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STUDY ON THE EFFECT OF *TERMINALIA CHEBULA* ON ALUMINIUM CHLORIDE INDUCED ALZHEIMER'S DISEASE IN CARASSIUS AURATUS

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ABSTRACT

Terminalia chebula extract is well known for its neuroprotective activity. The plant has been studied for its potential therapeutic effects in various disease conditions like depression, cognitive dysfunction, arthritis pain etc. To study the neuroprotective effect of Terminalia chebula extract on Aluminium chloride-induced neurotoxicity in gold fish. Gold fish behavior was assessed in terms of height of the fish in the tank, light /dark test, T-maze and color preference test. The fish were divided in to 4 groups, each group containing 6 fish and neurotoxicity was induced with aluminium chloride in goldfish. The behavioral assessment was carried out. Compared to the control group, the moment decreased throughout the duration of Aluminium chloride treated. Movement was restored up on treatment with drug. When fish are exposed to Aluminium chloride, their mobility is confined to the upper part of the tank. Conversely, when treated with Terminalia chebula extract their movement gradually returns tonormal. Under normal conditions, goldfish tended to frequent the yellow area of the tank, whilelargely ignoring the red region. However, when exposed to Aluminium chloride, they showeda preference for the red zone. Following treatment with Terminalia chebula extract, most fish returned to visiting the yellow region instead of the red. Gold fish have strong preference for the dark zone. The treatment with Aluminium chloride causes goldfish motility was restricted to the dark zone. But terminalia

chebula treatment restored mobility.

KEYWORDS: Neurotoxicity, Terminalia chebula extract, Aluminium chloride, Carassius auratus.

INTRODUCTION

The central nervous system comprises of brain and spinal cord. The Glial cells are supportive cells in central nervous system the CNS that provide structural and metabolic support to neurons.

Alzheimer's disease is a chronic irreversible disease that effects the cells of the brain and causes impairment of intellectual functioning. The most common neurodegenerative causes of dementia are AD. The condition typically affects older individuals, with symptoms worsening over time. AD characterised by synaptic dysfunction and neurodegeneration, neuroinflammation, as well as vascular dysfunction. One of the other features is the loss of connection between neurons in the brain. There is significant degeneration in the cerebral cortex, particularly affecting memory and cognitive function. This combination of neuronal loss surrounded by heightened inflammatory state is thought to give rise to eventual decline in cognition seen in AD patients. In AD the Key neurological hallmark includes the accumulation of beta amyloid plaques outside neurons on the formation of neurofibrillary tangles composed of aggregated tau protein inside neurons. These pathological changes contribute of brain tissue and cognitive decline seen in AD. There is currently no known cure for AD, various medication and strategies can help support individuals with the condition. Medication such as cholinesterase inhibitors and memantine can help in the manage symptoms and slow down the cognitive decline in some cases. Additionally, non-pharmacological intervention like cognitive stimulation, physical exercise, and social engagement can also be beneficial in supporting with AD. Neurotoxicity is a term used to describe the harmful effects of substance on the brain or peripheral nervous system. The activities of nervous system adversely effected due to neurotoxicity. To prevent the neuronal cell death by interacting and preventing the pathogenic reaction that led to cellular malfunction and death. This process is known as neuroprotection. Neurotoxicity is of different form, including neuropathy, axonopathy, myelopathy and transmission toxicity. The main reason of toxicity is organ transplantation, radiation therapy, cosmetics, heavy metals such as lead, mercury and cadmium, insecticides, chemotherapy medications designed to kill fast-grouping cells, viral infection and plastic burnings etc Terminalia chebula

(TC)commonly known as Kadukkai or Haritaki in India is a rich source of phytochemicals along with medical properties. The powder show may pharmacological activity like antioxidant, free radical scavenging, anticarcinogenic, hepatoprotective, cardioprotective etc. Neurotoxicity from exposure to Aluminium chloride is known to result in damage of learning memory and cognitive function both from clinical observation and from animal experiment. Carassius auratus (CA) is fresh water fish in the family Cyprinidae of order Cypriniformes. Model organism is essential tool in biological research, offering insight into fundamental biological process. Gold fish have indeed been utilized in research to study neurodegenerative disease like AD and tauopathy.

MATERIALS AND METHODS

Fish models

In adult male healthy Gold fish is to be obtained from the approved animal breeders and water in aquarium tank and temperature maintained at 26±2◦c.

Chemicals

- Aluminium chloride: LABOGENS Fine Chem Industry, Ahmedabad, Gujrat, India
- Dimethyl sulfoxide (DMSO): Burgoyne Burbidge's & Co. (1) Dun apartment, 3rd Flr, Tradeo, Mumbai 400 007
- Drugs: Terminalia chebula powder (TC)- Chaytanya Agro herbals Anaganahally, Mandya district Karnataka India.

Graph pad prism

Graph pad prism is a versatile software used for analysing data and creating graph is scientific research. Its available for both window and mac computer with a wide range of analysis from basic T-tests to complex ANOVA and regression analyses. Prism is equipped to handle diverse statistical needs.

METHODS

Sl.no	Groups	Treatments	No. of animals
1	Groups I	Normal control	6
2	Groups II	Alcl3 treated	6
3	Groups III	Alcl3+TC	6
4	Groups IV	Neostigmine	6

4 groups of Gold fish were studied under controlled conditions with constant aerations and water parameter maintained.

Neurotoxicity was induced using 1.5g aluminium chloride, with Terminalia chebula administered as a potential treatment. various behavioural parameter was assessed, including colour preference, light/dark environments, T-maze.

Evaluating Parameters

1. Height of the fish in the tank

The height at which the fish swim in the tank was used as an indicator of the anxiety, with their positions (like bottom, middle or upper levels) serving as an index. During the 1 minute of observation fish were scored based on their behaviour.

i. The movement are mainly restricted to the bottom of the tank.
ii. Preference to lower two-third.
iii. All three points have equal explorations.
iv. Two-third is preference
v. Upper third exclusive presence2.Colour preference:

Colour preference of Gold fish was evaluated by observing their response to various colours especially the movement towards different colour region. The rating was assigned based on the fish's preference in red and yellow region.

3. Light/dark method

In the light/dark test of the goldfish displayed a notable dark zone preference. This behaviour is similar to rodents, which often avoid brightly illuminated area. This test commonly asses anxiolytic effect of rodents. Fill the apparatus with 4cm of water, the shallow tank limits bottom dwelling, a known anxiety behaviour in new environments. Therefore, the primary protective strategy observing on the dark area which serves as the measure in this tank.

4. T-maze test

Place food pellets in one arm of the T-maze. Then put the fish in the maze. After 5 minutes, fish moves to the arm with food. Next, returning the fish to another tank. After another 5 minutes place the fish into the T-maze. We noticed that the fish tends to move towards the arm where it found food before.

RESULTS AND DISCUSSION

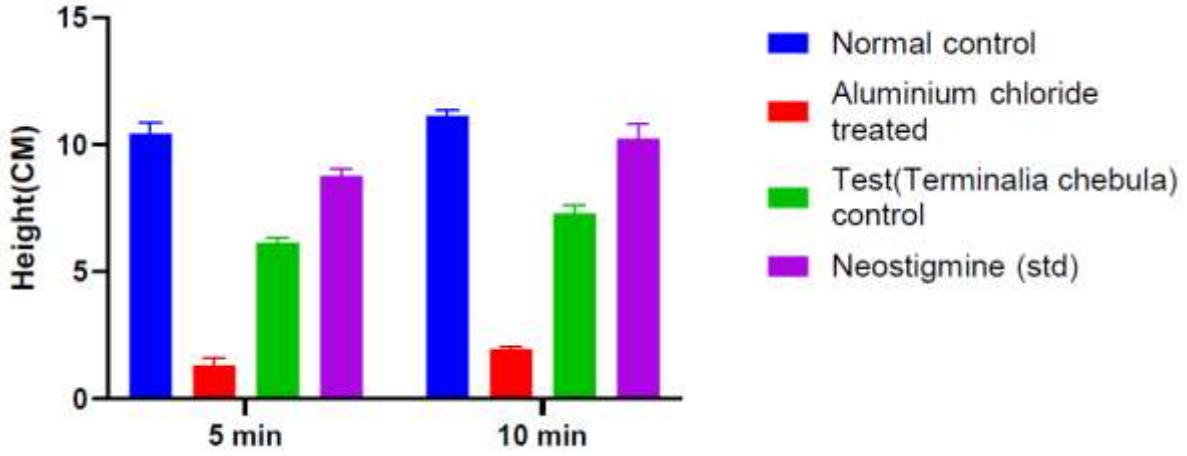
1. Height of the fish in the tank

The height of travelled by the fish was taken as the index of the anxiety. The height of the fish in the tank can be related to the cognitive function and behaviour. The height of the fish was observed at the 5mint and 10mint.

Table 1: The height of fish in the tank in 5 minutes and 10 minutes of various groups.

Groups	5 minutes				10 minutes			
Normal control	10	11	10.5	10.7	11	11.2	11	11.5
$Alcl_3$ treated	1.2	1.5	1	1.7	1.9	2.1	2	1.9
Test (Terminalia chebula)	6	6.2	6	6.5	7	7.3	7.7	7.5
Neostigmine(std)	8.5	9	9.1	8.8	10.5	9.5	11	10.5

Height of the Fish in tank



Groups

Fig 1: The height of the fish in tank in5mints and 10mints.

The values are evaluating statistically by using TWO WAY ANOVA. Expressing the values of Mean ±SEM P value, P=0.0249, P<0.0001, P<0.0001. This graph has been showed that there different significant between TC and standard group. TC is treatment is shows that statistically difference in height compared to Alcl3 treated group.

2. Light/dark test

Gold fish exhibits a distinct preference for dark zone. The aluminium chloride treatment is restricting the movement of goldfish in dark area. However, where the TC treated fish has the tendency to move towards the dark region.

3. Color preference

Groups	5 minutes				10 minutes			
Normal control	20	22	21	23	35	37	36	40
$AlCl_3$ treated	21	20	23	25	9	10	11	13
Test (Terminalia chebula)treated	12	10	11	13	25	20	27	30
Neostigmine (std)	29	28	30	31	35	38	36	40

From, this table has understood that control, drug treated and standard drug treated groups preferred yellow region than the red. while, aluminium chloride treated is preferred in yellow.

Table 2: Number of times fish visits in various groups (red and yellow region)

The table is depicting the number of visits of gold fish towards in red and yellow region of different groups. The TWO WAY ANNOVA was used to performing the statistical analysis of values using the Graph pad prism9 software.

Colour Preference

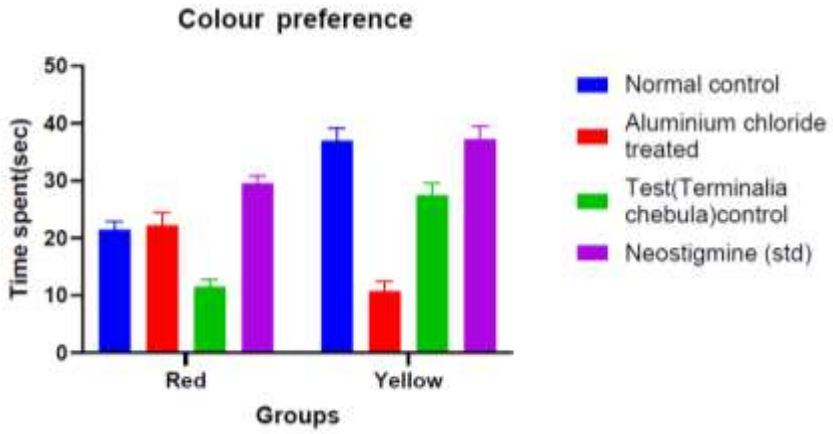


Fig.4: number fish towards the red and yellow region.

Statistically the values are evaluated by TWO WAY ANNOVA. The values are expressing to Mean ±SEM P value, P<0.0001, P<0.0001, P<0.0001.

4. T- maze test

Spatial memory of the gold fish was studied by using the T-maze apparatus. Here, the 4 sets of fishes are compared by observing their preference towards the arm containing food. The control, drug treated and standard groups showed the preference for arm containing food. It indicates that it has normal / improved cognitive function. In Aluminium chloride treated groups, they exhibit reduced navigation to the arm containing food which indicates their

impaired cognitive functions.

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