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Effects of natural remedies on memory loss and Alzheimer's disease

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Abstract

Alzheimer's Disease (AD) is a neurological disorder related to aging, considered a memory issue. Numerous research studies have been conducted to identify viable AD therapies. There isn't yet a suitable therapeutic option, though. Symptomatic behavior may help with memory loss and other dementia-related problems even though there is no known cure for AD. Since ancient times, traditional medicine has been utilized as a memory booster all across the world. Dementia, amnesia, and AD have all traditionally been treated with natural medicine, which includes herbs and botanical remedies. The use of botanical remedies in many medical systems, especially the Unani school of medicine, has long been beneficial for managing and treating memory deficits. The majority of plants and herbs have been evaluated chemically, and clinical trials have also shown their effectiveness. The underlying mechanisms for the activities, however, are still being created. In this essay, we covered several medicinal plants that are essential to the traditional herbal therapy used to treat memory loss and AD. The present review covers the literature survey from 1968 to 2023. The data have been collected from various journals, books, and some of electronic searches via Internet-based information such as PubMed, Google Scholar, ScienceDirect, EBSCO, online electronic journals, SpringerLink, Wiley, and Ayush. From the literature survey, it has been found that the herbal drug contains a wide variety of flavonoids, phenolic acids, steroids, volatile oils, lignans, alkaloids, polysaccharides, and so on. These phytochemicals exhibit a range of pharmacological activities including neurological disorders, antioxidant, and anti-inflammatory properties.

Keywords: Alzheimer's illness; medicinal plants; effectiveness; neuronal regeneration

1 INTRODUCTION

The neurodegenerative illness AD affects older people (AD). AD was identified in 1906 by a German psychiatrist and neuropathologist. Over 24 million individuals worldwide suffer from AD, which is the utmost common kind of dementia (Ballard et al., 2011). The symptoms of AD include behavioral changes, problems with performance, memory loss, and slow thought. Serious depression is similar to the condition (Squire, 1992). Impairment of the brain's cognitive and neurological functions is caused by oxidative stress on mitochondria, proteins, and nucleic acids (Sharma et al., 2024a). In Spain, 1,637 persons over the age of 64 participated in a survey on idiosyncratic memory concerns (SMC). SMC was described to 524 individuals (32.4%). The likelihood of SMC is correlated with age, education level, sex, mood, and cognitive function. SMC is reported to affect 24% of adults between the ages of 65 and 69. In the category of people 90 years of age or older, SMC rises by 57%. SMC is 52.8% when depression and anxiety are present (Montejo et al., 2011). Excessive use of drugs or stress may result in loss of memory. Numerous allopathic drugs are recommended for AD despite their side effects (Sharma et al., 2023c). Therefore, herbal medicines might be an excellent source of medications that treat AD and memory loss and have little to no adverse effects. The plants that may be used to cure AD and memory issues are covered in the present article (Pathak et al., 2022).

2 PATHOGENESIS

There are two distinguishing characteristics in the brains of AD patients. Amyloid-β (Aβ), a peptide created by the breakdown of amyloid-β precursors, is found in extracellular deposits in senile plaques (genetic locus 21q21-22) (Peng et al., 2013). Blood arteries have abnormal Aβ deposits as well (Hoyer, 1992). In the cytoplasm of neurons from AD patients, there exist aberrant fiber bundles called amyloid plaques tangles that are dense strands made of a different way of the microtubular-associated protein see in (Fig. 1) (Fernandez et al., 2008).

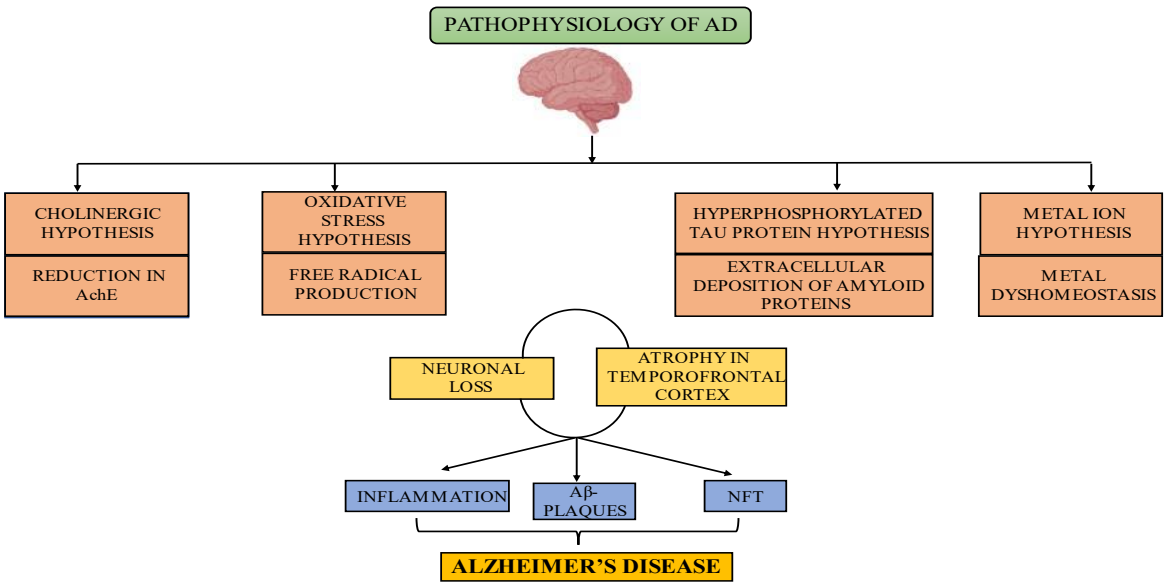

Fig. 1. Hypothesis for the pathophysiology of Alzheimer's disease

3 MOLECULAR MECHANISM

The primary symptoms of AD are the pathogenesis of neurofibrillary tau, which includes threads and knots, and extracellular Aβ pathology (Bamburg and Bloom, 2009). The Aβ hypothesis of AD etiology and development has dominated research for the past 25 years (Pimplikar, 2009). As a potential therapeutic target for Alzheimer's illness, tau has recently attracted more interest, however, as a result of the failure of amyloid-β-targeted treatments in CT and the discovery of the prion-like replication of intracellular aberrant proteins. Numerous neurodegenerative conditions contain tau pathologies, but in-depth examinations of extreme tau in diseased brains have shown that the faulty tau protein in each condition is physically different, validating the hypothesis that prion-like seed-dependent combination underlies the evolution of the diverse but identifiable tau disorders (Avila et al., 2004). It may be important to interfere with tau conversion to abnormal variants and tau sensor transfer to develop disease-modifying therapeutics for AD and other memory disorders (Hasegawa, 2016).

3.1 DRUG TARGETS

Tau and amyloid have become the focus of treatment due to the tau and amyloid hypothesis (Tang and Gershon, 2022). Currently, reducing amyloid levels, halting amyloid toxicity and accumulation, and halting tau clustering and activation are the key treatment goals (Bird, 2008). The etiology of AD is heterogeneous; a significant number of instances are classified as sporadic AD and have no known cause, while a smaller percentage of cases are classified as early-onset familial AD and are brought on by replications in several genes, including presenilin (PS1, PS2) and amyloid-β precursor protein (APP) (Sharma et al., 2024c). Apolipoprotein E (APOE), among other genes, is considered to enhance the incidence of AD (Kim et al., 2009). The pathogenesis of AD is significantly influenced by several proteins, including tau, apolipoprotein E, amyloid-β precursor protein, BACE (Aβ cleaving enzyme), PS1, PS2, secretases, and many more (Sharma et al., 2024b). To cure AD, research is focused on creating novel PS1, BASE, and secretase inhibitors (Wilkinson et al., 2004). Additionally, little has indeed been revealed about how cholinesterase functions in the brain and how to utilize cholinesterase blockers to treat AD (Yiannopoulou and Papageorgiou, 2013). In clinical trials for AD, a new generation of acetylcholinesterase and butyrylcholinesterase blockers is existence examined and examined concerning their mechanism of action (Grossberg, 2003). Other approaches to treating AD, including hormone therapy, antioxidants, medicine for decreasing cholesterol, anti-inflammatory drugs, and immunizations, are also being studied (Lahiri et al., 2002).

4 DRUG TREATMENT

There is a lot of interest in medication development as a result of the evidence of deterioration of the brain's cholinergic pathways (Kumar et al., 2024). AD is typically treated with acetylcholinesterase inhibitors. These medications aid in improving mental processes including cognition and memory. The use of these drugs may aid those with mild to severe AD (Houghton and Howes, 2005). A high dose of tacrine (a cholinesterase inhibitor) (160 mg/d) was purportedly used to cure AD (Schneider, 2022). Drug trials and cognitive test outcomes on tacrine were evaluated in a thirty-week randomized placebo-controlled investigation (Knapp et al., 1994). However, tacrine's use is restricted because of side effects such as hepatotoxicity

(Watkins et al., 1994). Antioxidants help relieve AD because they reduce the free radicals that destroy the cells in the brain (R Howes and J Houghton, 2012). The effectiveness of probiotics in improving memory has been documented. In AD, probiotics are utilized as an antidepressant. It lessens anxiety-like behavior and eases mental tension. Microbes are the producers of neurochemicals. Probiotics have an impact on the immune system and the nervous system. In addition, probiotics have immunomodulating properties (Misra and Medhi, 2013). Medicinal herbs are utilized in Chinese and ayurvedic medicine to treat cognitive disorders, AD, and neurodegenerative changes. Many of the medications used in the West to treat memory loss are plant-based. AD has been treated with alkaloids from plants, such as anticholinesterase. In the UK, neurodegenerative illnesses are also treated with galantamine derived from plants. According to estimates, 7.7 million Americans will have AD by 2030, up from the current five million cases. neurodegenerative diseases only show symptoms in people over the age of 60 (Qiu et al., 2022).

In 10-15% of cases, a genetic abnormality is the cause of neurodegenerative illnesses. There are indications of neuronal loss in the hippocampus, subcortical structure, and cortex in AD. Only a few of the chemicals that have been found by phytochemical investigations to have pharmacological qualities like anti-cholinesterase and anti-amyloidogenic include sterols, triterpenes, tannins, lignin's, flavonoids, alkaloids, and polyphenols (Ashique et al., 2024b). The treatment of AD and retention loss is greatly aided by medicinal plants. The ayurvedic, homeopathic, sidha, and unani systems of medicine are among the most significant traditional medicinal approaches (Sharma et al., 2023d). The ancient, highly scientific healthcare therapy provided by the unani system of medicine is a heavenly gift, and as a result, medicinal plants are of particular interest to the medical community worldwide. Preventive, protective, nutritive, and curative care are the main tenets of traditional medicine (Ashique et al., 2024b). Traditional remedies treat patients thusly with fewer or no negative effects and are secure and non-toxic. The use of herbal remedies dates back to ancient civilizations like the Egyptians, Indians, and Chinese. It involves using therapeutic herbs to treat AD and improves overall health and well-being. Numerous pharmaceutical medications are based on synthetic variations of naturally occurring plant components. Using botanicals as medication to treat illness and improve health, frequently without having any noticeable side effects, has drawn more scientific attention in current years as attention in herbal therapy has grown. The oldest known treatments are made up of natural ingredients and herbal medications. Throughout history, medicinal herbs have been used by all societies. Currently, there is an exponential rise in demand for herbal goods all over the world. In humans, the CNS regulates and guides the vast majority of both cognitive and uncontrollable bodily functions. Because the CNS and the ANS are interconnected, several medications that affect the CNS can also affect the ANS (Akram and Nawaz, 2017). Drugs that affect the CNS may also have anticonvulsant, psychopharmacological, and general stimulatory or depressive effects. An important global health issue is memory loss. Current medical practices are inadequate and have grave drawbacks. Possible alternative therapeutics for AD and memory loss are desperately needed. It is advised to use a variety of medicinal plants to improve memory. We have studied the research on herbal remedies for treating AD and cognitive problems (Xu et al., 2009). Many medicinal herbs have been utilized for centuries in various cultures to enhance memory, including *Punica granatum L, Valeriana officinalis*,

Bacopa monnieri Linn, Centella asiatica linn, Salvia officinalis and *Evolvulus alsinoides linn.* (Elufioye et al., 2012) reported several plants in sagamu, nigeria that is used for anti-aging and memory-improving activities. Florescent Bacopa, The eichlerian herb angraecum Inanigrescens parquet Gynandra Cleome Lacteal Dalbergia, the pepper fructescens *Melegueta aframomum*, Infirmary Digitaria the sapient musa *Brachyphyllum pinnatum, Precatorius Abrus, Exasperated ficus*, the mangenotiana Dioscorea curcas jatropha, *ponderosa mother*, the pepper frutescens acuminate cola, the Guinea worm, *sativa cannabis*, The *Mauritania ipomoea* the common bambusa, *Millenii Cordia guinea piper*, the *Sarmentosa dioclea* the cucumber plant, *Elixir officinalis, Basilicum ocimum, Ivorensis Khaya, alba carpolobia, Procera carapa*, useful entandrophragma *Thiopica xylopiaae*, *Citrus kola*, the cocoa plant, excels in Milicia Baphia nitida, Blighia sapida, pellucid peperomia, Zea mays with *Vernonia amygdalina.*(Elufioye et al., 2012) reported a few plants with anticholinesterase activity, including *Citrus aurantium, Punica granatum, Citrus aurantium, Rheum Officinale, Pelargonium graveolens, Rosa dama, Pistacia vera, Citrus aurantifolia, Ferula asafoetida, Camellia sinensis, Humulus lupulus, Citrus aurantifolia, Brassica alba, Brassica nigra, Cinchona officinalis. Juglans regia* and various plants have been shown to improve memory, (Haider et al., 2011) *Cuminum cyminum*, (Koppula and Choi, 2011) *Ficus religiosa*, (Kaur et al., 2010) *Melissa officinalis*, (Kennedy and Scholey, 2006) *Rosmarinus officinalis*, (Ozarowski et al., 2013) *Piper nigrum*, (Hritcu et al., 2014) *Ginkgo biloba*, (Tan et al., 2015) *Bacopa monnieri*,(Roodenrys et al., 2002) *Desmodium gangeticum*, (Mahajan et al., 2015) and *Emblica Officinalis Gareth* (Justin Thenmozhi et al., 2016). Since ancient times, the unani medical system has used herbal remedies to treat a variety of illnesses (Ashique et al., 2024a). However, science does not fully comprehend the efficiency and steadiness of the bioactive components present in therapeutic plants. In this study, they designed to gather data on herbs utilized as memory enhancers in AD (Sharma et al., 2023b).ma

5 PROMISING NATURAL PRODUCTS AGAINST ALZHEIMER'S DISEASE

The development of new clinical therapies for the various diseases linked to Alzheimer's disease is at a crossroads. This creates the opportunity to refocus prospective drug development efforts on disease modification, a problem for which there are already numerous solutions to be found. The most prevalent alkaloids, terpenoids, chemicals derived from Shikimate, and other substances are highlighted in this viewpoint as we discuss current developments in the development of neurodegenerative drugs. The main important phytochemicals that are contained in plants and are used for AD are shown in Fig. 2.

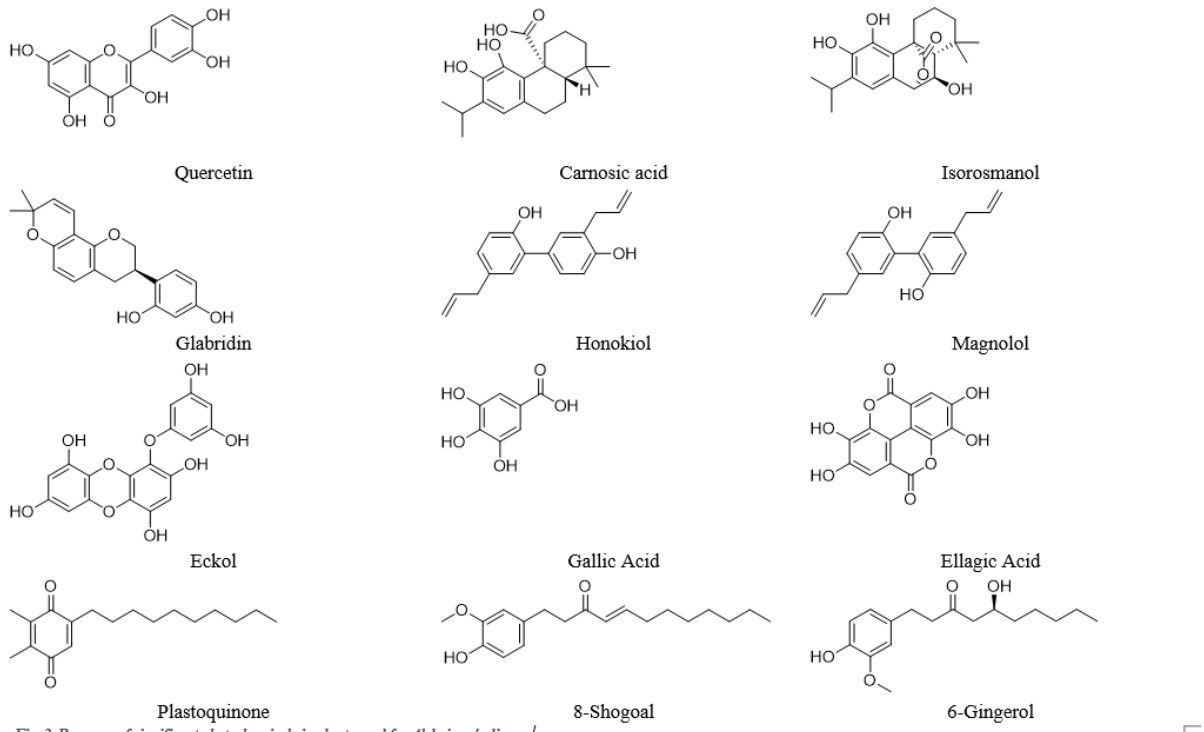

Fig. 2. Presence of significant phytochemicals in plants used for Alzheimer's disease

5.1 Withania somnifera

The solanaceae family includes *Withania somnifera*. Its (500 mg/d) soothing emphasis and brain damage implications were both seen (Abedon et al., 2008). In a prior investigation, *Withania somnifera's* cholinergic action was reported (Schliebs et al., 1997). *Withania somnifera's* capacity to raise Ach concentrations in the brain contributes to its memory- and cognitive-improving effects. *Withania somnifera* has been shown to have time-dependent and dose-dependent neurotic outgrowth action in human neuroblastoma cells. Dendrite and axon regeneration is accelerated by *Withania somnifera* (Kuboyama et al., 2005). Research on molecular modeling suggests that amides A and amides C bind to amides A and prevent fibril production.

5.2 Curcuma longa

The zingiberaceae family includes *Curcuma longa*. Due to the intake of turmeric, AD prevalence is low in southeast asian countries. It contains anti-inflammatory properties that are additionally linked to a decreased incidence of AD. In the brain, plaque deposition is decreased by curcumin (Sharma and Pathak, 2021). Oxidative stress and amyloid pathology are reduced by turmeric (Mishra and Palanivelu, 2008). In one study, mice with AD received low dosages of curcumin, and when compared to the control medication, the curcumin levels were lowered by up to 40% (Shytle et al., 2009). Low dosages of curcumin decreased the quantity of A plaques in the AD-afflicted mice's brains by 43%. Previous research found that for treating AD, modest doses of curcumin administered over an extended period were preferable to higher doses (Yang et al., 2005). Curcumin can bind to Aβ and prevents it from self-assembling (Reinke and Gestwicki, 2007). Curcumin has potent anti-inflammatory and antioxidant effects (Fan et al., 2015). Researchers claim that these properties aid in curing AD symptoms brought

on by oxidation and inflammation (Frautschy et al., 2001). By accumulating cholesterol esters inside of cells, hyperlipidemia and hypercholesterolemia worsen amyloid plaques. By preventing the production of cholesterol and lowering serum peroxides, researchers think curcumin may treat AD (Tokuda et al., 2000).

5.3 Convolvulus pluricaulis

The convolvulaceae family includes *Copluricaulis*. It is employed as a memory-improving substance. *Convolvulus pluricaulis* ethyl acetate and aqueous extract have been linked to improved memory and learning, according to a prior study (Bihaqi et al., 2011). Additional findings show that the nootropic and memory-improving effects of many bioactive compounds, including steroids, flavonol triterpenoids, glycosides, and anthocyanins, are accountable (Malik et al., 2011). It has been shown that *Convolvulus pluricaulis* soothes nerves by controlling the body's production of the stress hormones cortisol and adrenaline (Sethiya et al., 2009). The ethanolic extract, as well as its aqueous and ethyl acetate segments, of *Convolvulus pluricaulis* suggestively enhanced rats' memory retrieval and learning skills (Nahata et al., 2008). Another study conducted by, (Bihaqi et al., 2011) showed that Wistar rat memory was improved in a dosage-dependent manner by *Convolvulus pluricaulis* extracts. Similar to this, giving old mice Convolvulus pluricaulis for a week boosted their memory (Sharma et al., 2010). The hippocampal CA3 and CA1 regions, which are involved in learning and memory, saw an increase in acetylcholinesterase activity after receiving *Convolvulus pluricaulis* (Dubey et al., 1994).

5.4 Centella Asiatica

The apiaceae family includes *Centella asiatica*. It also contains glycoside, thankuniside, ascorbic acid, triterpene, thankunic acid, asiatic acid, thankuniside, brahmoside, ascorbic acid, brahminoside, centoic acid, centellic acid, vellarin, asiaticosides, and isothankuniside (Siddiqui et al., 2007). Epilepsy, rheumatism, mental deterioration, depression, and other disorders are treated using *Centella asiatica* (Gohil et al., 2010). It has spermatogenic, diuretic, anti-convulsant, tonic, anti-spasmodic, stimulant, antioxidant, and sperm-stimulating properties (Heidari et al., 2007). The amyloid-β pathology was restored and the oxidative stress reaction was reduced by *Centella asiatica* (Soumyanath et al., 2012).

(Rao et al., 2007) reported that wistar rats were given therapy with fresh leaf extract from *Centella asiatica* (linn) to improve their learning and memory capacities. For this investigation, adult rats that were 2.5 months old were chosen. For 2, 4, and 6 weeks, extracts were given at 3 distinct doses (2, 4, and 6 mg/kg). Assessments of passive avoidance (T-maze) and spatial learning (after the treatment period) were made. The outcomes were contrasted with those of control rats that were age-matched. There was a significant increase in spatial learning at a dosage of 6 ml extract. According to the passive avoidance test, the usage of *Centella asiatica* extracts improved memory recall. These findings demonstrated that *Centella asiatica* improves adult rats' learning capacity and memory retention (Veerendra Kumar and Gupta, 2003). The allegedly effective use of *Centella asiatica* in AD. It has been noted that it has cognitive-improving and antioxidant properties. Rats with cognitive impairment brought on by the drug streptozotocin (STZ) received *Centella asiatica'*s aqueous extract for 21 days. Male wistar rats received bilateral intracerebroventricular injections of STZ at a dose of 3 mg/kg on days 1 and

3. After 13, 14, and 21 days of therapy, cognitive behavior was evaluated. Rats were put to death after 21 days of therapy to gauge the degree of oxidative damage. Rats given an extract of *Centella asiatica* displayed considerably enhanced cognitive behaviors. The extract was administered at levels of 200 and 300 mg/kg, and this produced the greatest response. Results from, (Veerendra Kumar and Gupta, 2003) demonstrated the effectiveness of *Centella asiatica* in treating rats with STZ-induced cognitive impairment.

5.5 Celastrus paniculatus

The celastraceae family includes *Celastrus paniculatus*. Due to its antioxidant activity, it protected brain cells against hydrogen peroxide toxicity (Godkar et al., 2006). *Celastrus paniculatus* administration reduces glutamine-induced toxicity's harm to neuronal cells (Godkar et al., 2003). The capacity to enhance memory function is due in part to *Celastrus paniculatus's* ability to stimulate cholinergic activity (Bhanumathy et al., 2010). Antioxidant and brain-boosting qualities can be found in *Celastrus paniculatus'* aqueous extract (Kumar and Gupta, 2002). Because of their antioxidant and free radical scavenging properties, extracts of *Celastrus paniculatus* defended brain cells against injury brought on by H_2O_2 (Katekhaye et al., 2011).

5.6 Nardostachys jatamansi

The caprifoliaceae family includes *Nardostachys jatamansi*. It comprises sesquiterpene valeranone, a compound that has been utilized to relieve stress (Lyle et al., 2009). In one study, *Nardostachys jatamansi* corrected amnesia caused by scopolamine and diazepam and showed learning-enhancing and memory retention capacities in both young and old mice. Also, *Nardostachys jatamansi* corrected forgetfulness brought on by aging the *Nardostachys jatamansi* is effective in preventing memory loss brought on by stress (Joshi and Parle, 2006a; Karkada et al., 2012).

5.7 Coriandrum sativum

The coriander plant *Coriandrum sativum* belongs to the Apiaceae family. To investigate the herb's impact on cognitive function, male Wistar rats were given *C. sativum* for 45 days in one experiment. This research compared forgetfulness brought on by diazepam, scopolamine, and age. Due to its anti-inflammatory, antioxidant, and cholesterol-lowering actions, *C. sativum* has shown learning-enhancing properties (Mani and Parle, 2009).

5.8 Ficus carica

The moraceae family includes *Ficus carica*. Its impact on spatial recognition retrieval, retention, and acquisition was examined. The quercetin present in *Ficus carica* is essential in the treatment of AD and memory loss due to its antioxidant capabilities. In this investigation, both normal mice and animals with memory problems were used. A Y-maze and a rectangular maze model were utilized to evaluate the effect of *F. carica* on cognitive performance. Adult Swiss Wistar albino mice received doses of 100 and 200 mg/kg of hexane extract. Scopolamine served as the amnestic agent in this study while Bacopa monniera served as the reference medication. The highest nootropic response of *Ficus carica* 200 mg/kg was equivalent to that of the widely used drug Bacopa monniera. In conclusion, *Ficus carica* enhances learning

capacity and conduct at larger doses while just slightly improving memory at low levels (HAFSA, 2013).

5.9 Ginkgo biloba

The ginkgoaceae family includes *Ginkgo biloba*. It includes bilobalide, which has neuroprotective properties. In Alzheimer's sufferers, *Ginkgo biloba* reduces free radicals and improves memory (Shi et al., 2010). It has flavonoids that are important in improving memory (Bastianetto et al., 2000). *Ginkgo biloba* blocks hippocampus corticosterone's induction of GABA-inhibitory neurotransmission and neurodegeneration (Walesiuk and Braszko, 2009). Administration of *Ginkgo biloba* dramatically enhanced albino rats' memory and learning abilities (Nalini et al., 1992).

5.10 Ilex paraguariensis

The Aquifoliaceae family includes *Ilex paraguariensis*. It improves memory, in a way. Vitamins B12, B1, and C is present. As a dementia preventative, *Ilex paraguariensis* is employed (Bastos et al., 2007). In various rat models, its capacity to improve memory was examined (Colpo et al., 2007). It has been shown that *Ilex paraguariensis* improves both long and short-memory (Prediger et al., 2008). There is proof that Ilex paraguariensis enhances memory when used to treat vascular dementia (Heck and De Mejia, 2007). According to a literature review, *Ilex paraguariensis* is useful in treating neurodegenerative diseases like AD (Mazzafera, 1997).

5.11 Commiphora whighitti

The family burseraceae includes *Commiphora whighitti*. For the treatment of memory deficiencies brought on by scopolamine, it is a powerful cognition enhancer (Saxena et al., 2007). Another study demonstrates that cholesterol-fed rabbits acquire brain diseases similar to AD (Ghribi, 2008). It is backed by clinical studies demonstrating that statin therapy lowers the risk of AD (Raja and Dreyfus, 2004). A decrease in the amount of acetylcholinesterase in the hippocampus has been linked to the memory-improving and anti-dementia properties of *commiphora whighitti* (Lannert and Hoyer, 1998).

5.12 Glycyrrhiza glabra

The family fabaceae includes *Glycyrrhiza glabra*. Pentanol, terpinol, linalool oxide, tetramethyl pyrazine, geraniol, furfuryl formate, hexanol, terpinene, butanediol, propionic acid, ethyl linoleate, benzoic acid, methyl ethyl ketone, furfuraldehyde, trimethyl pyrazine (Rekha and Parvathi, 2012). For gastric ulcers, hoarseness, lung congestion, and throat issues, *Glycyrrhiza glabra* is used (Dastagir and Rizvi, 2016). Scopolamine-induced dementia has been linked to *Glycyrrhiza glabra's* memory-improving properties (Ambavade et al., 2001). (Dhingra et al., 2004) reported on the ability of *Glycyrrhiza glabra* to improve memory in mice. Mice were given *Glycyrrhiza glabra* extracts at 3 different dose concentrations (75, 150, and 300 mg/kg, p.o.) for seven days (Manju Koli, 2023). The memory-improving effects of *G. glabra* at 150 mg/kg were discovered (Dwivedi et al., n.d.).

5.13 Lepidium meyenii

The lepidium meyenii plant belongs to the Brassicaceae family. It is known as Maca, and it has enhanced learning and memory capacities (Rubio et al., 2007). Patients with AD who took *Lepidium meyenii* reported improved memory. Raising acetylcholine levels improves memory (Wang et al., 1995). Because of its antioxidant and AchE-inhibiting properties, it aids experimental memory impairment brought on by ovariectomy. Because *Lepidium meyenii* may reduce AchE and LPO in ovariectomized mice, it has been shown to improve memory recall and learning capacities in such animals (Rubio et al., 2011).

5.14 Panax ginseng

The araliaceae family includes Panax ginseng. An earlier investigation revealed that *Panax ginseng* ingestion improves learning capacity in animals (Cho, 2012). Recent research employing *in vivo* and *in vitro* models have shown the effectiveness of *P. ginseng* powder, extract, and other ginsenosides on AD (Kim et al., 2013). Clinical dementia rating, mini-mental state investigation, and AD assessment scale scores of individuals receiving korean white ginseng powder (4.5 g/d) or korean red ginseng powder (9 g/d) after 12 weeks of ginseng therapy showed a substantial improvement in contrast to those in the control group (Lee et al., 2008).

5.15 Emblica officinalis

The euphorbiaceae family includes *Emblica officinalis*. Both young and old rats showed a dosage-dependent enhancement in memory retention as a result (Ashique et al., 2024a). It undid the amnesia caused by scopolamine and diazepam. *Emblica officinalis* is crucial in the therapy of memory deficiencies and Alzheimer's Disease as a memory enhancer and deficit-reversing agent (Vasudevan and Parle, 2007). An investigation into the memory-improving effects of piracetam in combination with *Curcuma longa* and *Emblica officinalis* against oxidative damage and aluminum-induced cognitive impairment in rats was carried out. Rats were fed oral aluminum chloride for six weeks at a dose of 100 mg/kg. Rats received piracetam (200 mg/kg, i.p.) concurrently with curcumin (100 mg/kg, p.o.), *Emblica officinalis* (100 mg/kg, p.o.), and these doses were given daily for six weeks. Morris water maze tests and elevated plus maze tests were utilized to assess memory on day 21 and day 42 following therapy. On day 43 of the therapy, rats were killed to assess the level of oxidative stress. In comparison to rats given piracetam (200 mg/kg, i.p.) alone, rats given curcumin (100 mg/kg, p.o.), *Emblica officinalis* (100 mg/kg, p.o.), and piracetam (200 mg/kg, i.p.) had much lower levels of oxidative stress and significantly superior memory. As an antioxidant and memory-improving medication, *Emblica officinalis* may be employed to treat memory loss and Alzheimer's Disease (Ramachandran et al., 2013).

5.16 Magnolia officinalis

The magnoliaceae family includes *Magnolia officinalis*. It worsens the memory loss caused by scopolamine. The acetylcholinesterase activity is decreased by *Magnolia officinalis* (Lee et al., 2010). There have been claims that an ethanolic extract of *Magnolia officinalis* includes the antioxidants honokiol and magnolol (Lee et al., 2012). It has been shown that several Soxhlet and supercritical fluid extracts exhibit *in vitro* antioxidant activity; the Soxhlet extract

generated from ethyl acetate is the most active of them. Biphenolic lignins from the *Magnolia officinalis* to enhance the actions of AchE and inhibit Ach cleavage in addition to releasing acetylcholine from the hippocampus (Hou et al., 2000). Both compounds have antioxidant properties when tested *in vivo*. *In vitro, magnolia* exhibited neuroprotective qualities. Tests conducted *in vitro* and *in vivo* revealed that the compound had anti-inflammatory capabilities. Honokiol's anti-inflammatory activities are based on its ability to stop the generation of ROS (Dikalov et al., 2008). The management of AD and memory disorders benefits greatly from the antioxidant and anti-inflammatory properties of *Magnolia officinalis*.

5.17 Zingiber officinale

The family Zingiberaceae includes *Zingiber officinale*. It is used to treat gastric issues, rheumatism, and headaches (Malhotra and Singh, 2003). Through acetylcholinesterase activity suppression, it alleviates the memory impairment brought on by scopolamine (Joshi and Parle, 2006b). *Zingiber officinale* is vital in the therapy of AD and memory problems since it increases antioxidants and lowers free radicals (Masuda et al., 1997). Another study separated male rats (weighing 250-300 g) into treated and control groups. Three more subgroups of the therapy group were created. The first group received plant blended with food at a ratio of 6.25%. The second and third categories each received 50 and 100 mg/kg (intraperitoneal) of plant extract. Investigation of acquisition-recall and spatial recognition behaviors employed the shuttle box test and Y maze test. Male rats given *Zingiber officinale* intraperitoneally and orally showed significantly improved recall, retention, and acquisition (Gharibi et al., 2013).

5.18 Tinospora cordifolia

Menispermaceae is the family to which *Tinospora cordifolia* belongs. Pharmaceutical effects include immunomodulating, antioxidant, and anti-fertility effects (Reddy and Reddy, 2015). Animals with memory problems can benefit from *Tinospora cordifolia's* memory-improving properties (Malve et al., 2014). The production of acetylcholine and immunostimulation are the mechanisms through which *Tinospora cordifolia* enhances memory (Agarwal et al., 2002). Patients with AD who use *Tinospora cordifolia* have improved cognitive performance.

5.19 Punica granatum

The punicaceae family includes *Punica granatum*. It contains punicafolin, pedunculagin, punicacortein A, granatin, corilagin, and punicafolin. Diarrhea and dysentery are treated with *Punica granatum* (Das et al., 1999). It works as an astringent and anthelmintic. (Cambay et al., 2011) reported on the efficiency of *P. granatum* flower in enhancing memory and learning in diabetic rats. For this investigation, 12 rats were categorized into five groups: control, STZ, and STZ in combination with pomegranate blossoms at 300, 400, and 500 mg/kg/d. The findings demonstrated that STZ-treated rats exhibited higher memory impairment than control-group rats. Rats with diabetes were given pomegranate blossom powder to help them learn and remember knowledge. Compared to STZ-induced diabetic rats, treatment with pomegranate flower powder reduced oxidative stress and improved memory. To alleviate neurological impairments in people with DM, *P. granatum* is crucial (Pandey Priya, Kuma Nitin, Kaur Teljinder, Saini Shalini, 2022).

5.20 Crocus sativus

The iridaceae family includes *Crocus sativus*. To treat AD and memory problems, doctors are increasingly recommending *Crocus sativus*. Clinical experiments were conducted on 54 individuals, aged 55, over 22 weeks to assess the efficacy of *Crocus sativus*. Patients received either 30 mg of saffron capsules or 10 mg of donepezil at random. In individuals with mild to severe AD, *C. sativus* at 30 mg/d was shown to be therapeutically equivalent to donepezil after 22 weeks of therapy. Negative side effects occurred in both patient groups at comparable rates, except nausea, which happened more often in those receiving donepezil than saffron (Akhondzadeh et al., 2010). A second study of a similar sort compared memantine's and saffron extract's advantages in slowing cognitive deterioration in individuals with moderate to severe Alzheimer's Disease. In this clinical experiment, 68 people received either memantine (20 mg/d) or saffron extract (30 mg/d) for a whole year. Every month, patients were evaluated using the functional assessment staging and the severe cognitive impairment rating scale to look for any detrimental effects. *C. sativus* at 30 mg/d was shown to be therapeutically equivalent to memantine after a year of therapy in individuals with moderate to severe AD. Both treatment groups had side effects often, and there was no discernible difference between them (Farokhnia et al., 2014).

5.21 Cissampelos pareira

Cissampelos pareira belongs in the Menispermaceae family. We looked at how it affected the memory and learning of mice. Memory was assessed using the raised plus maze and the passive avoidance paradigm. *Cissampelos pareira* hydroalcoholic extract was given orally over seven days at dosages of 100, 200, and 400 mg/kg. Mice were given 400 mg/kg of *C. pareira*, which significantly enhanced memory and learning. At a dosage of 400 mg/kg, cissampelos pareira extracts prevented scopolamine-induced amnesia. *Cissampelos pareira* may have a nootropic effect due to its enhanced antioxidant and anti-inflammatory qualities as well as its reduced acetylcholinesterase enzyme activity (Pramodinee et al., 2011).

5.22 Mellisa officinalis

The lamiaceae family includes *Mellisa officinalis*. It has calming, inflammatory, and mood-enhancing properties (Taiwo et al., 2012). Kennedy *et al*. (2002) conducted a clinical trial in which 20 young individuals were enrolled and randomly allocated to take either a single dosage of *Mellisa officinalis* (300, 600, or 900 mg) or a placebo at intervals of seven days. At 600 mg, *Mellisa officinalis* greatly increased mental acuity. (Akhondzadeh et al., 2003) research to evaluate the efficiency and safety of *M. officinalis* (60 drops/day) in the therapy of AD was conducted (Sharma et al., 2023a). The test and placebo groups of patients were randomly assigned. For four months, individuals between the ages of 65 and 80 received *Mellisa officinalis* extract. *Mellisa officinalis* extract showed a substantial improvement in cognitive performance after 4 months of treatment compared to the placebo group. Except for agitation in the placebo group, neither treatment group had any notable adverse effects (Sharma and Chandra, 2023).

5.23 Moringa oleifera

The moringaceae family includes the *Moringa oleifera* plant. Vitamin E and vitamin C, which are antioxidants and help recover cognition in AD patients, are found in *Moringa oleifera* leaf extract (Pakade et al., 2013). It combats stress in AD and has nootropic properties (Obulesu and Rao, 2011). Monoamines are important in memory function and are changed by moringa oleifera (Ganguly and Guha, 2008). According to a rat study, *Moringa oleifera* lowers levels of monoamines such as dopamine, norepinephrine, and serotonin, which reduces the effects of AD caused by colchicine (Obulesu and Rao, 2011).

5.24 Salvia officinalis

The Lamiaceae family includes *Salvia officinalis*. It interacts with cholinergic and muscarinic pathways, which are important in the memory retention process, to improve memory retention (Eidi et al., 2006). In a study, the effectiveness of *S. officinalis* was examined in 42 patients with AD living in Tehran, Iran, who were between the ages of 65 and 80. There were 18 female and 24 male participants. Significantly more efficacy was seen in patients receiving *Salvia officinalis* after 4 months of treatment compared to individuals receiving a placebo. *Salvia officinalis* appears to be useful in treating AD and memory problems, according to research (Akhondzadeh et al., 2003).

5.25 Myristica fragrans

The Myristicaceae family includes *Myristica fragrans*. It contains d-borneol, b-pinene, garaniol, myristic acid, terpineol, myristicins, safrol, β-sitosterol elemicin, pentadecanoic acid, cymene, palmitic acid, stearic acid, oleic acid and lauric acid (Maeda et al., 2008). Leukemia, nausea, vomiting, tachycardia, vertigo, and memory issues are among the conditions for which *Myristica fragrans* are utilized (Asgarpanah and Kazemivash, 2012). It contains antioxidant, hypolipidemic, antibacterial, and antidepressant effects (Narasimhan and Dhake, 2006). Three days in succession, oral dosages of *Myristica fragrans* N-hexane extract at 5, 10, and 20 mg/kg p.o. were given to aged and young mice (Bhattacharya et al., n.d.). This drug at a dosage of 5 mg/kg corrected the memory deficits produced by diazepam and scopolamine. According to this research, *Myristica fragrans* are efficient in treating AD and memory issues (Parle et al., 2004).

5.26 Bacopa monnieri

Bacopa monnieri belongs to the Scrophulariaceae family of plants. Sterols, alkaloids, monnierin, saponins, herpestine, saponin acid A, and brahmine are among their constituents. To treat Alzheimer's disease (AD) and memory problems, traditional healers use *B. monnieri*, *Evolulus alsinoides*, and *C. astiatica* (Russo and Borrelli, 2005). In AD patients, bacopa monnieri improves memory. It has adaptogenic, neuroprotective, antibacterial, and memory-boosting properties (Aguiar and Borowski, 2013). (Calabrese et al., 2008) analyzed the effects of *B. monnieri* on cognitive function, anxiety, and depression in elderly patients and found that it was effective in improving cognitive functioning. Its function as a memory booster is supported by this study (Pratap Singh et al., n.d.). Another investigation found that *Bacopa monnieri* improves cognition in a rat model of Alzheimer's Disease and blocks cholinergic degradation (Uabundit et al., 2010).

5.27 Evolvulus alsinoides

Convolvulaceae is the family to which *Evolvulus alsinoides*. (Nahata et al., 2008) reported on the usefulness of *Evolvulus alsinoides* in boosting memory function and learning behavior in mice. Rats were tested for memory-improving effects of *Evolvulus alsinoides* ethanol extracts, along with their ethyl acetate and aqueous fractions. 200 mg/kg and 100 mg/kg of extracts were given orally. The learning capacity and memory retention of rats was greatly improved by all extracts. Additionally, these extracts (0.3 mg/kg, i.p.) significantly corrected the amnesia that scopolamine-induced in rats. The standard medication, piracetam, was used to compare the nootropic effect of extracts. In the step-down and shuttle-box avoidance paradigms, the extract significantly improved memory performance.

5.28 Ficus racemosa

Ficus racemosa is a member of the moraceae family (Ahmed et al., 2011). According to research that looked at the rat's memory-improving benefits of the bark, *F. racemosa* (250 and 500 mg/kg) markedly raised Ach levels in the hippocampus. According to this study, it may be used to treat people with AD who have memory problems.

5.29 Ginkgo ginseng

Ginkgo ginseng is a member of the ginkgoaceae family (Wesnes et al., 2000). 256 healthy middle-aged volunteers throughout 14-week research, described how Ginkgo ginseng improved memory. Before and after the treatment, participants completed a questionnaire on their quality of life, mood, and sleep. At weeks 0, 4, 8, and 14 of the courses of treatment, an evaluation was conducted. Memory deficiencies have been proven to be improved with *Ginkgo ginseng* powder.

6 CONCLUSION

In further depth, this article has discussed the management of Alzheimer's Disease and medicinal herbs with possible therapeutic advantages. There is only symptomatic treatment for this complicated condition, despite the huge quantity of information that is now available about it. Herbal treatment is therefore expected to slow the progression of AD and aid in the relief of AD-related symptoms. Thanks to herbal therapy, patients with AD and memory problems can live better lives. A viable cure for AD is being sought after by researchers everywhere. This analysis shows that herbal therapy is a promising approach to treating AD. The management and treatment of memory impairments can be greatly aided by the use of medicinal plants in several medical systems, particularly the Unani system. The vast majority of plants and herbs have undergone chemical analysis, and some are even currently undergoing CT. The outcomes are astounding and substantial. The fundamental mechanisms of action, however, are currently under development. As discussed in this research, additional CT with bigger sample numbers is required to examine the function of various plants and the underlying mechanisms involved.

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Conflict of interest

The authors declare that there is no conflict of interest.

List of abbreviations

Ach: Acetylcholine

AchE: Acetylcholinesterase

AD: Alzheimer's disease

ANS: Autonomic nervous system

APOE: Apolipoprotein E

APP: Amyloid precursor protein

Aβ: Amyloid-beta

BACE: Beta-secretase

CNS: Central nervous system

CT: Clinical trials

DM: Diabetes mellitus

GABA: Gamma-aminobutyric acid

LPO: Lipid peroxidation

ROS: Reactive oxygen species

SMC: Significant memory concern

STZ: Streptozotocin

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