

ROLE OF ANTIOXIDANT PHYTOCONSTITUENTS OF *SPHAERANTHUS INDICUS* AND *ABRUS PRECATORIUS* IN PREVENTING AGE-RELATED MEMORY DECLINE

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ABSTRACT

A rising neurological worry is the age-related loss of memory capacity, which is linked to oxidative stress, neuronal damage, and diminished cognitive efficiency. The potential function of medicinal plants that are rich in antioxidant phytoconstituents in neuroprotection and cognitive improvement is becoming more and more apparent. Two significant therapeutic plants, Sphaeranthus indicus and Abrus precatorius, are renowned for the abundance of phytochemicals found in their leaves. The medicinal benefits of these plants are due in part to the abundance of antioxidant chemicals found in them, including flavonoids, phenolics, alkaloids, and terpenoids. To reduce brain damage caused by oxidative stress, the phytochemical antioxidants found in Sphaeranthus indicus and Abrus precatorius are essential. These phytoconstituents aid memory and learning by scavenging free radicals, boosting the body's antioxidant defences, and preserving the integrity of neurones. Research on rats has shown that these plants' leaf extracts increase memory retention and cognitive function in age-related models, which might mean that they can help prevent memory loss. These plants have antioxidant and phytochemical properties that make them promising natural medicines for treating cognitive decline with age.

Keywords: Sphaeranthusindicus, Abrusprecatorius, Antioxidants, Phytochemicals, Memorydecline.

I. INTRODUCTION

The ability to learn, remember, retain information, and make sound decisions are all impacted by the age-related memory impairment. A growing number of people are living longer than ever before, which has serious implications for public health and quality of life due to the increased incidence of neurodegenerative diseases and age-related cognitive decline. Neuronal death, synaptic dysfunction, and changes in neurotransmitter systems are some of the anatomical and functional brain changes linked to age-related memory loss. The oxidative stress is one of the hypothesised pathways that contributes to cognitive decline. The ageing brain, with its high oxygen consumption and lipid-rich composition, is especially susceptible to damage produced by reactive oxygen species.

When free radical generation outpaces the body's antioxidant defence mechanism, oxidative stress ensues. Neuronal degeneration and reduced synaptic plasticity are the end results of mitochondrial malfunction, DNA damage, lipid peroxidation, and protein oxidation caused by excessive free radicals. Memory and learning centres in the brain, including the cerebral cortex and hippocampus, are negatively impacted by these abnormal alterations. Consequently, there has been a lot of interest in methods that try to boost antioxidant defence systems as a way to slow down or stop the cognitive deterioration that comes with becoming older. Medicinal plant-based natural antioxidants have shown promise in this regard owing to their safety, potency, and lengthy history of traditional usage.

Traditional medicine has a long history of using medicinal plants to treat neurological diseases and improve brain function. Phytochemicals found in plants, including as glycosides, alkaloids, terpenoids, flavonoids, and phenolic compounds, have powerful neuroprotective and antioxidant effects. These chemicals help keep neurones healthy by scavenging free radicals,

chelating metal ions, regulating cell signalling pathways, and decreasing inflammation. The interest in studying the function of traditional medicinal herbs in cognitive improvement and neuroprotection has been further bolstered by scientific confirmation of their therapeutic properties.

In Ayurvedic medicine, the famous medicinal plant *Sphaeranthus indicus* is used to treat metabolic, inflammatory, and neurological diseases. The leaves of *Sphaeranthus indicus* contain a wealth of bioactive components, including essential oils, phenolics, sesquiterpenes, and flavonoids. These compounds have anti-inflammatory, neuroprotective, and antioxidant properties. Preliminary research suggests it may mitigate oxidative stress, shield neurones from harm, and enhance learning and memory. Because of these characteristics, *Sphaeranthus indicus* is an excellent plant to examine for its potential to slow down the ageing process and preserve memory.

Similarly, *Abrus precatorius* has a long history of usage as a medicinal herb for a wide range of conditions, including those affecting the central nervous system. Traditional medicine makes extensive use of the leaves and roots of *Abrus precatorius* in moderate doses, despite the fact that the seeds contain the very poisonous protein abrin. The therapeutic potential of *Abrus precatorius* stems from the antioxidant phytoconstituents found in its leaf extracts, which include flavonoids, alkaloids, triterpenoids, phenolic compounds, and others. Its antioxidant, anti-inflammatory, antibacterial, and neuroprotective properties have been shown in scientific studies, lending credence to its possible function in brain health.

Some research suggests that *Sphaeranthus indicus* and *Abrus precatorius*, which contain antioxidant phytoconstituents, may help protect the brain from oxidative stress and boost the body's natural antioxidant defences. These plant compounds aid in learning and memory

by preserving the integrity of neuronal membranes, enhancing neurotransmission, and supporting synaptic plasticity. Plant extracts with anti-inflammatory and oxidative properties may delay neuronal ageing and forestall age-related cognitive decline.

To assess the effectiveness of possible therapy drugs and comprehend the processes behind age-related memory loss, experimental mouse models are crucial. For the purpose of researching cognitive function, rats are a good model since they share many physiological and neurochemical features with humans. It is usual practice to evaluate elderly rats' learning and memory using behavioural tests such the Morris Water Maze, Y-maze, and Passive Avoidance Test. Scientists may use these models to investigate the effects of plant extracts high in antioxidants on brain biochemistry and cognitive function in a systematic way.

II. ANTIOXIDANT PHYTOCHEMICAL CONSTITUENTS OF *SPHAERANTHUS INDICUS* AND *ABRUS PRECATORIUS*

Overproduction of free radical species, such as hydroxyl, nitric oxide (NO), and superoxide, causes oxidative stress, which in turn damages cellular proteins, enzymes, and membrane lipids. Inflammatory diseases, cancer, diabetes, and other conditions are all caused by oxidative stress, which kills cells. The good news is that antioxidants may help prevent this kind of oxidative damage to cells.

It has proven problematic to employ artificial antioxidants like 2,6-di-ter-butyl-4-methylphenol (BHT), 2-3-ter-butyl-4-methoxyphenol (BHA), and ter-butylhydroquinone (TBHQ) in food due to their toxicity. Based on this rationale, efforts are underway to identify edible herbal species that contain natural antioxidants and isolate them.

Oxidative stress, caused by excessive amounts of free radicals or active oxygen species, causes metabolic impairment and cell death among other biochemical and physiological damage. As a result, people should be sure to consume natural antioxidants. You may find a wealth of these chemicals in medicinal and delicious plants. Plants may be a renewable supply of raw materials in many situations, although this is not always the case. One may rationalise and isolate useful chemicals from plants that have no history of human usage if they choose to adopt a strategy that suggests some plants may generate effective drugs that rely on long-term human use (ethno medicine). Since there is a general consensus that plants can provide an infinite supply of unique and complicated chemical structures and beneficial biologic activities, patent protection is almost guaranteed.

Additionally, it is becoming fashionable, particularly in an industrial setting, to extract new bioactive components from plants in order to create synthetic versions that are less harmful and more effective. The structural diversity, biological diversity, and action mechanisms of the active natural compounds found in medicinal plants make them a rich resource. Antioxidants are the best tool for getting rid of free radicals, the culprits behind oxidative stress. Atherosclerosis, ischaemic heart disease, ageing, diabetes mellitus, cancer, neurodegenerative diseases, and a host of others can be slowed or prevented by the free radical scavenging abilities of certain phytochemical components, particularly polyphenols (including flavonoids, phenyl propanoids, phenolic acids, tannins, and many more). The *indica sphaeranthus* The Asteraceae family, to which Linn belongs, has some of the most adaptable medicinal plants due to the breadth and depth of their biological effects. It is a popular crop in India's tropical and subtropical regions, as well as in rice paddies and other arid wastelands.

Eudesmanoids, sesquiterpenes, sphaeranthene, stigmasterol, sitosterol, geraniol, sterol, and flavone glycoside are among the many phytochemical components that have been identified from different parts of *S.indicus*. Scientific investigations into the medicinal properties of this plant have uncovered a plethora of uses, including those of analgesic, antipyretic, hepatoprotective, antitussive, wound healing, bronchodilatory, immunomodulatory, antidiabetic, nephroprotective, neuroleptic, and antimicrobial properties.

One of the most important plants, *Abrus precatorius*, often called Indian liquorice, is a member of the Fabaceae family and originally from the Indian subcontinent. *Abrusosides A–D*, *abrusogenin*, a triterpene, *abrus agglutinin*, *isoflavan quinones* (including *abruquinones D, E, and F*), and other unique phytoconstituents give the plant's leaves its delicious flavour.

Research has shown that it has biological effects that can fight against a wide range of ailments, including those that cause diarrhoea, infertility, asthma, inflammation, infections, diabetes, convulsions, and even ulcers.

It is useful to determine the overall quantity of the herb extract's active secondary metabolites, such as phenolics, tannins, and flavonoids, since they are well-known potent natural antioxidants. In addition, by neutralising free radicals, antioxidants may help stave against illnesses including Alzheimer's, cancer, heart disease, and muscle damage. Incorporating natural antioxidants into food has gained significant popularity in recent decades due to their free radical scavenging capabilities, as well as the fact that they are safe, non-GMO, and generally well-received by customers. This research set out to compare the antioxidant power of different *S. indicus* and *A. precatorius* extracts. So, this study looks at the antioxidant properties of plant leaves as a potential natural food preservative and functional food ingredient.

III. ROLE OF ANTIOXIDANT PHYTOCONSTITUENTS IN PREVENTING AGE RELATED MEMORY DECLINE IN EXPERIMENTAL RODENTS

Age Related Memory Decline and Oxidative Stress

Memory loss, forgetfulness, and difficulties acquiring new information are all symptoms of age-related memory decline, a degenerative brain disorder. The hippocampus and cerebral cortex, two areas of the brain crucial for cognitive processing, undergo structural and functional changes as rats age in an experimental setting. The imbalance between the body's natural antioxidant defences and the reactive oxygen species (ROS) it produces is known as oxidative stress, and it is a key factor in these alterations. Cognitive impairment is caused by oxidative damage to neuronal membranes, proteins, and DNA, which in turn leads to synaptic dysfunction and neuronal death.

Antioxidant Phytoconstituents and Neuroprotection

Protecting the ageing brain from oxidative stress is an important function of antioxidant phytoconstituents obtained from medicinal plants. Glycosides, alkaloids, terpenoids, flavonoids, and phenolic acids are all examples of bioactive chemicals. By elevating the activity of antioxidant enzymes including glutathione peroxidase, superoxide dismutase, and catalase, plant extracts abundant in these compounds improve endogenous defence systems in experimental mouse models. These phytoconstituents aid in the preservation of neuronal integrity and the improvement of cognitive abilities with age by regulating redox equilibrium.

Effects on Learning and Memory in Rodent Models

Behavioral studies in experimental rodents demonstrate that antioxidant phytoconstituents significantly improve learning and memory performance. Rodents treated with antioxidant rich plant extracts show enhanced spatial learning, improved memory retention, and reduced escape latency in behavioral tests such as the Morris Water Maze, Y maze, and Passive Avoidance Test. These improvements are often associated with reduced lipid peroxidation and increased levels of neurotransmitters involved in memory processes, particularly acetylcholine.

Mechanisms of Action in Cognitive Enhancement

Free radical scavenging, decreased neuroinflammation, and regulation of neuronal signalling pathways are only a few of the ways in which antioxidant phytoconstituents protect neurones. Learning and memory are aided by flavonoids and phenolic compounds because they safeguard neurones against death and enhance synaptic plasticity. These chemicals also aid in warding off neuronal degeneration associated with ageing and keeping mitochondria functioning properly.

Significance of Experimental Rodent Studies

The function of antioxidant phytoconstituents in warding off age-related memory loss may be better understood with the use of experimental rat models. By using these models, we can examine the effects of antioxidant therapy on aging-related biochemical, behavioural, and neurological alterations in a systematic way. In conclusion, research on rats has shown that antioxidants found in plants might be a useful tool in the fight against cognitive decline and other neurological diseases.

IV. CONCLUSION

The current research emphasises the significance of the antioxidant phytoconstituents found in *Sphaeranthus*

indicus and *Abrus precatorius* in combating memory loss associated with ageing. Antioxidant and neuroprotective effects are mostly attributable to the abundance of bioactive chemicals including terpenoids, alkaloids, flavonoids, and phenolics in these plants' leaves. In order to keep cognitive abilities intact as we age, these phytochemicals are crucial, since they preserve neural structures and lower oxidative stress. Research like this lends credence to the idea that antioxidants found in plants might help keep brains healthy and stave off cognitive decline. Results from tests on rats also show that extracts from the leaves of *Sphaeranthus indicus* and *Abrus precatorius* boost the body's natural antioxidant defences and increase memory and learning. These findings provide credence to their long-standing usage in treating neurological problems and lend credence to the idea that they might improve cognitive function. In sum, the research highlights the medicinal plant's promise as a safer, more effective, and all-natural alternative to pharmaceuticals in the fight against memory loss associated with ageing. Novel plant-derived treatments for neurodegenerative and age-associated cognitive diseases may be possible with more investigation into their phytochemical composition, action mechanisms, and long-term safety.

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