**Review Article**

*Int Jou Hea Bio Sci, 6(4), 2025, 25-33*

International Journal of Health care and Biological Sciences

Content available at www.saap.org.in Online ISSN: 2582-7499

Open Access

# ROLE OF NATURAL PRODUCTS TO PREVENT ALZHEIMER'S DISEASE

**Thallapaku Jyotshna*, M. Amrutha Reddy, B. Vaishnavi, C. Sai Narasimha, V. Amrutha, R. Gouthami, A. Udaya**

**Department of Phamacology, Annamacharya College of Pharmacy, Rajampet, Andhra Pradesh 516126**

**Article History**

Received on: 14-10-2025
Revised on: 24-11-2025
Accepted on: 03-12-2025

**Abstract**

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that primarily affects older adults, causing memory loss, cognitive decline, and behavioral changes. Its pathology involves oxidative stress, chronic inflammation, mitochondrial dysfunction, and abnormal protein aggregation, particularly amyloid-beta plaques. Current treatments provide only limited symptomatic relief, highlighting the need for new therapeutic strategies. Plant-derived natural products have gained attention for their neuroprotective potential. Medicinal plants such as *Ginkgo biloba*, *Withania somnifera* (Ashwagandha), *Panax ginseng*, *Curcuma longa* (turmeric), and *Camellia sinensis* (green tea) contain bioactive compounds with antioxidant, anti-inflammatory, and anti-amyloid effects. Curcumin inhibits amyloid plaque formation and reduces oxidative stress, while resveratrol enhances mitochondrial function and neuronal survival. Ginseng and Ashwagandha improve cognition and stress resilience, and green tea polyphenols neutralize free radicals and modulate key signaling pathways. Traditional herbal formulations often combine multiple plants for synergistic effects. Although more clinical studies are needed, these plant-based therapies show promise as complementary approaches for AD management.

***Keywords:*** *Alzheimer's disease, pathophysiology, signs & symptoms, drugs, natural products.*



***Corresponding Author**
Thallapaku Jyotshna

## Introduction

AD is a chronic brain disorder a complex and steadily advancing a disorder of the nervous system that chiefly affects aging populations leading to declining memory function reasoning functions and behavioral patterns [1]. recognized as the leading cause of dementia ad involves the progressive destruction of nerve cells which leads to continuous deterioration ofgradual deterioration of brain activity eventually leads to profound impairment in critical skills such as memory and language on a global scale the condition affects nearly 24 million people with close to one in ten individuals over the age of 65 living with its consequences from a biological perspective ad develops when certain proteins in the brain malfunction disrupting normal cellular mechanisms this neuronal impairment results from cellular malfunction weakens synaptic connections and ultimately results in cell death the disease often begins silently many years before symptoms become apparent typically in brain regions responsible for memory in some cases onset may occur earlier during middle age according to the Alzheimer's association dementia including ad ranks as the seventh leading cause of death worldwide highlighting its immense social and economic burden [2].

The advancement of Alzheimer's disease ad is highly complex involving several interconnected mechanisms such as damage from free radicals ongoing inflammatory processes and impaired mitochondrial activity and reduced efficiency of cellular waste removal through autophagy [3] ongoing advances in neuropharmacology are fueling efforts to develop therapies that address these diverse pathological processes increasing scientific interest has turned toward plant-based compounds which exhibit neuroprotective activity by combining antioxidant and anti-inflammatory properties [4]. Natural products are gaining recognition because they can simultaneously influence multiple aspects of ad pathology including key drivers of Alzheimer's disease include oxidative stress mitochondrial impairment amyloid-beta buildup and neuroinflammation systems biology provides tools to analyze these overlapping processes and design multi-targeted interventions biology and pharmacogenomics

researchers are now able to incorporate these agents into personalized clinical management methods tailoring treatments to an individual's molecular and genetic profile [5] despite the growing body of research most studies on natural compounds in ad focus narrowly on specific biochemical pathways or particular groups of molecules rather than offering a comprehensive perspective that links experimental findings to practical clinical applications [6]

In East Asia, herbal medicine is commonly used to manage cognitive disorders such as Alzheimer's disease. Plants like Ginkgo biloba, Ashwagandha (Withania somnifera), Panax ginseng, Turmeric (Curcuma longa), and green tea (Camellia sinensis) contain active compounds that provide antioxidant, anti-inflammatory, anti-amyloid, and nerve-protective effects, making them valuable in Alzheimer's therapy. In traditional views, dementia has been linked to weaknesses in kidney function, poor circulation, and the buildup of harmful substances in the body [7, 8]. Recent studies on traditional Korean medicine (TKM) herbal formulas show that they can boost the growth of new neurons, support hippocampal function, lower oxidative stress, and help regulate brain inflammation-all of which contribute to improved memory [9].

### Types of Alzheimer's disease

Alzheimer's disease can be divided into different types based on when it begins, genetic risk factors, andClinical features. Recognizing these categories is important for accurate diagnosis and treatment planning. The main forms include: (1) Early-onset Alzheimer's disease (EOAD), (2) Late-onset Alzheimer's disease (LOAD), and (3) Subtypes or atypical variants of LOAD, such as the typical amnestic form. [10-12].

## Signs and Symptoms

Memory loss is the hallmark symptom of Alzheimer's disease. In its early stages, individuals often struggle to recall recent conversations or events and may find it difficult to think clearly [12]. Brain changes from Alzheimer's disease led to the following symptoms that get worse over time.

- Difficulty remembering conversations, scheduled activities, or important events.
- Frequently losing belongings and placing them in unusual or illogical spots.
- Struggling to recall the names of relatives or common everyday items.
- Finding it hard to express ideas, choose the right words, or maintain conversations.
- Problems with focus and reasoning, especially when dealing with abstract ideas like numbers.
- People with Alzheimer's often struggle to make sound decisions or judgments, which can lead to inappropriate social behavior or choosing clothing that doesn't match the weather conditions [13].

For individuals with Alzheimer's disease, carrying out everyday tasks that require following steps in sequence becomes increasingly difficult. Alongside this, they may experience emotional and behavioral changes such as depression, reduced interest in hobbies, withdrawal from social life, mood fluctuations, suspicion of others, irritability or aggression, disturbed sleep patterns, wandering, lack of self-control, and false beliefs-for example, thinking possessions have been stolen when they have not [14].

## Alzheimer's drugs

### Classification Basic mechanism of action

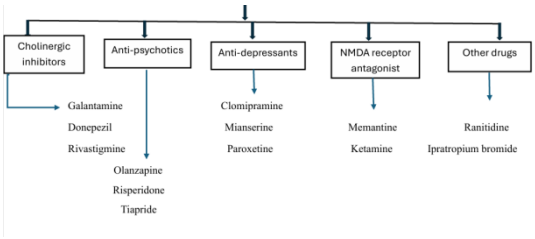


Fig 01: Classification of Alzheimer Drugs

### Basic mechanism of action

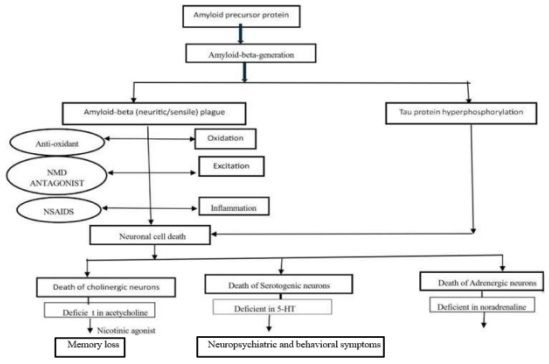


Fig 02: Basic Mechanism invaded in the Alzheimer Drugs

## Adverse Drug Reactions

Table 01: Adverse drugs Reactions for Alzheimer Drugs

| S. No | Category | Drugs | Common ADRs | Serious ADRs | Uses |
|---|---|---|---|---|---|
| 1 | Cholinesterase inhibitors | a. Donepezil b. Rivastigmine c. Galantamine | Nausea, diarrhea, insomnia, muscle cramps; GI upset, weight loss, dizziness; vomiting, anorexia, fatigue | Bradycardia, syncope; GI bleeding, severe skin reactions; cardiac arrhythmias | To treat mild to moderate Alzheimer's disease by increasing acetylcholine levels |
| 2 | NMDA receptor antagonist | Memantine | Dizziness, headache, constipation | Confusion, hallucinations | To treat moderate to severe Alzheimer's disease by regulating glutamate activity |
| 3 | Antipsychotics | Olanzapine | Weight gain, drowsiness | Metabolic syndrome, neuroleptic malignant syndrome | To manage mild to moderate behavioral symptoms in Alzheimer's disease |
| 4 | Antipsychotics | Risperidone | Weight gain, anxiety, drowsiness, tiredness, hormonal effects (e.g., galactorrhea), constipation, dizziness | Hyperprolactinemia, tardive dyskinesia, neuroleptic malignant syndrome (rare) | To treat schizophrenia or bipolar disorder; sometimes used for behavioral symptoms in dementia |
| 5 | Antidepressants | Clomipramine | Dry mouth, constipation, blurred vision, drowsiness, weight gain, sexual dysfunction | QT prolongation, seizures (lowered threshold), orthostatic hypotension, hepatic failure, suicidal ideation (especially in young adults), serotonin syndrome | To treat mild to moderate depression; strong sedative and anti-anxiety properties |

## Non Pharmacological Treatment

- Cognitive approaches that help stimulate thinking and memory skills
- Regular physical activity to support brain and body health
- Social interaction to maintain connections and reduce isolation
- Creative therapies such as art and music to enhance mood and cognition
- Animal-assisted programs that provide comfort and emotional support
- Training for caregivers to improve care strategies and patient well-being [15].

## Natural Products Treating Alzheimer's Disease

Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by memory loss, cognitive decline, and behavioral changes. Its pathology involves amyloid-beta plaques, tau protein abnormalities, oxidative stress, mitochondrial dysfunction, and chronic neuroinflammation [16]. Current therapies offer only symptomatic relief, prompting interest in natural products as multi-target strategies [17]. Plant-, herb-, and marine-derived compounds act via multiple mechanisms, including antioxidant activity, anti-inflammatory effects, inhibition of amyloid and tau aggregation, mitochondrial protection, and promotion of neuronal survival (Frontiers in Pharmacology, 2025; International Journal of Pharmaceutical Sciences, 2025). Notable examples include curcumin from turmeric, which prevents amyloid-beta aggregation and oxidative damage [18], resveratrol, which enhances mitochondrial function, activates SIRT1, and promotes amyloid clearance [19], and Huperzine A, an acetylcholinesterase inhibitor that improves memory and protects neurons [20-21].

Other compounds include ginsenosides (Panax ginseng) reducing oxidative stress and tau pathology, terpenoids from Ginkgo biloba improving cerebral blood flow and lowering neuroinflammation, EGCG from green tea preventing amyloid toxicity, and marine-derived molecules such as fucoidans and bryostatin supporting synaptic repair [22]. Additional agents like Boswellia, omega-3 fatty acids, ashwagandha, Bacopa monnieri, and lion's mane mushroom enhance neurogenesis, synaptic function, and cholinergic activity [23].

Overall, natural products offer multi-target neuroprotection and represent promising complementary strategies for slowing AD progression and improving cognitive function.

### Ashwagandha

(Withania somnifera), a member of the Solanaceae family, is also known as Indian ginseng or winter cherry. For Alzheimer's therapy, the roots are most commonly used, though leaves and seeds are also applied. The roots contain key Ashwagandha bioactive compounds such as alkaloids (convolamine, convoline, convolidine, convolvine), withanolides (including withanolide A, withasomnine, and withanosides), sitoindosides (like β-sitosterol and d-glycoside), along with steroidal constituents.

### History

Ashwagandha has been used in Ayurvedic medicine for over 3,000–4,000 years, tracing its roots to the teachings of the revered sage Punarvasu Atreya [24]. Ashwagandha is mentioned in the classical Ayurvedic texts, the Charaka and Sushruta Samhitas, where it is praised as a restorative tonic, particularly effective against weakness and suitable for people of all ages-even infants**.**

### Cultivation

Classical Ayurvedic texts such as the Charaka and Sushruta Samhitas describe Ashwagandha as a powerful rejuvenating tonic, valued for treating weakness and considered safe for people of all ages, including infants.

### Mechanism of action

Its antioxidant action works by boosting enzymes such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase, and NADPH dehydrogenase. These enzymes help neutralize free radicals, lower cellular stress, and support proper mitochondrial functio. Ashwagandha shows anti-inflammatory activity by blocking the excessive production of pro-inflammatory molecules such as TNF-α and prostaglandins (PGE2). It also suppresses cyclooxygenase-2 (COX-2) and nitric oxide formation by inhibiting nitric oxide synthase (iNOS). By reducing reactive oxygen species (ROS), interleukins (IL-8 and IL-1β), and NF-κB signaling, Ashwagandha helps counter conditions like arthritis and rheumatism.

### Uses

Ashwagandha exhibits a wide range of health benefits, including anti-inflammatory, neuroprotective, immune-regulating, liver-protective, heart-protective, anti-diabetic, adaptogenic, anti-arthritic, stress-relieving, and antimicrobial effects [25].

## Ginkobiloba

Ginkgo biloba, belonging to the Ginkgoaceae family and commonly called the maidenhair tree, is valued for its medicinal parts-mainly the leaves and seeds. Its chemical profile includes flavonoids such as quercetin, kaempferol, and isorhamnetin that provide antioxidant activity. Neuroprotective effects are attributed to compounds like ginkgolides (A, B, C, J, M) and bilobalide. Other constituents include proanthocyanidins, alkylphenols, and ginkgo toxin-a compound structurally similar to vitamin B6 but known to be neurotoxic.

### History

Ginkgobiloba is adistinctivelivingtree with a unique place inplant evolution and human culture. It is valued in horticulture and as a street tree, is a source of edible "nuts" and popular in herbal medicine, and it has proved inspirational in art, literature, and religion. Ginkgois also a livinglink to diverse seed plants that flourished over 100 million years ago. With recent discoveries of extinct fossil ginkgo relatives, and the recent draft sequence of its genome, ginkgo offers opportunities to increase public understanding of plant science and the importance of plant conservation [26].

### Cultivation

Ginkgo trees thrive in sunny, well-drained soils, preferring slightly acidic to neutral conditions. They can grow 50–80 ft tall, so adequate space is essential. Planting is best in spring or fall; dig a hole twice the size of the root ball, position the root flare at ground level, refill, press lightly, and water thoroughly. Young trees require regular watering, while mature trees tolerate drought but benefit from occasional deep watering. Mulch 2–3 inches around the base, keeping it away from the trunk. Prune dead, damaged, or crossing branches in late winter or early spring. Fertilize with a balanced slow-release formula in early spring, though mature trees need minimal additional nutrients.

### Mechanism of action

Ginkgo biloba and its extracts may help protect against Alzheimer's disease by disrupting the formation of beta-amyloid plaques. In addition, they can ease inflammation by lowering the release of pro-inflammatory cytokines such as IL-1, IL-6, and TNF-α. Ginkgo also reduces the production of reactive oxygen species (ROS), limits oxidative stress, and prevents cell death, all of which contribute to its potential in Alzheimer's prevention.

### Uses

Ginkgo biloba provides multiple health benefits, including antioxidant defense, anti-inflammatory activity, improved circulation and cardiovascular support. It may also help ease anxiety and depression, promote eye health, aid recovery from post-stroke depression, and act as a natural antidepressant.

## Turmeric

Curcuma longa L., a member of the Zingiberaceae family, is best known for its rhizome (underground stem), which is the main part used medicinally. Its active compounds are curcuminoids (2–9%), with curcumin being the most abundant (about 77%). Other notable curcuminoids include desmethoxycurcumin (17%) and bisdemethoxycurcumin (3%). (AAPS Journal et al., 2013)

The essential oils found in turmeric include turmerone, atlantone, and zingiberene. In addition, the plant contains other bioactive compounds such as phenylpropenes, diarylheptanoids, terpenoids, sterols, and alkaloids.

### History

Turmeric has been part of Indian tradition for almost 4,000 years, first used in the Vedic culture as both a spice

and a sacred substance. Over time, it spread across the world-arriving in China around 700 AD, East Africa by 800 AD, West Africa by 1200 AD, and later reaching Jamaica in the 18th century. In 1280, Marco Polo wrote about turmeric, noting its striking resemblance to saffron. In South Asia, ancient Sanskrit texts along with Ayurvedic and Unani traditions record its long medicinal use. The Susruta Samhita, dating back to around 250 BC, even prescribes a turmeric-based ointment to counter the harmful effects of contaminated food.

**Cultivation**

Turmeric grows well in tropical climates from sea level up to 1,500 meters, with temperatures between 20–35 °C and annual rainfall of at least 1,500 mm. It can adapt to different soils but performs best in well-drained red or clay loam soils with good organic matter and a pH of 4.5–7.5. Proper drainage is crucial. For planting one hectare, about 2,000–2,500 kg of rhizomes is needed, and only healthy, well-developed, disease-free rhizomes should be chosen.

**Uses**

Curcumin offers a wide range of health benefits. It acts as an antioxidant, supports healing, reduces inflammation, and shows anti-cancer as well as anti-amyloid effects. It also aids digestion, improves gut health, and helps ease indigestion. Importantly, curcumin has neuroprotective properties that may help prevent or slow the progression of neurodegenerative disorders such as Alzheimer's disease Turmeric has traditionally been applied to support mental performance and maintain overall brain health.

**Mechanism of action:**

Inhibits amyloid-β aggregation, reduces neuroinflammation, and oxidative stress in neurons.

## Garlic

Garlic *(*Allium sativum L.), a member of the Amaryllidaceae family, is primarily valued for its bulb. It contains a variety of sulfur-based compounds such as ajoene's, alliin, inyldithiins, and allicin, along with flavonoids like quercetin. Different garlic extracts and isolated molecules include allyl mercaptan, S-allyl cysteine, diallyl disulfide, diallyl trisulfide, and S-allylmercaptocysteine. These compounds are responsible for garlic's wide range of biological activities.

**History**

Garlic is among the oldest flavoring and seasoning plants, woven into the culinary traditions of many cultures worldwide. Originating in Central Asia and domesticated during the Neolithic era, it spread to the Middle east and North Africa around 3000 BC, eventually reaching Europe. Valued for both its nutritional qualities and diverse medicinal benefits, garlic soon became recognized as one of nature's most treasured plants. Through selective breeding, it has since developed into numerous popular varieties now cultivated and consumed across the globe.

**Cultivation**

Garlic grows best in fertile, well-drained soil with a pH of 6.0–7.5 and a cool, dry climate (12–24 °C). Excess rain or waterlogging can reduce bulb quality and increase disease risk (ICAR, 2023). Garlic is planted using individual cloves, typically between September and November, with proper fertilization, irrigation, weed control, and pest management (Rubatzky & Yamaguchi, 2012). Bulbs are harvested 4–6 months later when leaves yellow, then cured for several days to reduce moisture and stored in a cool, ventilated place to prevent spoilage.

**Mechanism of action**

Protects neurons by antioxidant activity, reduces amyloid toxicity, and enhances neuroprotection.

**Uses**

Garlic demonstrates a wide range of medicinal effects. It acts as an antioxidant, protects kidney function, helps prevent hardening of the arteries, shows anti-cancer potential, supports blood sugar control, fights microbes,and contributes to lowering high blood pressure [27].

## Tulasi

Tulasi (Ocimum tenuiflorum), a member of the Lamiaceae family, is primarily valued for its leaves. These leaves contain key bioactive compounds such as eugenol and rosmarinic acid, along with volatile oils rich in luteolin, apigenin, and ursolic acid. Together, these constituents contribute to Tulasi's medicinal properties.

**History**

Tulsi (Ocimum tenuiflorum), commonly known as holy basil, holds a special place in Hindu culture, where it is honored as a sacred and spiritually significant herb. Across Indian households, the Tulsi plant is often placed in the courtyard, representing purity, devotion, and the sacred presence of Lord Vishnu and Goddess Lakshmi. Revered in Ayurveda as the "Queen of Herbs," Tulsi serves both as a focus of daily worship and as a powerful source of natural healing. This guide highlights Tulsi from two perspectives: its deep spiritual role in Hindu tradition and its scientifically recognized medicinal value

**Cultivation**

Sow Tulsi seeds 1/4 in (0.6 cm) deep in a pot full of moist, well-drainingsoil. Set the pot in a warm spot that gets6-8 hours of bright sunlight. Mist the soil with water to keep it moist. Wait for the seedlings to sprout in 5 to 7 days. Plant the seedlings in a large pot indoors or in your garden outdoors. Pluck off leaves or cut off whole stems during the growing season.

***Mechanism of action***

Ocimum sanctum extract (OSE) promotes the density of pyramidal cells in the CA1 and CA3 mediated by increased concentration of Ach. Ocimum sanctum combats oxidative stress and regulates neurotransmitter levels which are critical for neuronal function. **Uses**

Rich in Antioxidants, lower blood sugar and cholesterol while reducing inflammation, Stress Relief, anxiety, and

improved mood and energy, Immunity and Respiratory Health, Tulsi has broad antimicrobial and anti-inflammatory action.

Its essential oils and extracts show antibacterial, antiviral and antifungal effects. This makes it a traditional remedy for colds, coughs and fevers.

### Neem

Neem, scientifically known as Azadirachta indica, belongs to the mahogany family (Meliaceae). Different parts of the plant are valued for use, including its leaves, seeds and fruits, bark, and wood. Neem is rich in a wide variety of bioactive compounds such as glycoproteins, triterpenes, limonoids, flavonoids, phenols, tannins, nimbins, saponins, catechins, azadirachtin, and gallic acid.

### History

Azadirachta indica, commonly known as neem, belongs to the mahogany family and has long been valued in traditional medicine across South Asia and Africa. Today, its use is expanding worldwide. The name "neem" comes from the Sanskrit word Nimba, and the plant is often referred to as the "Village Pharmacy," "Divine Tree," Nature's Drugstore," "Medicinal Cabinet," or even a "Panacea," highlighting its reputation as a universal healer. Neem is among the earliest medicinal plants mentioned in Siddha medicine, one of humanity's oldest healing systems. Virtually every part of the tree-flowers, seeds, bark, and roots-has been employed to treat a widerange of ailments

### Cultivation

Neem (*Azadirachta indica*) grows well in areas with 350–1200 mm annual rainfall and can withstand temperatures up to 50–52°C, but it is sensitive to frost, heavy shade, and extremely cold climates. It adapts to various soils, with black cotton soil being optimal, and enriches soil fertility while reducing acidity. Young plants can be raised in nurseries or sown directly, ideally before or during the rainy season. Seeds should be harvested when yellow-green, cleaned, and soaked in cold water for 24 hours to improve germination (~90% for fresh seeds), which begins in 6–7 days. Seedlings are ready for transplanting at 8–10 cm height with a 15 cm taproot, and older seedlings (25–30 cm) survive better in dry areas. Planting is recommended in 30 $cm^3$ pits with 3×3 m spacing at the start of the rainy season.

### Mechanism of action

Exhibits neuroprotective effects by reducing oxidative stress, inhibiting amyloid-β accumulation, and modulating neuroinflammation in Alzheimer's disease.

### Uses

Neem (*Azadirachta indica*) possesses diverse medicinal properties, including antioxidant, anti-inflammatory, anticancer, antidiabetic, neuroprotective, and cardioprotective effects. It supports DNA repair, regulates the cell cycle, enhances immunity, and modulates signaling pathways to reduce inflammation, inhibit angiogenesis, and prevent tumor metastasis. Neem also exhibits antimicrobial, antibacterial, antiviral, larvicidal, anti-malarial, and spermicidal activities. Traditionally, it has been used to manage atherosclerosis, smallpox, leprosy, urinary disorders, infections, and hypertension [28].

## Some of Natural Products Used in Treatment of Alzheimer's Disease

Table 01: Detailed information for the Natural Products Which is used for the Alzheimer's disease

| Plant name | Biological source | Family | Extract used | Plant part used | Inducing agent / Effect |
|---|---|---|---|---|---|
| Ginkgo biloba | Ginkgo biloba L. | Ginkgoaceae | Leaf extract | Leaves | Antioxidant, Anti-amyloidogenic |
| Curcuma longa | Curcuma longa L. | Zingiberaceae | Curcumin | Rhizome | Anti-inflammatory, Aβ inhibition |
| Bacopa monnieri | Bacopa monnieri L. | Plantaginaceae | Bacosides | Whole plant | Memory enhancer, antioxidant |
| Withania somnifera | Withania somnifera L. | Solanaceae | Withanolides | Roots | Reduces oxidative stress |
| Centella asiatica | Centella asiatica L. | Apiaceae | Asiaticoside | Leaves | Neuronal growth, antioxidant |
| Camellia sinensis | Camellia sinensis L. | Theaceae | EGCG (catechins) | Leaves | Amyloid-beta inhibition |
| Rosmarinus officinalis | Rosmarinus officinalis L. | Lamiaceae | Rosmarinic acid | Leaves | Cholinesterase inhibition |
| Salvia officinalis | Salvia officinalis L. | Lamiaceae | Essential oil | Leaves | Memory enhancement |
| Crocus sativus | Crocus sativus L. | Iridaceae | Crocin, safranal | Stigma | Antioxidant, neuroprotective |
| Panax ginseng | Panax ginseng L. | Araliaceae | Ginsenosides | Roots | Cognitive improvement |
| Glycyrrhiza glabra | Glycyrrhiza glabra L. | Fabaceae | Glabridin | Roots | Anti-inflammatory |

| | | | | | |
|---|---|---|---|---|---|
| Piper nigrum | Piper nigrum L. | Piperaceae | Piperine | Fruits | Enhances bioavailability of curcumin |
| Zingiber officinale | Zingiber officinale L. | Zingiberaceae | Gingerol | Rhizome | Anti-inflammatory, antioxidant |
| Ocimum sanctum | Ocimum sanctum L. | Lamiaceae | Eugenol | Leaves | Stress reduction, neuroprotective |
| Tinospora cordifolia | Tinospora cordifolia L. | Menispermaceae | Tinosporaside | Stem | Immunomodulatory, antioxidant |
| Emblica officinalis | Phyllanthus emblica L. | Phyllanthaceae | Gallic acid | Fruit | Antioxidant, anti-aging |
| Moringa oleifera | Moringa oleifera L. | Moringaceae | Quercetin | Leaves | Anti-inflammatory, antioxidant |
| Aloe vera | Aloe barbadensis Mill. | Asphodelaceae | Aloin | Leaves | Neuroprotective, anti-inflammatory |
| *Allium sativum* | *Allium sativum* L. | Amaryllidaceae | Allicin | Bulb | Reduces oxidative stress |
| *Nigella sativa* | *Nigella sativa* L. | Ranunculaceae | Thymoquinone | Seeds | Anti-inflammatory, antioxidant |
| *Berberis aristata* | *Berberis aristata* DC. | Berberidaceae | Berberine | Bark | Neuroprotective, anti-diabetic |
| *Terminalia chebula* | *Terminalia chebula* Retz. | Combretaceae | Chebulagic acid | Fruits | Antioxidant, memory enhancer |
| *Terminalia arjuna* | *Terminalia arjuna* Roxb. | Combretaceae | Arjunolic acid | Bark | Cardioprotective, antioxidant |
| *Ficus religiosa* | *Ficus religiosa* L. | Moraceae | Flavonoids | Bark | Cognitive support |
| *Boerhavia diffusa* | *Boerhavia diffusa* L. | Nyctaginaceae | Punarnavine | Whole plant | Anti-inflammatory |
| *Convolvulus pluricaulis* | *Convolvulus pluricaulis* L. | Convolvulaceae | Alkaloids | Whole plant | Brain tonic, memory enhancer |
| *Evolvulus alsinoides* | *Evolvulus alsinoides* L. | Convolvulaceae | Flavonoids | Whole plant | Nootropic, antioxidant |
| *Nardostachys jatamansi* | *Nardostachys jatamansi* DC. | Caprifoliaceae | Jatamansone | Rhizome | Sedative, neuroprotective |
| *Valeriana officinalis* | *Valeriana officinalis* L. | Caprifoliaceae | Valerenic acid | Roots | Calming, sleep aid |
| *Melissa officinalis* | *Melissa officinalis* L. | Lamiaceae | Citral | Leaves | Mood enhancer, memory support |
| *Lavandula angustifolia* | *Lavandula angustifolia* L. | Lamiaceae | Linalool | Flowers | Anxiolytic, neuroprotective |
| *Cinnamomum verum* | *Cinnamomum verum* J. Presl | Lauraceae | Cinnamaldehyde | Bark | Anti-inflammatory, memory enhancer |
| *Syzygium aromaticum* | *Syzygium aromaticum* L. | Myrtaceae | Eugenol | Flowerbuds | Antioxidant, neuroprotective |
| *Punica granatum* | *Punica granatum* L. | Lythraceae | Ellagic acid | Fruits | Anti-amyloidogenic |
| *Coffea arabica* | *Coffea arabica* L. | Rubiaceae | Caffeine | Seeds | Cognitive stimulant |
| *Theobroma cacao* | *Theobroma cacao* L. | Malvaceae | Flavanols | Seeds | Memory enhancer, antioxidant |

| | | | | | |
|---|---|---|---|---|---|
| *Trigonella foenum-graecum* | *Trigonella foenum-graecum* L. | Fabaceae | Saponins | Seeds | Neuroprotective, anti-diabetic |

## Conclusion

Natural substances are increasingly recognized as valuable in addressing Alzheimer's disease because they can influence multiple disease processes at once. In contrast to conventional drugs that usually act on a single pathway, plant-derived compounds such as polyphenols, alkaloids, and terpenoids demonstrate the ability to reduce oxidative stress, control inflammation, and slow the buildup of amyloid plaques. At the same time, they protect nerve cells and enhance memory-related functions. These natural agents may also work alongside current therapies, offering safer and more holistic treatment strategies. However, extensive pharmacological investigations and clinical trials are still required to confirm their effectiveness and safety in humans. Overall, natural products represent a promising and expanding field in Alzheimer's research, with potential to strengthen both preventive and therapeutic approaches.

## Acknowledgement

Authors are thankful to the management of Annamacharya College of Pharmacy

## Conflicts of Interest

The authors declare no conflicts of interest.

## Author Contribution

All are contributed equally

## Financial Support

None

## Ethical Considerations and Inform Consent

Not Applicable.

## References

1. Tripathi PN, Lodhi A, Rai SN, Nandi NK, Dumoga S, Yadav P, et al. Review of pharmacotherapeutic targets in Alzheimer's disease and its management using traditional medicinal plants. Degener Neurol Neuromuscul Dis. 2024;14:47–74. doi:10.2147/DNND.S452009
2. GBD 2019 Dementia Collaborators, Nichols E, Abd-Allah F, Abdoli A, Abosetugn AE, Abrha WA, et al. Global mortality from dementia: application of a new method and results from the Global Burden of Disease Study 2019. Alzheimers Dement (N Y). 2021;7(1):e12200. doi:10.1002/trc2.12200
3. Park MN, Rahman MA, Rahman MH, Kim JW, Choi M, Kim JW, et al. Potential therapeutic implication of herbal medicine in mitochondria-mediated oxidative stress-related liver diseases. Antioxidants (Basel). 2022;11(10):2041. doi:10.3390/antiox11102041
4. Park SY, Lee HR, Lee WS, Shin HK, Kim HY, Hong KW, et al. Cilostazol modulates autophagic degradation of β-amyloid peptide via SIRT1-coupled LKB1/AMPKα signaling in neuronal cells. PLoS One. 2016;11(8):e0160620. doi:10.1371/journal.pone.0160620
5. Papadopoulou P, Polissidis A, Kythreoti G, Sagnou M, Stefanatou A, Theoharides TC. Anti-inflammatory and neuroprotective polyphenols derived from the European olive tree (*Olea europaea* L.) in long COVID and other cognitive disorders. Int J Mol Sci. 2024;25(20):11040. doi:10.3390/ijms252011040
6. Tohda C, Yang X, Matsui M, Inada Y, Kadomoto E, Nakada S, et al. Diosgenin-rich yam extract enhances cognitive function: a placebo-controlled, randomized, double-blind, crossover study. Nutrients. 2017;9(10):1160. doi:10.3390/nu9101160
7. Zhou J, Liu T, Cui H, Fan R, Zhang C, Peng W, et al. Xuefuzhuyu decoction improves cognitive impairment after traumatic brain injury via synaptic regulation. Oncotarget. 2017;8(42):72069–72081. doi:10.18632/oncotarget.18895
8. Zhou J, Yang Z, Shen R, Zhong W, Zheng H, Chen Z, et al. Resveratrol improves mitochondrial biogenesis and activates the PGC-1α pathway after subarachnoid hemorrhage. Front Mol Biosci. 2021;8:620683. doi:10.3389/fmolb.2021.620683
9. Zhang Y, Noh K, Song W. Chinese herbal medicines for cognitive function and daily living in Alzheimer's disease: a systematic review and meta-analysis. Integr Med Res. 2019;8(2):92–100. doi:10.1016/j.imr.2019.04.006
10. Zhang Y, Lin C, Zhang L, Cui Y, Gu Y, Guo J, et al. Cognitive improvement in mild Alzheimer's disease with a Chinese herbal formula: a randomized controlled trial. PLoS One. 2015;10(6):e0130353. doi:10.1371/journal.pone.0130353
11. Marshe VS, Gorbovskaya I, Kanji S, Kish M, Müller DJ. Clinical implications of APOE genotyping for late-onset Alzheimer's disease risk estimation. J Neural Transm (Vienna). 2019;126(1):65–85. doi:10.1007/s00702-018-1934-9
12. Ramanan S, Marstaller L, Hodges JR, Piguet O, Irish M. Neural basis of episodic amnesia in logopenic progressive aphasia. Cortex. 2020;125:272–287. doi:10.1016/j.cortex.2019.12.026

13. Arellanes IC, Choe N, Solomon V, He X, Kavin B, Martinez AE, et al. Brain delivery of docosahexaenoic acid: a randomized placebo-controlled clinical trial. EBioMedicine. 2020;59:102883. doi:10.1016/j.ebiom.2020.102883
14. Youn BY, Ju S, Joo S, Kang H, Jeon K, Cheon C, et al. Complementary and alternative medicine use among Korean elite athletes. Evid Based Complement Alternat Med. 2021;2021:5572325. doi:10.1155/2021/5572325
15. Luo XM, Zhang BY, Ding Y, Wang CP, Luo QL, Tan R, et al. Ershiwuwei Shanhu pills regulate Akt/mTOR/GSK-3β signaling in Alzheimer's disease mice. Zhongguo Zhong Yao Za Zhi. 2022;47(8):2074–2081. doi:10.19540/j.cnki.cjcmm.20220127.701
16. Zhao Z, Yan J, Huang L, Yang X. Phytochemicals targeting Alzheimer's disease via the AMPK pathway. Biomed Pharmacother. 2024;173:116373. doi:10.1016/j.biopha.2024.116373
17. Nahar L, Charoensup R, Kalieva K, Habibi E, Guo M, Wang D, et al. Natural products in neurodegenerative diseases: recent advances and future outlook. Front Pharmacol. 2025;16:1529194. doi:10.3389/fphar.2025.1529194
18. Chen X, Drew J, Berney W, Lei W. Neuroprotective natural products for Alzheimer's disease. Cells. 2021;10(6):1309. doi:10.3390/cells10061309
19. Chen Z, Wang X, Du S, Liu Q, Xu Z, Guo Y, et al. Traditional Chinese medicine and acupuncture interventions for Alzheimer's disease based on neuroinflammation. Chin Med. 2024;19(1):35. doi:10.1186/s13020-024-00900-6
20. Yang F, Lim GP, Begum AN, Ubeda OJ, Simmons MR, Ambegaokar SS, et al. Curcumin inhibits amyloid-β aggregation and reduces amyloid in vivo. J Biol Chem. 2005;280(7):5892–5901. doi:10.1074/jbc.M404751200
21. Qian ZM, Ke Y. Huperzine A as a disease-modifying drug for Alzheimer's disease. Front Aging Neurosci. 2014;6:216. doi:10.3389/fnagi.2014.00216
22. Xia C, Zhou M, Dong X, Zhao Y, Jiang M, Zhu G, et al. Ginkgo biloba extract inhibits mitochondrial oxidative stress in an Alzheimer's disease rat model. PLoS One. 2024;19(8):e0307735. doi:10.1371/journal.pone.0307735
23. Thancharoen O, Limwattananon C, Waleekhachonloet O, Rattanachotphanit T, Limwattananon P, Limpawattana P. Ginkgo biloba extract versus cholinesterase inhibitors and memantine in Alzheimer's disease: a network meta-analysis. Drugs Aging. 2019;36:435–452. doi:10.1007/s40266-019-00648-x
24. Alzobaidi N, Quasimi H, Emad NA, Alhalmi A, Naqvi M. Bioactive compounds and traditional herbal medicine for dementia. Degener Neurol Neuromuscul Dis. 2021;11:1–14. doi:10.2147/DNND.S299589
25. Bălaşa AF, Chircov C, Grumezescu AM. Marine biocompounds for neuroprotection. Mar Drugs. 2020;18(6):290. doi:10.3390/md18060290
26. Doytchinova I, Atanasova M, Salamanova E, Ivanov S, Dimitrov I. Curcumin inhibits amyloid-β primary nucleation: a molecular dynamics study. Biomolecules. 2020;10(9):1323. doi:10.3390/biom10091323
27. Shi Z, Chen H, Zhou X, Yang W, Lin Y. Pharmacological effects of ginsenosides against Alzheimer's disease. Front Pharmacol. 2022;13:952332. doi:10.3389/fphar.2022.952332
28. Zhang M, Niu H, Li Q, Jiao L, Li H, Wu W. Active compounds of *Panax ginseng* in Alzheimer's disease and spatial metabolomics applications. Pharmaceutics. 2023;17(1):38. doi:10.3390/ph17010038