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MEMORY ENHANCER ACTIVITY OF ETHANOLIC EXTRACT OF SOLANUM LYCOPERSICUM (TOMATO) STEMS: AN VIVO STUDY

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ABSTRACT:

OBJECTIVE: To determine the Memory enhancer action of ethanolic extraction of Solanum lycopersicum (Tomato) stems by morris water maze test.

MATERIALS AND METHODS: Stems of Solanum lycopersicum was collected, dried and crushed. The stems were extracted with ethanolic by using maceration method of extraction. After the extraction phytochemical screening were performed. The ethanolic extract stems of Solanum lycopersicum was studied at dual dosage level (100mg/kg and 250mg/kg, in p.o. administration) in rats by applying MWM model. The animals are shared into 5 sets and every group contain 6 rats. Group I: The control group received oral administration of water. Group II received an i.p. admin of scopolamine (0.5 mg per kg) for negative control. Group III: Rats oral administration of Memantine standard (20 mg per kg) and AD caused by toxic agent (scopolamine). Set IV: Rats receive a low dosage of extract (100 mg/kg) orally, and Alzheimer's disease was created using scopolamine. Group V: Animals receive a high dosage of extract (250 mg/kg) orally and produced Alzheimer's using scopolamine.

Memory enhancer activity action of ethanolic extract of Solanum lycopersicum was estimated by MWM apparatus test. In MWM test, ethanol extract of Solanum lycopersicum showed. Ethanolic extracts of Solanum lycopersicum stems were investigated for Alzheimer protective activity in the MWM. Commonly utilized MWM to assess memory enhancer in animals. These demonstrated dose-dependent decline in EL time while increase in TSTQ.

RESULTS: Phytochemical investigation of Solanum lycopersicum ethanol excerpt exposed the existence of alkaloids, flavonoids, triterpenoids, phenols, and phenolic chemicals. Administration of memantine (20mg/kg p.o.) produced a significantly decrease the Alzheimer's behaviour when matched by control treated group. Admin of Solanum lycopersicum excerpt (100mg/kg & 250mg/kg) to rats significantly decrease the Alzheimer's like behaviour when matched through memantine cured group and it was found that abstract dose 250mg/kg show higher anti-Alzheimer activity than 100mg/kg dose of excerpt of Solanum lycopersicum.

CONCLUSION: Results suggest that stems of Solanum lycopersicum possess significantly anti-Alzheimer activity.

KEYWORDS: Solanum lycopersicum, memantine, anti-Alzheimer, MWM.

I. ALZHEIMER'S DISEASE

AD are long-lasting neurodegeneration illness these are commonly starts gradually and characterized by difficulty in remembering recent events. It is characterized by short term memory loss, poor thinking ability.

Dementia:

Dementia has developed as a worldwide healthiness concern. Rendering to the WHO 2022 roadmap for dementia investigation, an expected 55.2 million people worldwide are suffered. Incidence amongst persons above oldness of 60 differs via geography, through Southeast Asia at 2.9%, Europe at 6.5%, and other regions ranging from 3.1% to 5.7%. Dementia is charming more communal in general, yet it is decreasing in certain high-income countries. By 2030, the predictable number of persons through dementia would have risen to 78 million. AD, is most common form of dementia, follows alike epidemiological tendencies and constitutes an crucial and rising global warning [1]. These illness initiates gradually and get worse over time. Alzheimer's illness is primarily defined by dementia, which is marked by a worsening in mental functions such as memory, praxis, and orientation. Quick sickness symptoms include short time memory damage, failure to learn new things, mood changes, trouble locating words, disremembering designations, and misplacing stuff. Patients through Alzheimer's illness usually exhibit defeat, aggression, and irritability. In severe cases, people become completely incontinent, forget their memories, and lose track of period and place. Antioxidants, for sample, are desirable kinds for together inhibition and management because they can stop the radical chain reaction, reducing ROS formation. This species have likewise been demonstrated to improve the efficacy of predictable managements when utilized in conjunction. Scopolamine, an antimuscarinic medication, increases AChE action in cortex and hippocampus via effectively. Scopolamine causes cerebral blood flow to decrease due to cholinergic hypofunction. Scopolamine also produces ROS, Long-lasting scopolamine admin caused severe histological abnormalities in cerebral cortex, containing neuronal death [2].

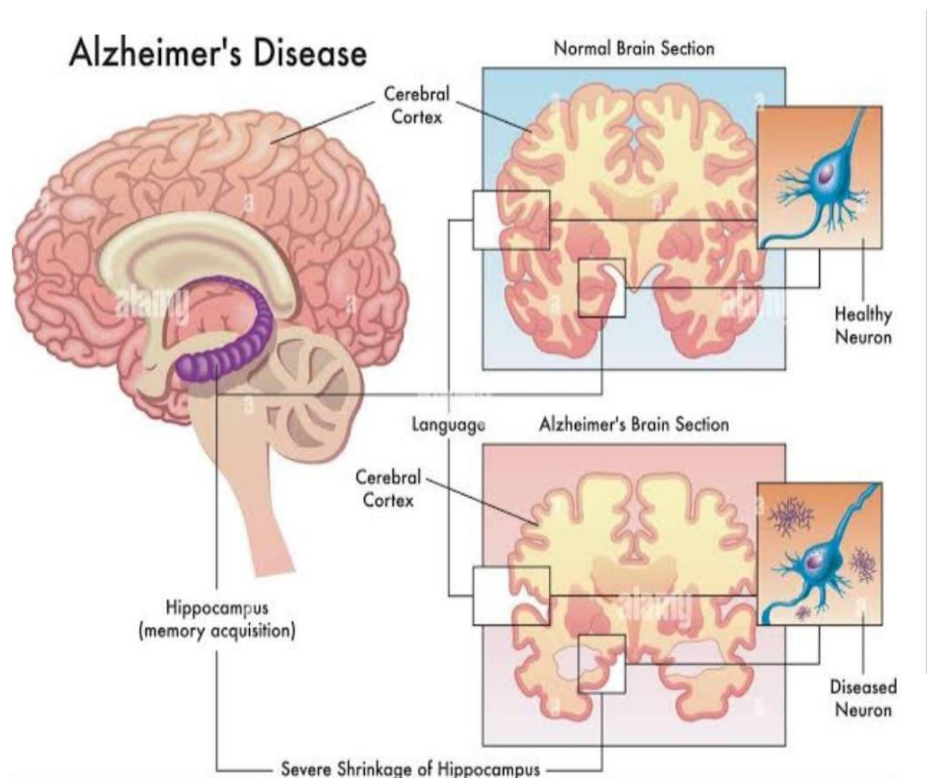


Figure 1. Alzheimer's illness

1.1. Types of AD:

1.1.1. Quick-Onset AD:

Progresses beforehand oldness of 65. Often, but not always, associated with a genetic component. Symptoms can appear more rapidly than in late-onset cases.

1.1.2. Late-Onset AD:

The greatest communal form, developing after age of 65. While hereditary issues can show a role, lifestyle and environmental factors are also considered influential.

1.1.3. Familial Alzheimer's Disease (FAD):

A unusual, genetic system of Alzheimer's. Triggered via specific gene mutations that are passed down through families. Often, individuals with FAD develop signs at a younger age than persons through late-onset Alzheimer's[3].

1.1.4. Other Presentations and Subtypes:

Posterior Cortical Atrophy (PCA): It mostly affects the back and upper-rear parts of the brain, influencing visual processing and spatial awareness. Early signs may include issues with vision, reading, and spatial judgment.

- ❖ **Logopenic Aphasia:** Involves damage to language areas of the brain, leading to speech difficulties, such as long pauses and labored speech.
- ❖ **Frontal Variant Alzheimer's Disease:** Impacts the frontal lobes, causing problems with planning, decision-making, and social behaviour.

1.1.5. Stages of Alzheimer's Illness:

- ❖ **Mild Alzheimer's:** Memorial harm, trouble with familiar tasks, and variations in mood and personality are common.
- ❖ **Moderate Alzheimer's:** Worsening memory, confusion, difficulty recognizing loved ones, and changes in behavior like hallucinations or paranoia.
- ❖ **Severe Alzheimer's:** Inability to communicate, complete dependence on others for care, and physical decline[4].

1.1.6. Mixed Dementia:

A combination of Alzheimer's illness and another type of dementia, utmost usually vascular dementia.

1.2. Causes of AD:**1.2.1. Protein Abnormalities:**

Amyloid Plaques: Beta-amyloid protein fragments cluster calm, forming plaques that disturb communiqué among head cells.

Tau Tangles: Tau proteins twist into tangles within neurons, interfering with the transportation of nutrition and other vital particles.

1.2.2. Genetic Factors:

Quick-onset Alzheimer's: Rare cases of quick-onset Alzheimer's (affecting individuals in their 30s to mid-60s) can be caused by specific gene mutations passed down through families.

Late-onset Alzheimer's: While most cases are not solely caused by genetics, certain genes like APOE4 can rise the threat of increasing the disease future in lifespan[5].

1.2.3. Age:

Age is the utmost substantial hazard reason for Alzheimer's illness. The threat of increasing the illness doubles around each 5 yrs. afterward age of 65[6].

1.2.4. Lifestyle and Environmental Factors:

- **Cardiovascular Health:** Situations alike hypertension, great cholesterol, hyperglycemia, and fatness can growth the risk.
- **Physical Inactivity:** Lack of exercise is linked by a advanced risk.
- **Food:** An unhealthy diet can contribute to the risk.
- **Smoking and Alcohol Misuse:** These habits can increase the risk[7].
- **Head Injuries:** Traumatic brain injuries can accelerate development of Alzheimer's, particularly in individuals with genetic predispositions. [8].

1.3. Signs and symptoms of AD:-

- Memory damage: Disremembering recent actions, discussions, or arrangements.
- Disorientation: Difficulty understanding time and place.
- Communiqué complications: Trouble discovery the accurate words or subsequent discussions.
- Mood variations: Charming simply disturbed, nervous, or unhappy.
- Difficulty with regular tasks: Suffering by each day activities, such as showering, dressing, or cooking.
- Disorientation in familiar places: Receiving lost in acquainted environments or having trouble understanding directions.
- Changes in behavior: Becoming more suspicious, agitated, or aggressive.
- Loss of coordination: Trouble with balance, movement, or coordination.
- Difficulty with speech: Trouble speaking or understanding language.
- Sleep disturbances:
- Appetite changes:
- Wandering:
- Personality changes[9]

II. METHODOLOGY

2.1. Assembly of herb resources:-

Plant was picked for proposal view of its customary, phytochemical profile was assembled from herbal garden of R.K. Pharmacy College in Kashipur, Surai, Sathion, Azamgarh, Uttar Pradesh.

2.2. Authentication of plant:-

Prof. N.K. Dubey, Section of Botany, B.H.U. Varanasi, India, permitted the plant. For upcoming reference, (Voucher specimen no. **Solana. 2024/01**) was set at the herbarium of BHU Varanasi.

2.3. Requirements:-

Table No. 1. : Requirements

Instruments	Chemicals	Drugs
❖ Incubator	Mayer's, Wagner's,	Scopolamine
❖ Hot air oven	Shinoda, Benedict test	Memantine
❖ Weighing balance	Hager's, Molisch's test reagents	
❖ Condenser	Lead acetate	
❖ Desiccator	Biuret , Ethanol Reagents and Distilled Water	
❖ Grinder	Ninhydrin	
❖ MWM apparatus	Foam test, Ethanol Reagents and Distilled Water	
❖ Syringe	Ferric chloride test	
❖ Oral cannula	Keller-killiani test	

2.4. Preparation of extracts:-

The dried powder material of Solanum lycopersicum stems (200 gram) was placed in a 1 liter beaker, and appropriate ethanol was added before maceration for 72 hours. The ethanolic excerpt was clarified complete Whatman No. 1 filter paper and concentrate via a vacuum at forty degree Celsius get 15 gm concentrate. The concentrated extract was kept in vacuum desiccators for further use.

2.5. Experimental Animals:-

For this experiments utilize wistar albino rats balancing 140-190 gms. Using cages made of poly (a total of 38 x 23 x 10 centimeters) with paddy husk as bedding was arrangement for all rats treatment groups. Organization Temperature of 25±2°C, comparative humidity of 50±5 percent rats housed. Monitored light (12 h dim / 12 h sunny period). Fresh water ad libitum, fed using normal pellet nutrition allowed to all animals. The experiments was performed following

Animals ethics guidelines of “Institutional Animals Ethics Committee” (Approval No: 1384/PO/Re/S/10/CCSEA) and (project id no. IAEC/RK/2024/04).

Table No. 2. Grouping of Animals:

Sr. No.	Groups	No. of Animals
1	Normal control given free excess of water p.o.	6
2	Negative (Scopolamine 0.5 mg per kg i.p.)	6
3	Standard (Memantine (20 mg per kg p.o.)	6
4	T-1 (EESL 100 mg per kg p.o)	6
5	T-2 (EESL 250 mg per kg p.o)	6

Note: Scopolamine 0.5 mg per kg admin all (Except normal control).

2.6. MWM assessment (Scopolamine-induced amnesia) in rats:

The device was made up round pond ((forty-five centimeters overall height, one hundred centimeters total circumference) via a flat inside superficial. Pool was full with opaque water ($22 \pm 2^\circ\text{C}$'s) at a standing height of thirty centimeters. and separated into 4 quadrants of equivalent zone, labeled 1, 2, 3 and 4. A 29 cm \times 6 cm platform was put one cm lower than water level in the center of one of four quadrants. Position of platform remained constant through trial. Trial began on day ten of management period, when animals were permitted to swim for 120 seconds lacking the platform to acclimate. Throughout following 4 days, every rat was given four 120-second learning test with a 60-second intertrial gap. For every learning test, animal was located in the water, fronting puddle wall diagonally contrary the quadrant where the platform was stored. For each experiment, the escape latency time was calculated using the time it took rat to identify submerged platform. If some of the rats were incapable to identify the platform within 120 seconds, they were absorbed to it and allowable rest for 60 seconds, at which point escape latency time was noted as 120 seconds. On day 15 (24 hours following last learning trial), platform was detached from pool, and memory retention was assessed via a probing trial session. Every animal was placed in water diagonally opposed target quadrant and given 60 seconds to swim and discover The region in which scaffolding was formerly positioned. Time spent by the rat in target region were measured.[10].

Normal control given free excess of water oral.

Negative control (Scopolamine 0.5 mg per kg i.p.)

Standard (Memantine (20 mg per kg p.o.)

Test-I (EESL 100 mg per kg p.o)

Test-I (EESL 250 mg per kg p.o)

Note: Scopolamine 0.5 mg per kg admin all (Except normal control)

All Agents are administered for 15 days.

2.7. Statistical investigation:-

The records was examined with BioStat Pro (version 5.9.8). Results for every group are provided as mean \pm SEM. The statistical differences were examined utilizing a one-way ANOVA, tracked by Tukey-Kramer examination. Examinations with $P < 0.05$ remained measured statistically significant.

*** showed $p < 0.001$

** showed $p < 0.01$

* showed $p < 0.1$

* are utilized towards compare standard and experiment groups to illness control set. Investigational data were collected since everything creatures various assemblies, documented, and charted on a broadsheet utilizing an MS Excel application toward create graphs.

III. RESULT

3.1. Phytochemical Screening:-

Solanum lycopersicum exposed the existence of alkaloids, flavonoids, triterpenoids and phenols. In order to address the existence of various phenolic mixes, such as polyphenols, flavonoids, phenolic acid, etc

Table No. 3: Preliminary phytochemical investigation of solanum lycopersicum

Plant chemicals	Term of the examination	Remark	Result
Alkaloids	Mayer's	Creamy white ppt.	+
	Wagner's	Deep chocolate ppt.	+
	Hager's	Yellow crystalline precipitate	+
Flavonoids	Shinoda	Development pink colour	+
	Specific	Orange to red	+
	Lead acetate	Yellow coloured	+
Proteins and Amino acids	Biuret	No precipitate	-
	Millon's	No precipitate	-
	Ninhydrin	No precipitate	-
Saponins	Frothing test	Formation of stable froth	+
Triterpenoid	Salkowski's test	Develop Golden yellow layer	+
Tannins	Gelatin test	No precipitate	-
Steroid	Liebermann-Burchard's test	No precipitate	-

3.2. Study Against Alzheimer's:

MWM Test:

Throughout development periods (days 11 to 14), scopolamine cure caused considerably higher EL than controls; however, these outcome was minimized by co-admin of test preparation. On days 2-4 (cure days 12-14) of the acquisition sessions, escape latencies were significantly lesser in control cluster than on day 1 (treatment day 11), but No in Scopolamine-treated animals. This variance were recovered in animals treated through both Scopolamine and test preparation. On day 15, during the probe experimental session, Scopolamine-cured animals spend substantially fewer period Swim into desired area than controls, whereas animals co-administered via test preparation and Scopolamine spent more time within the selected area compared to sickness norms.

TABLE 4. : Outcome of ethanolic excerpts stems of solanum lycopersicum on EL period in scopolamine-produced AD in rats.

Group Name	Escape Latency Period (Sec.)			
	Day 11 th	Day 12 th	Day 13 th	Day 14 th
Normal (Water) oral	82.23 + 2.12	73.83 + 0.54	52.25 + 0.76	23.33 + 0.88
Negative scopolamine (0.5 mg per kg) i.p.	95.5 + 1.58#	81.75 + 0.76#	61.75 + 0.77#	33.83 + 2.11
Standard Memantine(20mg/kg) oral	77.03 + 4.11***	51.23+0.75***	23.91+0.72***	11.20+ 1.23 ***
Test-I (100 mg/kg) oral	81.25 + 0.58**	65.17+1.79***	38.5 + 0.47***	19.75 + 0.53***
Test-II (250 mg/kg) oral	72.92 + 0.72***	52.33+0.57***	34.83+1.53***	15.17 + 0.53***

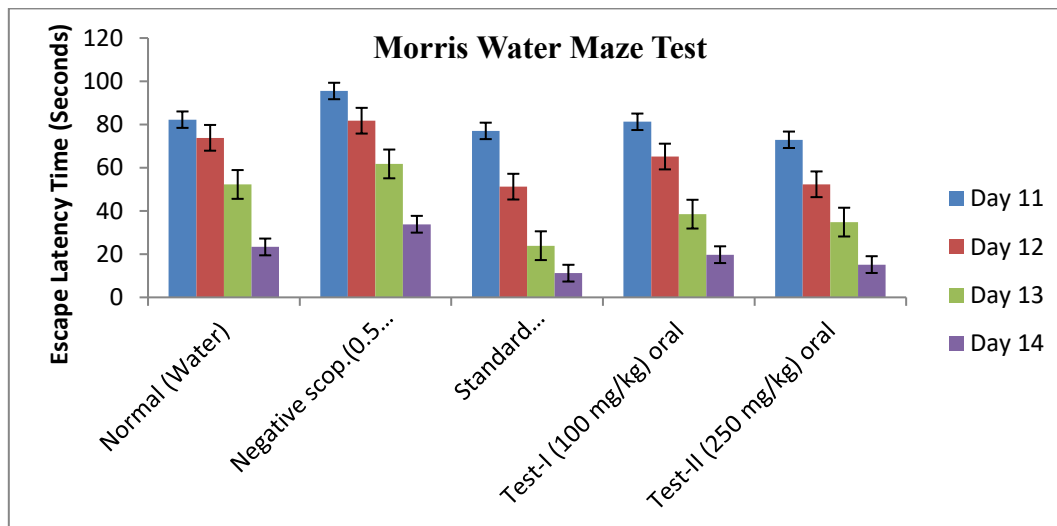


Figure no. 2. Outcome of ethanolic excerpts of stems of solanum lycopersicum on EL period in scopolamine-produced AD in rats:

Table no. 5. Outcome of ethanolic extracts stems of solanum lycopersicum on TSTQ in scopolamine prompted AD in rats:

Group Name	TSTQ (sec.)
Normal (Water) oral	10.23 + 0.6
Negative scopolamine (0.5 mg per kg) i.p.	5.66 + 0.74
Standard Memantine(20mg/kg) oral	20.22+ 1.21
Test-I (100 mg/kg) oral	11.33 + 0.74
Test-II (250 mg/kg) oral	15.66 + 0.6

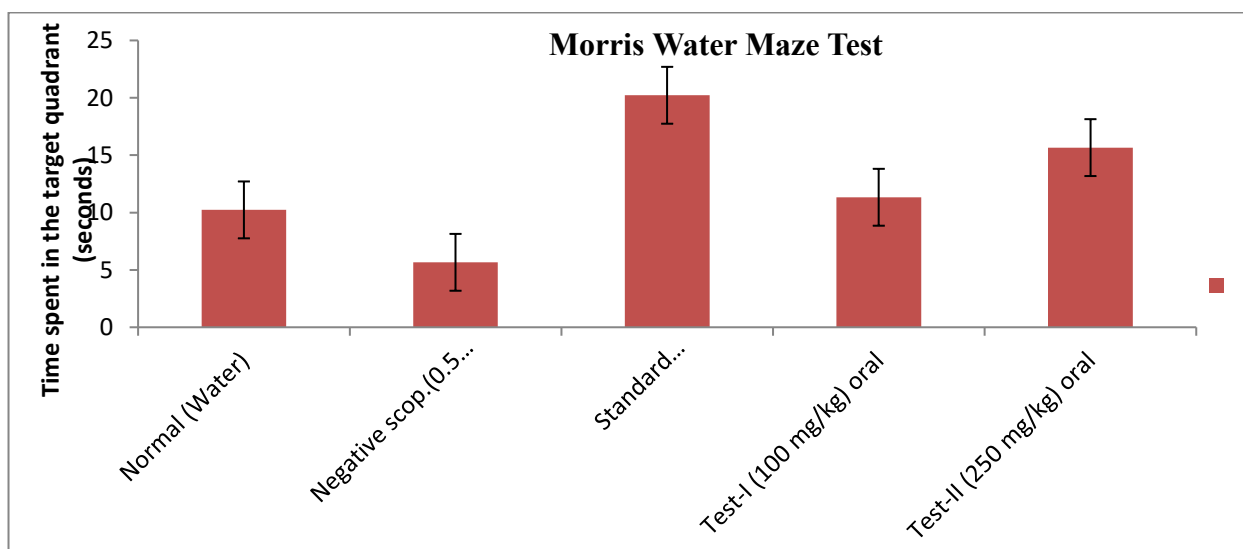


Figure no.3. Effect of ethanolic extracts stems of solanum lycopersicum on TSTQ in scopolamine produced AD in rats:

IV. DISCUSSION

AD is a deteriorating Mental condition these reasons memory harm and mild mental weakening, ultimately progressing to dementia. Congenital irregularities, neurofibrillary tangle formation, inadequate amyloid progenitor processing, mitochondrial inadequacies, neurotropic factor insufficiency, trace element neurotoxicity, dynamism metabolic rate flaws, and oxidation impairment remain just a rare of causes of Alzheimer's disease. Acute memory loses, incapability to acquire anything novel, mind fluctuations, trouble Learning words, ignoring individualities, as well as a mistake items remain wholly signs of previous illness. Alzheimer's sufferers frequently exhibit frustration, aggression, and irritability. However, the anti-Alzheimer activity of the ethanolic excerpt of solanum lycopersicum stem (100 and 250 mg/kg oral) was tested using MWM test, which is recommended when the experiment agent decline in escape latency time and an increasing in time spent in the target quadrant. Standard drug (memantine) has long been used as a anti-Alzheimer, and it is as well commonly used in behavior pharmacology as a reference chemical for potentially anti-Alzheimer compounds. However, rats cured by 250 mg per kg body wt. of plant excerpt displayed a significant reduction in EL time and an increasing in TSTQ. There are still several studies being conducted on cures that can inhibit or at least significantly alter the course of AD, similarly Famous is "disease-modifying therapies." Examine for novel treatments This comprises both harmless plus in effect combat alongside AD has already necessitated the participation of numerous researchers and thousands of willing volunteers. Ethanolic extracts of Solanum lycopersicum stems were investigated for Alzheimer protective activity in MWM trial. MWM method is commonly utilized to assess Directional memory and learning in animals. This demonstrated a dose-dependent reduction in EL period plus increase in TSTQ.

V.CONCLUSION

The current study's findings show that ethanolic extracts of Solanum lycopersicum stems can help inhibit or cure AD by drastically lowering Acetylcholinesterase stages in the brain. A primary phytochemical examination of ethanolic extracts of Solanum lycopersicum stems exposed the attendance of alkaloids, flavonoids, triterpenoids, phenols, and phenolic chemicals.

The current study concluded that ethanolic extracts of solanum lycopersicum stems have anti-Alzheimer action via improving spatial memory, as well as a substantial rise in beginning of achievement and a decrease period of action and retrieval time when matched to negative control, therefore explanatory its Alzheimer protective action, which could be due to the existence of phenolic components, flavonoid, alkaloid, and triterpenoids as phytoconstituents. Further research is recommended to categorize the active phytochemicals and demonstrate their method of action.

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