RESEARCH PAPER

Neuroprotective Medicinal Plants and Herbal Therapeutics for Neurodegenerative Disorders Including Alzheimer ’s disease

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ABSTRACT

Many neurodegenerative disorders are rapidly becoming an international epidemic. Disease-causing changes in the brain lead to the progressive degeneration of nerve cells, cognitive decline and impaired mobility. Examples of these conditions include Alzheimer's and Parkinson's disease, and they impose significant costs on society and individuals as well as presenting a clinical burden. Unfortunately, current available drug therapies primarily target symptoms rather than modifying the underlying course of disease progression and they are also often associated with negative side effects, poor efficacy in modifying the course of the disease process and inconsistent therapeutic responses among patients. Thus, there is considerable interest in using medicinal plants and herbal medicines as possible agents to protect against neurodegeneration and improve quality of life in individuals who suffer from neurodegenerative diseases. Medicinal plants have been found to contain many different biochemicals that have potential medicinal or therapeutic value. For example, they contain numerous biologically active substances such as polyphenols, flavonoids, alkaloids and terpenoids, all of which have ability to provide protection against oxidative stress, inflammation, apoptosis and provide neuromodulatory effects. These phytochemicals may serve a crucial role in ameliorating the pathological processes associated with neurodegeneration including excessive oxidative stress, neuroinflammation, impaired mitochondrial function, excitotoxicity and aberrations in synaptic regulation. Recent scientific evidence suggests that agents obtained from plants can enhance Neuronal survival, improve cognitive functioning or modulate neurochemical pathways implicated in the progression of neurodegenerative diseases. The current literature on medicinal plants and herbal medicines that may be used as neuroprotective agents for the treatment of neurodegenerative disorders is reviewed in this analysis, with particular emphasis placed on Parkinson's Disease and Alzheimer's Disease; however, other disorders (such as epilepsy and related types of neurological disorders) will also be briefly discussed. Emphasis will be placed on examining the mechanistic basis, potential therapeutic benefit and potential for translation of these agents into clinical practice. Although the results of preclinical studies have been promising thus far and indicate possible beneficial effects, rigorous clinical studies are still necessary to verify the clinical efficacy, safety and usefulness of a plant-derived intervention for neuroprotection.

Keywords: Neuroprotective agents, human and disease, Traditional medicine, Terpenoids, Cognitive enhancement, Neuro degenerative disorder, Antiepileptic agents

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INTRODUCTION

Neurological disorders represent a major global public health problem. The WHO countries estimate that approximately 1 billion people worldwide are living with neurological disorders. Neurological disorders contribute to the burden of disease, disability, and death at a substantial rate[1]. In addition to primary neurological disorders, people also have large diverse number of secondary conditions including but not limited to brain tumors, stroke, migraine, traumatic brain injury, cognitive decline, dementia, epilepsy, bipolar disorder, schizophrenia, Alzheimer’s disease (AD), and Parkinson's disease (PD). Neurological disorders are estimated to kill an estimated 6 million people per year, which is one of the highest kills from a non-communicable disease. The burden associated with neurological conditions in non-higher-middle income (NCMI), purchasing manager index (PMI) is significantly greater than higher-middle income

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(HMI). Because of lack of access to accurate diagnosis, treatment, and long-term care available for most people who live in low-middle income areas of the world.

Prevalence and impact of central nervous system (CNS) disorders vary by geographic region; for example: significant higher rates of mental health conditions such as Schizophrenia, Bipolar Disorder, and psychosis are reported in Africa. Epidemiological research indicates that people with severe psychiatric disorders (e.g., Schizophrenia) experience shorter life expectancy than generally who are not diagnosed with Schizophrenia. Although results are inconclusive with respect to the causes of these findings, due attention should be given to the following factors that may contribute to reducing life expectancy. The progression of disease and other significant complications affecting the central nervous system may occur if early signs and symptoms are not recognized and managed early enough. Anxiety and depression are the most common causes of mental health disorders in people, affecting nearly 20% of those over the age of 65, and are frequently worsened by factors such as high levels of stress, smoking, and excessive workplace demands.

Pharmacological treatment of disorders of the central nervous system (CNS) mainly involves the use of medications such as sedatives, hypnotics, antidepressants, and antipsychotics. These drugs are widely prescribed to manage symptoms associated with neurological and psychiatric conditions including anxiety, depression, insomnia, and neurodegenerative disorders. While these drugs are important for keeping symptoms under control, they usually don't help treat the root cause of most CNS disorders. They mostly just help relieve the symptoms. Long-term use of these drugs can lead to a variety of negative side effects including cognitive impairment, dependence on medication, immune system dysfunction, respiratory complications, as well as other physiological changes related to long-term use of sedative and benzodiazepine-based therapies[2]. Therefore, there is a growing risk of the safety of using chronic pharmacological treatment for CNS disorders.

Herbal Neuroprotective Therapies

Managing symptoms of CNS disorders with pharmacotherapy often relies on the use of drugs such as sedatives, hypnotics, antidepressants and antipsychotics. Medications have become extremely important for relieving the symptoms of CNS diseases (neurological disorders such as anxiety and depression), such as insomnia and neurodegenerative diseases, but they do not necessarily address the root cause or underlying pathology of many CNS diseases. Long-term usage of pharmacological treatments for CNS disorders can result in some negative side effects which can affect cognitive function, lead to dependency issues, have effects on the immune system, result in complicate respiratory issues. The concern for the safety of long-term use of pharmacological therapies for CNS disorders continues to grow with the understanding of the side effects associated with long-term use of sedative and benzodiazepine-based therapy.

Conventional 'allopathic' treatments often focus on the management of symptoms rather than curing the disease itself. For example, although anti-depressants will help regulate neurotransmitter levels, they won't necessarily prevent degeneration of neurons or re-establish damaged neural networks; similarly, sedatives/hypnotics may improve sleep and reduce anxiety, but they can also lead to tolerance, dependence or withdrawal effects, if taken for an extended period. Research and clinical practice have been affected by limitations. As a result, alternative methods of managing neurological conditions in a safer and more sustainable way are being explored. Recently there has been increased interest in the potential of using medicinal plants and natural products for treatment of CNS disorders[3].

Medicinal plants have been utilized in traditional systems of medicine such as Ayurveda, Unani, Traditional Chinese Medicine and other ethnomedicinal practices for thousands of years. These plants may contain many different types of bioactive materials, including alkaloids, flavonoids, terpenoids, glycosides, and phenolic compounds that can have neuroprotective effects as well as anti-inflammatory, antioxidant, and anxiolytic properties[4]. In addition, a number of these phytochemicals have been shown to affect the activity of neurotransmitters, decrease the amount of oxidative stress that occurs, and protect neuronal cells from damage associated with neurodegenerative conditions. Oxidative stress and chronic inflammation appear to be two of the key mechanisms in the development of neurological disorders such as Alzheimer's disease, Parkinson's disease, or any other neurodegenerative disorders. Antioxidants derived from plants may assist in neutralizing free radicals and decreasing the amount of damage to neurons, thus potentially slowing the progression of disease.

There have been many promising results regarding the neuroprotective properties of medicinal plants through both laboratory studies and clinical trials. For example, Bacopa monnieri is renowned for its memory-boosting and cognitively enhancing capabilities and has been studied in detail. The bacosides (the active constituents of Bacopa monnieri) may facilitate increased synaptic communication and repair of damaged neurons[5]. Similarly, Withania somnifera (Ashwagandha) is known to have both adaptogenic properties and neuroprotection. It has shown reductions in stress, improved cognitive functioning, and facilitated neuronal regeneration. Ginkgo biloba, a very well-known medicinal plant, contains flavonoids and terpenoids, which help to improve blood flow to the brain and exhibit antioxidant activity. Ginkgo biloba has been shown to assist with the management of cognitive decline and neurodegenerative illnesses[6].

The research on the use of medicinal plants in treating CNS disorders is not only focused on single therapeutics but also on combinations of herbal extracts. The potential

benefits of these herbal combinations may provide a variety of beneficial effects through various methods of action, including modulation of neurotransmitter systems, decreased neuroinflammation, enhanced antioxidant defense mechanisms, and protection of neuronal cells from degeneration. These multi-targeted effects of herbal combinations are of value in the treatment of complex neurological diseases in which many different pathological changes occur at the same time.

Modern pharmacology research has increasingly focused on isolating and characterizing the active phytochemicals responsible for the therapeutic effects of medicinal plants. The discovery of plant-derived compounds that act on specific molecular targets in the nervous system has been facilitated by advances in biotechnology, phytochemistry, and molecular pharmacology. There are many examples of plant-derived compounds that are currently being developed as potential neuroprotective agents, which may help create safer and more effective therapies for central nervous system (CNS) disorders.

In summary, despite the important role of traditional pharmacological treatments for the management of CNS disorders, the limitations of these treatments and the potential for their adverse effects provide a reason to explore alternative therapeutic strategies. The availability of medicinal plants as a natural source of bioactive compounds with neuroprotective properties makes them promising complementary or alternative treatments for neurological diseases. Continued research is essential to confirm efficacy, establish appropriate dosing, and assure safety through well-designed clinical trials.

METHODOLOGY

A literature review indicated available data on plant-derived compounds with neuroprotectant activity against neurodegenerative diseases, particularly AD. Searches were performed between scientific databases of PubMed, Scopus, Web of Science, Google Scholar, and Science Direct (from 2001-2025) using keywords such as "herbs with neuroprotective activity," "herbs for Alzheimer's disease," "phytochemicals associated with neurodegenerative disease," and "naturally occurring compounds with neuroprotective activity," which were used together and with Boolean operators (AND, OR). Peer-reviewed studies, experimental studies (in vivo and in vitro), clinical trials, and review articles that addressed the efficacy of herbal interventions for neurodegenerative disease were included; however, reports that were not scientific or repetitive or that did not include relevant data were excluded. Relevant information regarding plant species, active phytochemicals, mechanisms of action, and therapeutic outcomes was extracted and critically analyzed to summarize current evidence on herbal neuroprotective strategies for neurodegenerative disorders.

Therapeutic and Pharmacological Effects of Plant-Derived Natural Products

The medicine derived from plants, which is a combination of extracts from the plant and the active chemical substances derived from various parts of the plant like the rhizome, bark, stem, leaves, flowers, seeds, and the whole plant, is very potent to solve problems related to the central nervous system. In most of the developing countries, plants remain the main source of medications and their use for the treatment of central nervous system diseases is still very common. It has been reported that the people in Europe, Australia, and North America are gradually being drawn to plant-based medicines. Years ago, people still required the medical treatment of herbalist practitioners even though the natural area had no such achievement.

Researchers have reported that there are over 300,000 plant species in Asia, Africa, and America and about 60% of them are used for medicinal purposes. One must be aware that in India alone, over 10,000 plants are already documented as having therapeutic applications. Traditional plant-based medicines are still utilized today and are blamed for various health problems such as high blood pressure, fatigue, overweight, malaria, diabetes, arthritis, heart disease, infertility, premenstrual syndrome, central nervous system disorders, fever, cough, and menstruation[7]. The use of these medicinal plants has revealed several important properties such as antioxidants, anti-inflammation, and others like anti-pyretic, anti-hypertensive, anti-aging, etc.

On the one hand, allopathic treatment relies on continuous social, ethnic factors and scientific evidence from practice while natural medicine is research-based with phytotherapists studying the plants that contain the specific constituents for treating a central nervous system disorder[8]. Researchers involved in the investigation of modern-day primary medicine are not just studying the effect of extracts from plants but are also looking at the entire plants' qualities and their capability to support human life as well. Some of the plants that are featured in the discussions and have been supporting brain-related issues are Cleome rutidosperma, Ginkgo biloba, Hypericumperforatum (St. John's Wort), kava kava (Piper methysticum), Valerianaofficinalis, Bacopamonnieri, Convolvulus pluricaulis, Withaniasomnifera (ashwagandha), Curcuma longa (turmeric), Bacopamonnieri (brahmi), Centellaasiatica (gotu kola), Celastruspaniculatus (jyotishmati), Commiphorawightii (guggulu) and many others. The mentioned diseases that affect the central nervous system the most are multiple sclerosis, Parkinson's, Alzheimer's, epilepsy, anxiety, and depression. One of the natural medicine and bioactive compounds with the biggest impact is presented by disorder at a time. The first one is an Alzheimer's case[9].

Herbal plants are the main source of medicine in Alzheimer's disease treatment. Higher is the probability of these plant extracts being very effective in preventing this disease. Some herbal plants are the suppliers of the very important chemical substances that are recognized to be of use in pharmacological applications; their action is like that of both excitatory and inhibitory molecules. There are quite a few drugs that affect the treatment of dementia.

The use of plants has not been often referred to in the treatment of Alzheimer's disease[10].

Medicinal Plants in Alzheimer’s Disease

H. perforatum is a shrub that may grow to a height of almost 80 cm. The leaves of this species are shaped like a spoon. The Perforatum is the primary component of the plant. The plant's foliage contains a high concentration of flavonoids, choline, hypericin, hyperforin, tannins, and essential oil. All these plant compounds are with the brain disorders healing process because they usually lessen the inflammation and have a calming effect. Quercitrin and quercetin are two main flavonoids obtained from this plant that are known for their antioxidant activity and ability to prevent lipid oxidation. The dose before the injection is 1.4 mg/kg. The patient can activate up to 4 mg, 8 mg, and 12 mg of H. perforatum extracts after 30 minutes which are the amounts helpful for coping with oxidative stress.

Scopolamine-causedmemory loss[11] can be reversed by the intake of hyperforin while St. John's Wort can help with Alzheimer's. Caprylic acid triglyceride is one of the essential elements for medical food. Its significant properties make Axona, which is synthetized from coconut oil, a good candidate for the treatment of Alzheimer’s disease. The brain's wrong uptake of glucose in this condition results in the appearance of neurological symptoms that gradually worsen and finally culminate in AD. The use of this acid would prevent brain damage through its ability to convert into ketone bodies, which are considered an energy source[12].

Galantamine, an anti-cholinergic dohsikaloid and a derivative of the European daffodil (Narcissus jonquilla), is a HungaryWelsh-induced compound on cholinesterase receptors. Galantamine, an alkaloid, not only eases Alzheimer's disease symptoms[13] but also aids short-term memory in patients who have been using it for 6 months at 24 mg/d. Curcumin's constituent compounds have exhibited a remarkable amount of anti-inflammatory activity, at the very least, as compared to other substances with similar benefits. The orange-hued compound diferuloylmethane purified from turmeric (Curcuma longa) along with the polyphenolic component has been recognized as capable of Alzheimer's disease treatment. Due to curcumin's ability to trigger macrophages to do their job of removing foreign particles, its application is in the reduction of amyloid plaques in Alzheimer's disease. Macrophages are the immune system's assets that are responsible for getting rid of the improperly formed plaques. Thus, they hinder the process of the disease by dispersing the spots[14]. Moreover, the application of Passiflora vulgaris as a traditional antipyretic is one more application. It possesses the capability of controlling oxidative stress, killing the pathogens, and preventing inflammation in the body. Moreover, it is one of the reasons for memory loss and thus is used in the case of treating depression and anxiety. A patient getting either 25 mg or 50 mg of this drug is an AD case who is greatly influenced by the medication.

Bacopamonnieri is known as an antidepressant herb but at the same time it is also used for the relief of anxiety[15] which is a symptom of AD. This herb improves learning and therefore is also helpful in memory loss. The plants have the following constituents: alkaloids, herpestine, mannitol D, and saponins. Besides, Bacosides, betulic acid, and beta-sitosterol are the factors that control the progression of Alzheimer's disease. Ginkgo biloba is another drug that is prescribed for the cure of AD. The extract of this plant works efficiently in the treatment of memory loss. In their study, the researchers chose 309 patients suffering from Alzheimer's disease for their investigation. The organization provided a yearly supply of a 120 mg dose of the drug. After six months of the trial, an evaluation was conducted and it was found that over 30% of the participants had reported their memory improvement. Afterwards, a total of 112 people with very severe mental disorders were selected for another research.

Patients received equal amounts of the extract and showed good response because the extract was supplying the patients with the needed oxygen and blood which had been cut off because of the disease, and at the same time, the disease was being prevented. Thus, the conclusion of the trial is that if we treat the patient with this illness in the first stages, he will live. In other words, the extract from this plant can be used to rejuvenate the acetylcholinergic receptors, increase their action, and prevent the disease. Besides, it is also used to trap and eventually remove the fatally toxic amyloid that infests the brain, and thus, to cure dementia. Furthermore, a duration of three to four months of applying this herbal extract is suggested for the ultimate results.

Ashwagandha, known scientifically as Withaniasomnifera, contains withanolide A, which is the main phenolic compound, amongst others, and is thought to be the primary reason for the devotion of the whole plant for AD therapy and enhancement of memory functions. A long-term supply of this treatment, that is 14 days of daily intake, in the form of root extract, is sufficient to keep the disease at bay for three months[16]. Another plant with great medicinal value is Cyperusrotundus whose main components are essential oil such as pinene, cineole, terpenes, and isopropyl. The extracts from the plant exhibit an anti-cholinergic effect. If such plant extracts are given to the patients in doses of 100 mg mg, they would not only have improved memory but also become free from AD.

Herbal Therapeutics in Alzheimer’s Disease

Patients with Alzheimer's disease experience memory improvement through medical treatment Huperzine A which also decreases their symptoms. Huperzine A protects brain cells through its anticholinesterase activity which also provides neuroprotective effects. The study results mentioned that 450 Alzheimer's disease patients showed better cognitive abilities after receiving huperzine A treatment[17]. The study results showed that 12-week continuous treatment led to disease progression reduction. The saponin found in Panaxnotoginseng has emerged as an

effective therapeutic agent which shows potential to treat Alzheimer's disease. The compound protects neurons because it enhances learning and memory capabilities while it keeps cerebral β-amyloid levels stable and brings back normal cholinesterase functioning[18].

Vincamine functions as an alkaloid which researchers can extract from Vinca minor leaves and Voacangaafricana seeds that native African medicinal plants provide[19]. Compound vincamine shows potential as a treatment option for Alzheimer's disease because it improves brain blood circulation and boosts cognitive abilities. The product is sold in European markets under the brand name Cavinton. Lemon balm herbal medicine (Melissa officinalis) provides scientists with crucial neurocognitive benefits through its different medicinal characteristics. The herb displays pharmacological properties through its ability to attach to both muscarinic and nicotinic receptors while it inhibits acetylcholinesterase activity and disrupts central cholinergic pathways. The clinical study demonstrated that patients with mild Alzheimer's disease who received lemon balm treatment for 12 to 16 weeks experienced less memory loss and cognitive decline than before treatment.

The main active ingredient of Salvia officinalisrosmarinic acid delivers multiple health advantages which safeguard against oxidative damage while blocking the development of lipid peroxidation. The research found that people who used Salvia officinalis products for 16 weeks showed major improvements in their mental skills and their complete health status. The research conducted by Asadi and co-workers[20] shows that the herbal combination acts as an effective treatment support for patients with Alzheimer's disease. The research team developed multi-herbal combinations for Alzheimer disease treatment by uniting existing components with their newly created materials. The traditional medical product Shenwu capsule has been used in clinical practice for many years, showing a high level of safety because no serious side effects have been detected. Depression works as a widespread brain disorder which primarily affects people from 25 to 65 years old. The genetic components which influence the development of depressive disorders establish an essential connection to the onset of psychotic disorders. The existing research shows that different herbal treatments produce antidepressant effects which equal their capacity to treat depression.

Herbal and Phytochemical Therapies for Depression and Anxiety

Researchers show that the dried flower stigmas of Saffron (Crocus sativus L.) function as a medicinal herb for depression treatment. The clinical evidence demonstrates that saffron doses of 30 mg or higher produce strong antidepressant effects. Phytotherapeutic assessments show that saffron supplementation acts as a safe and effective treatment for patients with depressive disorders. Saffron functions as an antidepressant because it causes neuroendocrine changes while it contains anti-inflammatory and antioxidant and neuroprotective components. The study demonstrated that saffron capsules with a daily dosage of 100 mg for 12 weeks led to decreased depressive symptoms[21].

The green tea plant (Camellia sinensis) provides multiple health benefits because it helps to stop fibrosis and combat cancer and reduce inflammation and safeguard brain health from neurodegenerative diseases. The plant's active compounds exist as polyphenolic substances which show their ability to reduce depression through their effects on the hypothalamic-pituitary-adrenal HPA axis system. The compounds produce their effects through the mechanism which decreases serum corticosterone levels that function as a vital component in stress-induced depression. Research studies demonstrate that an oral dose of approximately 20 mg/kg administered over seven days produces measurable antidepressant effects. The HPA axis serves as an essential system which establishes depression development while C. sinensis polyphenols enable users to control their emotional states and handle their stress[22].

The researchers discovered that the Nelumbonucifera fruit functions as a strong natural relaxation agent which produces two separate antidepressant effects. The research studies which include both experimental and clinical tests show that the treatment produces positive results for mental health by decreasing symptoms of depression. Scientists discovered that the seed extract named Nelumbinis semen can reduce all typical depression symptoms which include both behavioral and biochemical manifestations of the disorder[23]. The European and Iranian name for the medicinal plant Borage which scientists call Echiumamoenum describes a flowering plant which displays strong antidepressant and anti-inflammatory and antipyretic and anticancer properties through its petal display. The clinical assessment results indicated that E. amoenum flower aqueous extract functions as an effective depression treatment. The studies show that the body can handle a daily oral dosage of 375 mg which produces therapeutic effects[24].

The active compounds in medicinal plants create protective effects which treat various medical conditions that include heart disease and immune system disorders and brain degeneration and dementia in older adults. Proanthocyanidins and ferulic acid and theanine and quercetin and resveratrol and curcumin and carvacrol and other polyphenols create strong antidepressant effects through their operation on neurotransmitter systems and their ability to decrease oxidative damage and their capacity to stop neuroinflammatory processes.

People who experience anxiety disorder develop a serious medical condition which disrupts their brain function through its link to permanent medication use and the consumption of sedative-hypnotic drugs which produce psychological conditions. People select natural treatments which cause minimal side effects because traditional anxiety medications produce dangerous toxic effects along with harmful side effects. Multiple medicinal plants show their ability to reduce anxiety through their active

compounds which include Actaeaspicata and Gelsemiumsempervirens and Coriandrumsativum and Valeriana species and Piper methysticum (kava) and Passifloraincarnata (passionflower) and Melissa officinalis (lemon balm) and Lavandulaangustifolia (lavender) and Matricariachamomilla (chamomile) which all show clinically effective anti-anxiety effects[25].

Herbal Therapies in Neurodegenerative and Neurological Disorders

Neurodegenerative disorders account for a large percentage of neurological diseases, and they affect approximately 10 million around the world. Therefore, scientific studies on these diseases will require detailed research into all aspects of the condition. Many herbs are known to have therapeutic value; some examples include Ginkgo biloba, Curcuma longa, Camellia sinensis, Withania somnifera, Mucuna pruriens, Atropa belladonna, Hyoscyamus niger, Lepidium meyenii, and Asparagus racemosus. In their research, Patel and co-workers[26] indicated that all these herbs have therapeutic potential and represent good treatment options for Parkinson’s due to their stated anti-Parkinsonian properties.

Plant-derived medicines are commonly utilized as adjunctive therapies for epilepsy management and therefore can be used to treat epilepsy due to their anticonvulsant properties. Rahman and co-workers[27] found medicinal plants such as Brahmighrita, Cissus sicyoides, Passiflora incarnata (passion flower), Rosa damascena, Argyreia speciosa, Desmodium burmannii, Glycyrrhiza glabra, Pongamia pinnata, Ocimum sanctum, Berberis vulgaris, Echium amoenum, Crotalaria infortunatum, Boerhavia diffusa, Butea monosperma, and Saussurea lappa have anticonvulsant properties and may therefore be useful in the management of epilepsy.

MS (Multiple sclerosis) is a type of autoimmune condition that is characterised by the progressive degeneration of the central nervous system and the immune system. Herbal treatments can be used for MS, including Ginkgo biloba, Zingiber officinale, Curcuma longa, Hypericum perforatum, Vaccinium macrocarpon, Nigella sativa, Piper methysticum, Saffron, Panax ginseng, Boswellia papyrifera, Vitis vinifera (red wine), and Oenothera biennis[28] and all these herbs have anti-inflammatory, antioxidant, and neuroprotective effects.

CONCLUSION

The evidence discussed in this review highlights the significant therapeutic potential of medicinal plants and herbal formulations in the management of neurodegenerative disorders affecting the brain and spinal cord. A wide range of plants and their bioactive constituents possess neuroprotective properties, including antioxidants, anti-inflammatory, anti-apoptotic, and neuromodulatory effects, which may contribute to slowing disease progression and alleviating neurological symptoms. The popularity of herbal medicines is growing among the general population, primarily due to their easy, accessible use, perceived lower toxicity and greater safety than most synthetic substances. Additionally, plant-based substances provide useful new compounds for developing new neurotherapeutics against the broad range of complex disease processes associated with Alzheimer’s or Parkinson’s and other central nervous system diseases. Although there have been several positive experimental and preclinical studies demonstrating the potential of using various plant extracts in treating individuals with Alzheimer's disease and related conditions, further pharmacological validation, extensive standardization of the herbs, and well-designed clinical trial studies are necessary to determine the effectiveness, safety and necessary dosing of these products. Incorporating references from traditional herbal medicine literature into the conduct of contemporary scientific studies may help develop evidence-based, affordable and accessible neuroprotective therapies. Overall, the use of medicinal plants is a viable additional approach to treating individuals with neurodegenerative diseases and has significant opportunities for improving current therapeutic approaches and, subsequently, enhancing the quality of life for all affected by neurodegenerative diseases.

Competing Interests / Conflict of Interest

The author declares no competing interests.

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