VALIDATION OF CHENOPODIUM LEAVES EXTRACTS PRIOR TO THE IMPLICATION OF NOOTROPIC ACTIVITY IN WISTAR RATS

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AbstractIn accordance with the World Health Organisation (WHO), 80% of the population use herbal treatments for certain aspects of primary healthcare. As a consequence, natural products might constitute a new source of beneficial neuropsychotropic drugs if they undergo rigorous research and their mechanisms are accepted. Based on data from the World Health Organisation (WHO), 80% of the global population use botanical medicines for certain aspects of primary healthcare. As a result, natural products could be a new source of useful neuropsychotropic drugs if they undergo extensive research and their mechanisms are had comprehended. Alzheimer's disease is one of the most prevalent manifestations of dementia (50%). Cholinergic antagonism-induced cognitive declines mimic the cognitive hallmarks of Alzheimer's disease. The present work was under taken to evaluate the Nootropic activity of *Chenopodium album* leaves extracts in Scopolamine induce Alzhimer type Dementia in rats.For the purpose ethanolic & aqueous extract of *Chenopodium album* leaves were prepared and screened for phytochemical constituents and Nootropic activity.

Keywords*Chenopodium album, Nootropic Activity, Alzheimer,cholinergics,neuropsychotropic.*

IntroductionResearchers have been looking at acetylcholine for over 20 years since its deficiency has been connected to senile dementia and other degenerative cognitive diseases like Alzheimer's disease. Due to age-related declines in acetylcholine receptors, it becomes more important to rely on this neurotransmitter. The breakdown of acetylcholine is prevented by drugs that block the enzyme acetylcholine-esterase (AChE).Problems with learning, memory, focus, and decision-making are only some of the cognitive symptoms of ageing. The degree of mental decline might vary widely. A person with this illness might have cognitive decline over time, but they would still be able to function normally and maintain their independence. A person's ability to speak, write, move, and comprehend may be impaired by a more severe disability.[1]Cognition encompasses a person's internal and external mental processes, including their ideas, knowledge, interpretation, understanding, and beliefs. Damage to these regions may lead to severe cognitive dysfunction.

Degenerative neurological illnesses are a leading cause of memory loss and other cognitive issues that affect individuals all over the globe. It disproportionately affects the elderly, but does not discriminate between sexes.[2]Epilepsy patients often struggle with cognitive impairment due to either the disease itself or the medications used to treat it. Evidence suggests that nootropics may help with a variety of memory and focus issues. while piracetam (PIM) research has focused mostly on its cognitive benefits, it has also been demonstrated to have anti-myoclonus and anti-amnesic qualities in a variety of experimental conditions. The anticonvulsant phenytoin has been shown to impair learning and memory [3] Mental illness is becoming an unavoidable demographic reality. Dementia and other forms of mental decline are becoming more common as people live longer. Mild cognitive impairment with a single amnestic symptom in late life is a good predictor of Alzheimer's disease; however, localised brain lesions, metabolic disorders, and alcohol use are all potential causes of solitary amnestic illnesses.[4]

SEVERITY OF NEURO TRAUMAA degenerative disease of the neurological system is usually the root cause of significant cognitive impairment.As a societal cost, dementia is up there with cardiovascular illness and cancer (5) The prevalence of dementia and other kinds of cognitive impairment is growing globally, and this growth is anticipated to be fastest in developing nations.The current number of people living with dementia, estimated at 35.6 million, is expected to rise to 115.4 million by 2050, with most new instances happening in developing countries.[6]

RESTORATION CONCERNING MEMORY ACQUISITION Depending on their volume, composition, and accessibility, memories may be organised in many ways. From the perspective of data processing, there are three stages of memory formation. The process of encoding (which combines and processes incoming data) Step two is archiving, or saving a copy of the encrypted information for the long term.It is possible to recall information from storage in response to a trigger and utilise it in a new setting. A near-identical copy of visual and auditory input is recorded in sensory memory. Sensory memory is characterised by recall periods on the order of milliseconds to seconds, whereas short-term memory is defined by recall times on the order of seconds to minutes.[7]

Deterioration seems to be the primary cause of memory loss. Some information from sensory memory, but not all, is transferred to working memory. Within STM, there are fundamentally three processes at work. iconic memory- The ability to vividly recall memorable images or things.Acoustic memory - Remembering and recalling information heard before. Sounds are more readily retained than visuals.Working memory is used when you need to keep something in mind until you can use it, such as when you are practising a phone number until you can dial it. The goal is not to store the information in long-term memory (LTM), but to put it to use immediately. It's possible that during this sorting process, the importance or emotional weight of a piece of information plays a bigger part in determining whether or not it will be stored in long-term memory. It is our duty as instructional designers to make learning enjoyable and relevant for students so that they retain what they've learned [8].

Sr.No.	Neurotransmitter/Neuromodulator	Receptor systems
1	Glutamate	NMDA, AMPA receptors
2	Acetylcholine	Muscarinic, nicotinic
3	Dopamine	D1, D2 receptors
4	Serotonin	5-HT3, 5-HT1A receptors
5	Neuropeptides	G-protein-coupled peptidergic receptors
6	GABA-β-carbolines	GABAA/BZD receptor complex
7	Neurosteroids	NMDA/GABAA receptors.

Table 01 Showing Neuromodulator and Receptor systems

COMMUNICATIVE NEUROCHEMICALS

DopaminergicsSince the synthesis of dopamine is the rate-limiting step in the synthesis of all catecholamine neurotransmitter. (Claudia Gonzalez-Espinosa, Fabiola González-Espinosa), the mesocortical dopamine system is critically important to cognition. Dopamine primarily regulates prefrontal cortex functions.[9]

SerotonergicsSubstances that act on serotonin or the parts of the nervous system that rely on serotonin are known as serotonergics. More research has been done on how serotonin affects memory and learning. Experimental animals' behavioural performance is negatively affected by stimulating serotonergic neurotransmission, whereas it is improved by inhibiting it. Antidotes to 5-HT3 (serotonin) receptor agonists, including ondansetron and zacopride, have been associated with improved mental acuity. The entorhinal cortex is thought to be important in learning and memory because it has a high concentration of 5-HT1A (serotonin) receptors and because 5-HT3 receptors have been postulated to regulate ACh release in the cortex. Many serotonergic drugs, including ipsapirone, a 5-HT1A agonist, have been shown to increase memory performance in rats, while others have failed to affect learning and memory processes. [10]

CholinergicsAccording to the cholinergic hypothesis (Claudia González-Espinosa and Fabiola Guzmán-Meja in Identification of Neural Markers Accompanying Memory, 2014), a decline in cholinergic neurotransmission is principally responsible for the loss of cognitive functionindementia. Scopolamine, a cholinergic muscarinic antagonist, is a d-synaptophysin.[11]

IMPACT OF HERBAL MEDICATIONS ON THE CNS

Herbalism(also "herbal medicine" or "phytotherapy") is the study and use of plants for medicinal or nutritional purposes. Traditional medicines that have their roots in plants are still widely utilised today, just as they were for the vast majority of human history. It is standard custom in contemporary medicine to find the pharmacological basis for new drugs in plant-based compounds.Although there are not many high-quality clinical trials or criteria for purity or dosage, herbs and pharmaceuticals derived from natural sources may be put to the test using current standards of effectiveness through phytotherapy.[12]

Plants	Useful parts	Active constituents
Allium sativum	Bulb	Sallylcysteine
Bocopa monniera	Whole plant	Bacosides A & B
Celastrus paniculatus	Seeds	Celapagine & Celapanigine
Nicotiana tobaccum	Leaves	Nicotine
Withania somnifera	Roots	Withanolides
Ricinus communis	Beans	Ricinine
Salvia officinalis	Leaves	Monoferpenoid
Ginkgo biloba	Leaves	Ginkgolides
Huperzia serrate	Moss	Huperzine
Uncariato mentosa	Bulbs	Total alkaloids
Physostigma vennosam	Beans	Physostigmine
Acorus calamus	Rhizomes	Asarone & methyl isoeugenol
Terminalia chebula	Rhizome	Chebulic acid

Table.02 showing Some Plants used as Memory Enhancers

PLANT PROFILE

Fig.1 Showsleaves of *Chenopodium album* herb

Botanical Classification	
Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Caryophyllidae
Order	Caryophyllales
Family	Amaranthaceae
Sub Family	Chenopodiaceae
Genus	Chenopodium
Species	Chenopodium album

Table 03 Showing Botanical Classification

HabitatChenopodium album may be found almost everywhere, with notable concentrations in areas with high levels of nitrogen in the soil (such as those in Africa [13], Australia [14], North America,[15] and Oceania [16].

Description of Plants Chenopodium album is an extremely fast-growing annual plant that is mostly farmed in India during the winter months. It is also known as a wild plant or weedy plant due to its tendency to grow in unintended areas and produce undesired crops.Many regions cultivate Chenopodium album, although others treat it as a weed. Chenopodium album is also known as bathua, pig weed, melde, goose foot, fat hen, and weed. Plants may grow to be between 10 and 150 cm (occasionally up to 3 m) tall, but recline without support once they begin to produce flowers and seeds.

Leaves The 3-7 centimetre long and 3-6 centimetre wide leaves of the bathua tree grow in an alternating pattern and have a rough diamond form.

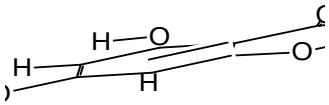
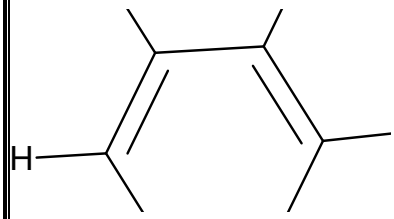
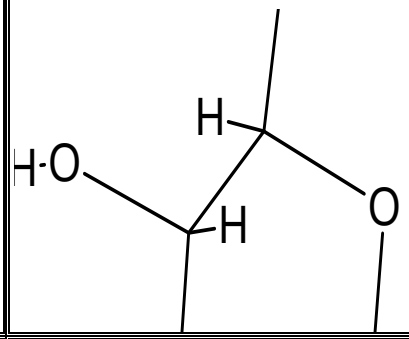
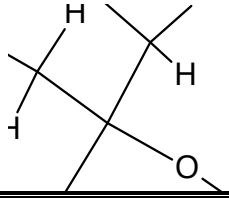
FlowerThere is no accompanying leaf and the flowers resemble a cluster of tiny globules.

Seed:A normal seed will have a diameter of around 1 to 1.5 mm, a lateral shape with hebetate margins, and a follicle that is only slightly coarsen towards the seed.[17]

Components in Chemistry Oil v/w yielded was 0.64% from Chenopodium album leaves. The following may be found in the oil extracted from Chenopodium album leaves: Benzyl alcohol: trace; p-cymene: 40.9; limonene: 4.2; myrecene: trace; alpha-thu-jene: trace; alpha-pinene: 7.0; camphor: trace; beta-pinene: 6.2; myrecene; trace; p-cymene; trace; - 1,8-cineole: traces; cis-ocimene: traces; -terpinene: traces; linalool: traces; pinane-2-ol: 9.9; allo-ocimene: traces; citronellal: traces; born-eol: traces; terpinen-4-ol: traces; alpha-terpinen-1-ol: 6.2; cit [18]. 100 grammes of leaves from a plant, dry weight, are analysed for their trace element content- Ferrous, Sodium, Manganous, Zinc, Potassium, Calcium, Copper, Nitrogen, and Phosphorus [19]. Different phenolic compounds were isolated from

different plant tissues. Separating 4, vinyl-phenol from the Chenopodium album plant stem using HCl aqueous solution extracts; isolating vanillic alcohol and 4-methyl-benzaldehyde after HCl aqueous solution precipitation. After being separated from the methanol - extract of seed, the glycoside cheno-albuside is found in Chenopodiumalbum.[19]

Chemical Constituents Present In*Chenopodium Album*LeavesLeaves powdered from Chenopodium album were subjected to a battery of micro-chemical analyses, the results of which revealed the presence of cellulose, chitin, fixed oils and fats suberin, sudan red cutin, tannins, starch, mucilage, proteins, calcium oxalate crystals, cellulose cell wall, and calcium carbonate. Five flavonoids and eight phenolic acids were detected for the first time in aerial parts of this plant species,the most abundant compounds being rutin, kaempferol,rutinoside,4-OH-benzoic acid,and syringic acids.[20]

SR. NO.	PUBCHEM ID	COMPOUND NAME	MOLECULAR WEIGHT	STRUCTURE
1	5280805	RUTIN	610.5 g/mol	
2	5280863	KAEMPFEROL	286.24 g/mol	
3	12314995	RUTINOSIDE	326.30 g/mol	
4	2755984	4-OH- BENZOIC ACID	252.27 g/mol	

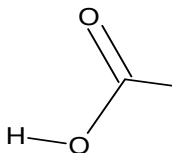
5	**10742**	**SYRINGIC ACIDS**	**198.17 g/mol**	

Table 03. Chemical Constituents of Chenopodium album leaves

Death activity of sperm cell:-Oxygen induces apoptosis, the cause of sperm cell death, and is seen or observed with the aid of DNA ladder formation and manganese-superoxide-dismutase action and protein manifestation in fluoro-metry experiments reflecting collection of reactive-oxygen-species in spermatozoa. Seeds of the Chenopodium album plant have been shown to hasten the demise of sperm cells by oxidising their macro-molecules. [22]

Activity of antioxidants & free radical scavenging:-Antioxidant activity includes scavenging free radicals, which are responsible for a wide range of illnesses and health problems in humans, including cancer, cardiovascular disease, neuron or brain disease, lipid peroxidation, and more. Because of their mobility, free radicals contribute to many illnesses. Superoxide anions, hydrogen peroxide, and hydroxynitric oxide are all examples. Blocking, triggering, and propagating oxidising chain reactions reduces or delays lipid peroxidation and free radical scavenging. [23]

Phytochemical And Physical Characteristics of Chenopodium Album Leaves:-The value of ashes, section. the ash content of a medicine indicates the extent to which its collection and foreign matter content are a cause for worry. Chenopodium album leaf ash was measured according to known techniques and was found to be total, acid insoluble, and water soluble.[24]

The value of ash is calculated:-This technique was used to determine the overall quantity of leftover material after inflammation. Physiological and non-physiological debris, as well as irrelevant materials like sand and dirt, pass through the plant's surface.2 gm. of air-dried plant material was placed in preweight clean sintered silica crucibles, which were then heated to a high enough temperature to burn or calcinate the material. (400 to 500oC) in a muffle furnace continuously until white or continuous ash is obtained. at ambient temperature, the crucible was quenched. using a desiccator and weighing the resulting ash.

SR.NO.	CONSTITUENTS	TEST	OBSERAVTION	INFERENCE
1	CELLULOSE	IODINE SOLUTION	PALE YELLOW COLOUR	+
		IODINE SOLUTION + SULPHURIC ACID	BRIGHT BLUE COLOUR	-
2	CHITIN	IODINE SOLUTION	DEEP BLUE COLOUR	+

		IODINE SOLUTION + SULPHURIC ACID	**BROWN COLOUR**	+
		SAFRANIN	**RED COLOUR**	+
		PHLOROGLUCINOL+ CONC. HCL	**PHLOEM FIBERS STAINED RED COLOUR**	+
3	**FIXED OILS AND FATS**	**CHLOROFORM**	**SOLUBLE**	+
4	**SUBERIN,SUDAN RED CUTIN**	**IODINE SOLUTION**	**DEEP YELLOW COLOUR**	+
		IODINE SOLUTION + SULPHURIC ACID	**DEEP BROWN COLOUR**	+
		IODINE + SUDAN RED III SOLUTION	**RED COLOUR**	+
5	**TANNINS**	**DILUTE FERRIC CHLORIDE SOLUTION**	**BLUE BLACK COLOUR**	-
6	**STARCH**	**IODINE SOLUTION**	**BLUE COLOUR**	+
7	**MUCILAGE**	**METHYLENE BLUE**	**DEEP BLUE COLOUR**	+
		IODINE SOLUTION + SULPHURIC ACID	**VIOLET COLOUR**	+
8	**PROTEIN**	**IODINE SOLUTION**	**YELLOW CRYSTALLOIDS**	+
		ALCOHOLIC PICRIC ACID SOLOUTION	**YELLOW CRYSTALLOIDS**	+
		MILLIONS REAGENT	**YELLOW COLOUR**	-

Table 04. Observation test and chemical constituents of Chenopodium album leaves

Phytochemical Screening Of *Chenopodium Album*Leaves ExtractsPhytochemicals are non-nutritive, chemically active compounds found in plants that have a measurable physiological effect on humans and a crucial role to play in the treatment of life-threatening illnesses. Plants have been used for illness treatment and prevention since ancient times. Alkaloids, tannins, saponins, quinones, coumarin, sugars, and gums were analysed in the powdered leaves of the plants in this investigation using the usual techniques listed below.

CHEMICAL TEST	**OBSERVATION**	**INFERENCE**	
		AQUEOUS EXTRACT	**ETHANOLIC EXTRACT**
DETECTION OF ALKALOIDS			
MAYERS TEST	YELLOW CREAM PRECIPITATES PRODUCED	+	+
HAGERS TEST	YELLOW CREAM PRECIPITATES PRODUCED	+	+
DETECTION OF TANNIN			
GELATIN TEST	WHITE PRECIPITATES PRODUCED	-	-
DETECTIONS OF SAPONINS			
FOAM TEST	FOAM PRODUCED	+	+
FROTH TEST	FORMATION OF LAYER OF FOAM	+	+
DETECTION OF QUINONES			
QUINONES TEST	CHANGE OF COLOUR BLUE TO RED	+	+
	DETECTION OF COUMARIN		
COUMARIN TEST	YELLOW COLOUR PRODUCED	+	+
DETECTION OF SUGAR			

SUGAR TEST	CHANGE OF COLOUR YELLOW TO RED	+	-
DETECTION OF GUM			
GUM TEST	FORMATION OF SWELLS	+	+

Table 05 Observation of phytochemical screening of extracts

EVALUATION OF BEHAVIORAL PARAMETERS Effect of Ethanol, Aqueous extract of Chenopodium album leaves and Piracetam effects on memory performance in Step down passive avoidance in Scopolamine treated rats after 24 hr & 15 day. Table 06 displays the memory-improving benefits of Chenopodium album leaves. It was found that SDL was considerably (P0.001) lower in the scopolamine group compared to the control group. After receiving 150 mg/kg of piracetam daily for 15 days, SDL was found to be considerably (P0.001) higher in the piracetam group than in the scopolamine group. After 24 and 15 days, a dose-dependent change in SDL was seen in the Chenopodium album leaves ethanol and aqueous extract group compared to the scopolamine treated group.

Treatment	After 24th hrs	15th Day
Normal	10.67 ± 4.50	15.50 ± 4.09
Scopolamine (3mg/kg; i.p)	5.67 ± 5.27[a]	5.3 ±4.82[a]
Piracetam (150 mg/kg; i.p.) + Scopolamine (3mg/kg; i.p)	137.83 ± 6.30[b]	97.07 ± 3.32[b]
CaAe (250mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	61.82 ± 1.56[b]	26.83 ± 3.08[b]
CaAe (500mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	78.42 ± 3.08[b]	46.83 ± 3.08[b]
CaEe (250mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	87.3 ± 1.50[b]	38.76 ± 3.02[b]
CaEe (500mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	115.63 ± 1.86[b]	68.35 ± 1.49[b]

Table 06 Effect of treatments on step down latency (SDL) of scopolamine induced cognitive deficit rats by using step down apparatus.

ELEVATED PLUS MAZE Chenopodium album leaves have been shown to improve memory (see table 07). Scopolamine treatment resulted in a statistically significant (P0.001) boost in Transfer lantency value compared to the control group. After receiving 150 mg/kg of piracetam daily for 15 days, the Transfer lantency value was considerably (P0.001) lower in the piracetam-treated group than in the scopolamine-treated group. The transfer latency value was found to be significantly lower in the Chenopodium album leaves ethanol and aqueous extract dosage of 250mg/kg group compared to the scopolamine treated group. As can be seen in table 07, the transfer latency of the group given 500 mg/kg of both the ethanol extract and the aqueous extract reduced significantly (P0.001). It has shown results comparable to those of piracetam.

Treatment	After 24th hrs	15th Day
Normal	10.67 ± 4.50	20.83 ± 0.47
Scopolamine (3mg/kg; i.p)	52.17 ± 1.93	35.33±0.66 [a]
Piracetam (150 mg/kg; i.p.) + Scopolamine (3mg/kg; i.p)	13.83 ± 0.82	23.1 ±0.47[b]
CaAe (250mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	38.01 ± 0.32	31.0 ± 0.93[b]
CaAe (500mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	31.73 ± 0.84	27.63 ± 0.83[b]
CaEe (250mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	32.56 ± 0.73	28.31 ± 1.02[b]
CaEe (500mg/kg/p.o.)+ Scopolamine (3mg/kg; i.p)	28.95 ± 0.34	25.84 ± 0.83[b]

Table 07 Effect of treatments on step down latency (SDL) of scopolamine induced cognitive deficit rats by using step down apparatus

DISCUSSIONThe term "nootropic" refers to any substance (drug, supplement, nutraceutical, functional food, etc.) that improves cognitive performance."Smart drug," "memory enhancers," "neuro enhancers," "cognitive enhancers," "intelligence enhancers," "motivational" and "stress management" are all terms used to describe nootropics. The discovery of nootropics as one of the beneficial supplements for the mind has sparked a renewed interest in the field, inspiring many to take steps to improve their own concentration, focus, and memory. Some of the more concrete effects may be on working memory, motivation, and concentration. So, a herbal supplement derived from Chenopodium album leaves is being tested in this study for its potential to mitigate the symptoms of Alzheimer's disease.Alzheimer's patients commonly struggle with non-cognitive symptoms that hinder their daily life, such as depression, apathy, and psychosis.[25] The National Institute of Health projects that by 2030, there will be more than 8.5 million people living with AD in the United States alone.[26]The National Institute of Health projects that by 2030, there will be more than 8.5 million people living with AD in the United States alone.[27]Although there are effective therapies available, the severity and spread of the illness are not yet under control. Thus, several kinds of complementary and alternative medicine, such as herbal supplements, phytochemicals, and extracts, are being employed in the treatment of AD.[28,29]According to current understanding about the mechanisms by which neurons undergo necrotic or apoptotic processestherapeutic usage of natural antioxidants may be effective in ageing and neurodegenerative disorders.[30,31]

CONCLUSIONusing a rodent AD model system that shows impairment in motor and cognitive functions and increase in oxidative–nitritive stress, the present study has investigated the neuroprotective effects of Chenopodium album leaves extracts and Piracetam against scopolamine induced neurotoxicity. consistent with earlier results, chronic systemic injection of scopolamine in rats resulted in severe deficits in cognitive and motor functioning as well as an increase in oxidative-nitritive stress. it has been shown that scopolamine-induced neurotoxicity in rats may be greatly mitigated by treatment with extracts from the leaves of the Chenopodium album plant and Piracetam.among the extracts

of Chenopodium album leaves employed in the current investigation, the ethanol extract of the leaves was shown to be the most efficient in enhancing the animals cognitive and motor performance and reducing the scopolamine-induced oxidative-nitritive stress.

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