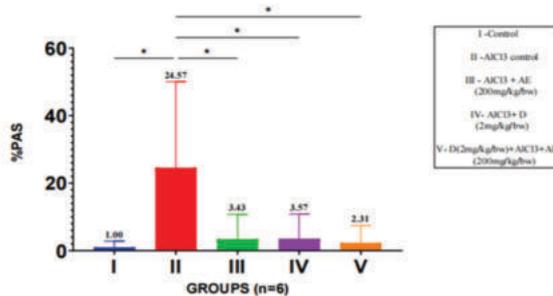
Effect of Various Treatments on Working Memory Performance



The study investigated the effects of different treatments on working memory performance in AICl₃+ AL-Treated Mice showed that mice treated with both AICl₃ and AE showed increased working memory compared to AICl₃-treated mice, suggesting an improvement in working memory.

Effect of Various Treatments on Reference Memory

REFERENCE MEMORY ERROR - AIC₃ INDUCED MICE



A significant improvement in reference memory was seen in *Abelmoschous esculentus* treated mice when compared to untreated mice.

DISCUSSION

Our research aimed to explore how *Abelmoschous esculentus* affects memory performance and oxidative stress in the brains of mice treated with AICl₃ (aluminum chloride).

This study yielded significant findings. Firstly, we observed that exposure to aluminium led to a decline in spatial working memory in mice. Secondly, when *Abelmoschous esculentus* and aluminium were administered together, the spatial working memory performance improved, indicating that *Abelmoschous esculentus* might play a role in preventing aluminium-induced behavioral impairment. Thirdly, our investigation into oxidative stress corroborated the behavioral data, suggesting that the spatial working memory deficit might be linked to oxidative stress in the cortical and subcortical brain tissues. Lastly, when administered concurrently with aluminum chloride, the effect of *Abelmoschous esculentus* on spatial working memory was similar to that of diazepam.

The radial arm maze test is a hippocampal-dependent assessment used to measure spatial working memory, as indicated by previous studies (Zhang and O'Donnell, 2000; Sun et al., 2007; Hodges et al., 2009; Al-Amin et al., 2016). In this experiment, mice were tasked with locating a target arm while making fewer errors (incorrect entries). The swiftest re-entry to the target arm indicated that the mice encoded spatial information from the baited arm, which was not directly visible, relying on hippocampal encoding and retrieval of spatial memory.

Our study using the radial arm maze test revealed that mice exposed to aluminium made more mistakes in finding the target arm. Additionally, these aluminium-exposed mice tended to visit arms that did not contain the target. These findings suggest that aluminium treatment impairs spatial working memory formation. The administration of aluminium chloride also led to a decline in spatial memory performance, as evident from the radial arm maze test results. These results align with previous research in this area.

However, when mice were treated with both Donepezil and aluminium, they showed improved memory of food-containing arms in the radial-arm maze (RAM) test. The RAM test is a reliable way to assess learning and memory in various species, including rats and mice (Levin, 2015). The RAM test device has seven options, providing the animals with opportunities to make mistakes by entering the wrong arm.

The results showed that mice treated with *Abelmoschous esculentus* and aluminium together performed better in the RAM test compared to the group treated with aluminium alone. They spent less time picking up food and also spent more time in the arms containing food. These findings align with a previous study demonstrating improved learning and memory performance (Ritter and Cummings, 2015).

Collectively, there is a potential association between aluminium exposure and spatial working memory issues in animals. Conversely,

Abelmoschous esculentus has been found to counteract the negative impact of aluminium on spatial working memory, suggesting its potential cognitive benefits. However, the precise mechanism responsible for the impairment of spatial working memory due to aluminium exposure remains unknown.

When comparing the impact of *Abelmoschous esculentus* with donepezil on aluminium-induced spatial working memory deficit, we observed no significant difference. Previous studies have demonstrated that *Abelmoschous esculentus* extract improves spatial working memory deficits induced by aluminium chloride and scopolamine in mice. It is likely that the underlying mechanism behind these behavioral findings is similar.

CONCLUSION-

our study led to a conclusion that *Abelmoschous esculentus*, helped to restore memory so could be helped in treatment of neurodegenerative diseases.

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