A REVIEW ARTICLE ON MEDICINAL HERBS HAVING NEUROPROTECTIVE PROPERTIES

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ABSTRACT

Herbs are a group of plants used in medicinal herbal remedies, most of which have therapeutic properties. Before the introduction of allopathic medicines, people relied heavily on the healing properties of medicinal herbs. Some people believe these plants are useful, they rely on herbs as medicines because they are scarce, cheap, and widely available. Neurodegeneration is the death of neurons as a result of a progressive disease process, usually persisting over a long period of time, resulting in a chronic condition. When neurons die, they don't regenerate, leading to cognitive impairment. There are many different types of brain disorders in humans such as Alzheimer's disease, Parkinson's disease, Huntington's disease etc. The broad term 'Neuroprotection' is often used to describe therapeutic approaches that can halt, slow, or even reverse neuronal damage. Herbs are used all over the world as an affordable, efficient and safe alternative. All over the world, herbal medicine is widely used as an affordable, efficient and safe alternative treatment. Because the plant contains a variety of phytochemicals, it can be used in many processes at once, making it more logical yields good results. The use of medicinal plants in the prevention and treatment of cognitive impairment has great potential. People in this region still use many medicinal plants in traditional medicine to treat various ailments. The purpose of this manuscript is to review plants with neuroprotective potential and to serve as a resource for future research on new alternative therapies to treat neurological deficit.

Keywords:- *Neurodegeneration, Brain disorder,Neuroprotective, Medicinal herbs*

1. INTRODUCTION

The nervous system is a complex network of nerve cells that regulates the body's voluntary and involuntary actions and transmits nerve impulses between different parts of the body. It consists of two main parts: the central nervous system (CNS), which consists of the brain and spinal cord, and the peripheral nervous system (PNS), the remaining nervous system structures not within the CNS [1]. Neuroprotection refers to strategies that can protect the central nervous system (CNS) from neuronal damage due to both acute (such as stroke and trauma) and chronic neurodegenerative diseases (such as Alzheimer's disease, AD, Parkinson's disease and PD) refers to the mechanism. [2,3,4]Poor memory, poor retention, memory difficulties, poor concentration, poor analytical skills these are prevalent problems in modern society. Apart from several conditions such as stress, aging and emotions, it can lead to serious threats such as memory impairment, amnesia, dementia and sometimes Alzheimer's disease (AD) and schizophrenia.[5, 6] Neurodegenerative diseases (NDs) are one of the leading causes of morbidity and mortality, especially among older adults in the 2040s [7]. 50 million people worldwide suffer from dementia, the two main causes being Alzheimer's disease (AD) and Parkinson's disease

(PD), which account for up to 70% of cases [8]. Recent research has shown that medicinal herbs are reservoirs of phytochemicals for curing human ailments and have distinct physiological effects on the human body [9] .

Herbal medicines and natural products originated in ancient cultures and are known to mankind to treat various neurodegenerative diseases. Today, the demand for herbal products is growing exponentially all over the world [10]. Researchers around the world are searching for bioactive phytochemicals from herbs used as neuroprotectants in traditional medicine such as Chinese medicine system, Indian Ayurvedic system of medicine, Korean system of medicine, Mediterranean system of medicine, etc. herbs from different traditional systems, their bioactive phytochemicals on neuroprotective functions and other related disorders, especially their mechanism of action and therapeutic potential them [11].

2. NEURODEGENERATIVE DISORDERS

Degenerative neurological diseases, also known as neurodegenerative diseases, are progressive diseases of the cerebrospinal nervous system that affect the central and peripheral nervous system. Neurodegenerative disorders include Alzheimer`s disease (AD). In Parkinson`s disease (PD) and Huntington's disease (HD), loss of neurons from structures in the basal ganglia leads to abnormal motor control. Amyotrophic lateral sclerosis (ALS) , manifested by muscle weakness, results from degeneration of spinal, bulbar, and cortical motor neurons [13].

2.1 Alzheimer's disease (AD)

Alzheimer's disease is a condition that primarily occurs in older populations who develop progressive loss of cognitive function, gradually losing their ability to function and primarily to care for themselves. The exact cause of this disorder is unknown, but it is believed to be due to abnormal breakdown of acetylcholine, accumulation of aluminum in certain brain stem regions [14] and abnormal changes in certain biogenic amines [15].

2.2 Parkinson's disease (PD)

Parkinson's disease is the second most common age-related neurodegenerative disease and can severely impact quality of life. In contrast to the cognitive deficits of AD, PD is a movement disorder whose typical features include resting tremor, bradykinesia, extrapyramidal stiffness, and loss of postural reflexes such as gait and balance disturbances. The consequences of these diseases are also of great importance with respect to the cost of patient care [16,17]. The pathological hallmark of Parkinson's disease is the loss of pigmented dopaminergic neurons in the substantia nigra, pars compacta, with the appearance of intracellular inclusions known as Lewy bodies [18].

2.3 Huntington`s disease (HD)

Huntington's disease The mechanisms of this incurable neurodegenerative disease are poorly understood. Mutations in the huntington gene lead to production of the mutant protein huntington, causing cellular changes in the brain. The most characteristic early physical symptoms are jerky, involuntary, uncontrolled movements called chorea. Rigidity and dystonia become apparent as the disease progresses [19]

3. MECHANISM OF NEUROTOXICITY

3.1 Apoptosis

Apoptosis can be triggered by a variety of cell surface cues, and it is identified by nuclear alterations such as chromatin aggregation, DNA fragmentation, and cell shrinkage. Even in acute human neurodegenerative diseases, apoptosis is frequently linked to excitotoxicity. The activation of a family of proteases, which activate numerous inert proteins, appears to constitute the ultimate step in apoptotic cell death [21].

3.2 Excitotoxicity

Olney firstly introduced this hypothesis in 1978. Excitotoxicity is a form of neuronal degeneration caused on by excessive glutamate receptor stimulation. The presynaptic neuron generates glutamate, which activates ionotropic glutamate receptors like the N-methyl-D-aspartate receptor (NMDA) and AMPA receptor during glutamatergic neurotransmission alternative remedies for the treatment of neurological ailments. During glutamatergic neurotransmission, glutamate released from presynaptic neurons activates ionotropic glutamate receptors on postsynaptic neurons such as the N-methyl-D-aspartate receptor (NMDA) and AMPA receptor. When these glutamate receptors are activated, Na^+ and Ca^{2+} ions enter the cell, causing depolarization and,

eventually, the generation of an action potential [22]. Although glutamate is essential for excitatory neurotransmission, changes in glutamate homeostasis can have serious consequences for neurons by triggering neurotoxic or excitotoxic cascades [23]. Continuous activation of a large number of NMDA receptors increases intracellular calcium loads and catabolic enzyme activities, which can fixed off such a series of events that ultimately leads to apoptosis or necrosis [24]. Excitotoxicity may inflict neuronal damage in conditions including stroke, neurotrauma, epilepsy, and other neurodegenerative diseases like amyotrophic lateral sclerosis, according to experimental findings [25].

3.3 Oxidative stress

Reactive oxygen species (ROS) generation and antioxidant defences must coexist in a balanced manner for there to be no oxidative stress. Overproduction of ROS results in oxidative stress, which causes significant adverse effects on cells. Role of ROS in lipid peroxidation (LPO). An significant amount of tissue damage is caused by the self-sustaining process of LPO, which amplifies the consequences of the original free radical. The nature of neuronal tissue in the brain makes it prone to free radical-mediated chain reactions, which can result in LPO. This makes the brain particularly vulnerable to LPO. In addition to its high oxygen consumption, the brain contains high levels of polyunsaturated fatty acids and redox transition metal ions. Lower molecular weight and enzymatic antioxidant levels, on the other hand, are relatively low and may contribute to the accumulation of oxidative damage [26]. LPO in the brain is a significant contributor to a wide range of neurological disorders.

3.4 Amyloid cascade

The amyloid cascade hypothesis dominates the field of Alzheimer`s disease (AD) research and provides an intellectual framework for therapeutic intervention [27]. It has been proposed that β-amyloid deposition is the first pathological event in AD, leading to senile plaque formation, followed by neurofibrillary tangles, neuronal cell death, and ultimately dementia. Genetic studies have confirmed that mutations in the genes encoding the amyloid precursor proteins presenilin 1 and presenilin 2 lead to β-amyloid accumulation and early-onset familial dementia [28].

3.5 D-galactose-mediated neurodegeneration

D-galactose, a reducing sugar that can form advanced glycation end products (AGEs) in vivo, is not further metabolized and accumulates in neurons, and is a pathological mechanism of this aging model. [29].The free radicals generated by the oxidation of D-galactose exceed the cell's ability to remove them. As a result, a chain reaction of lipid peroxidation (LPO) and end-products such as malondialdehyde (MDA) bind to proteins and phospholipids, causing cell membrane damage and central nervous system damage [30]. It has also been reported that AGEs can increase oxidative stress, promote abnormal phosphorylation, and promote neurodegeneration[31].

3.6 Sodium nitrite-mediated neurodegeneration

Sodium nitrite (NaNO2) reduces the oxygen-carrying capacity of blood due to the ability of nitrite to convert normal hemoglobin to methemoglobin. This hypoxia causes varying degrees of memory impairment. The combined effect of NaNo2 and D-galactose has also been reported in clinical manifestations of AD [32].

4. HERBAL NEUROPROTECTIVE

The lack of effective and widely applicable pharmacological treatments in modern treatments of neurodegenerative diseases may explain the growing interest in traditional medicines[33].The WHO estimates that 70-80% of the world's population relies on traditional medicine, primarily herbal medicine, for their primary health needs [34]. These drugs offer a safe and well-tolerated treatment for chronic diseases with fewer side effects than conventional treatments [35].Traditional raw forms of remedies have evolved into standardized herbal extracts, their formulations, and even compound formulations has been integrated [36,37].

4.1 CROCUS SATIVUS L (C. SATIVUS)

Commonly known as saffron, it belongs to the Iridaceae family and consists of dry, dark red stigmas with small segments of the yellowish style of C. sativus. It is mainly used as herbal medicine in various parts of the world. Saffron has 150 different compounds, including a family of carotenoids that are glycosides of crocetin. Saffron also has four major bioactive components such as crocin, crocetin, picrocrocin, and safranal. Another component of saffron was picrocrocin, which has a bitter taste [38,39]. Medicinal Properties of Crocus sativus: Crocus sativus is used in both human and animal models to treat cognitive impairment, seizures, and Alzheimer's disease. Its main component, crocin, has powerful antioxidant properties by lowering

malondialdehyde (MDA) levels. Administration of C. sativus extract prior to induction of cerebral ischemia by middle cerebral artery occlusion (MCAO) significantly reduces glutamate and aspartate levels. Moreover, it reduces aluminum chloride-induced neurotoxicity in mice for the treatment of mild to moderate AD in a 55-year-old patient [39,40]

Acute and subacute toxicity studies: 5 mice were orally administered a single dose of 3 g, and 5 groups (5 mice in each group) were given 0.5, 1, 1.5, 2, 2.5, and 3 g/ Crocin was administered intraperitoneally at a dose of kg. Observations were made at 24 and 48 hours to determine mortality and signs of toxicity. Subacute toxicity studies provide information on the effects of repeated exposure to chemicals on living organisms. No mortality was observed with crocin (0.5, 1, 1.5, 2 and 3 g/kg, ip or 3 g/kg orally) after 24 and 48 hours of treatment. Chemicals with LD50 in the range of 1-5 g/kg are considered virtually non-toxic. This component of saffron appears to be substantially less toxic when taken acutely or intraperitoneally compared to acceptable doses (oral and intraperitoneal) of 3 g/kg crocin. process. Studies confirm that crocin appears to be a virtually non-toxic drug [41]

4.2 CENTELLA ASIATICA

It consists of fresh or dried leaves and stems of the Centella asiataceae family. It contains saponins and asiaticoside also contains asiatic acid, madakasic acid and betulinic acid. Medicinal properties of Centella asiatica: Used as an anxiolytic, epileptic and antidepressant. It reduces malondialdehyde (MDA) levels while increasing brain glutathione levels. [38]. It has various pharmacological effects on the central nervous system. Previous reports have also shown that Centella asiatica leaf extract is involved in the morphology of hippocampal CA3 and amygdala neural branching in neonatal rats [42,43].

Acute and subchronic toxicity studies: 10 male and 10 female mice were orally administered 10 g / kg of the extract. The doses of extract given did not cause any signs of toxicity or death within the 14-day observation period. No acute toxicity occurred at doses up to 10 g / kg, and no significant subchronic toxicity was observed in rats receiving 10-1000 mg / kg Ca [42].

4.3 BACOPA MONNIERI

The Bacopa monnieri plant, commonly known as Brahmi, belongs to the Plantaginaceae family. Brahmi is considered a powerful brain or nerve tonic and plays an important role in memory enhancers or nootropics. Brahmi also contains many pharmacological actions such as tranquilizer, diuretic, tranquilizer, cardiotonic, and anti-stress agent [44]. Uabundit N et al. We studied the neuroprotective activity of an ethanol extract from the aerial parts of B. male Wistar rat monnieri. Doses of 20, 40, and 80 mg/kg of the extract showed significant neuroprotective activity [45]. The neuroprotective activity is due to the presence of bacosides A and B [46].

4.4 HUPERIZA SERRATA

Huperiza serrata, commonly known as Chinese crab moss, belongs to the Lycopodiaceae family. It is a Chinese medicinal plant, commonly known as Qian Ceng Ta, that has shown promise as a medicinal herb for neurodegenerative diseases. Apart from its neuroprotective properties, it has many other pharmacological activities such as anti-inflammatory, antiapoptotic, anticonvulsant and antinociceptive [47].

Ohba T et al. studied the neuroprotective activity of ethanolic plant extracts of H. Serrata against scopolamine-induced cognitive impairment in mice. The extract at a dose of 30 mg / kg showed significant neuroprotective activity due to the presence of the alkaloid Huperzine A [48].

4.5 CORIANDRUM SATIVUM

Coriandrum sativum, commonly known as Dhanya, coriander belongs to the Apiaceae family. Unripe fruit with a very pungent aroma. The leaves of these plants are used in cooking and contain many medicinal properties. Coriander has numerous pharmacological properties, including antidiabetic, diuretic, hepatoprotective, anticancer, antiinflammatory, antimutagenic, anticonvulsant, anxiolytic, sedative, and hypnotic effects [49]. Elahdadi-Salmani M et al investigated the neuroprotective activity of C. sativum ethanol leaf extract against epilepsy-induced learning and memory deficits in male Wistar rats. A dose of 200 mg/kg of the extract showed significant neuroprotective activity [50].

4.6 ECLIPTA PROSTRATA

Eclipta prostrata is commonly known as Bhringraj (Ayurveda) and false daisy (English) belongs to the Asteraceae family. It is a traditional herbal medicinal plant used hundreds of years ago in Asia and South America for the prevention of many bleeding disorders, respiratory ailments, heart disease, skin diseases, etc has

assuring pharmacological activity. Promoting hair growth, hepatoprotection, cytotoxicity, antibacterial, antidiabetic, anti-inflammatory, lipid-lowering, etc[51]

Chong, Wai et al. investigated the neuroprotective action of the ethanolic plant extract E. prostrat against scopolamine-induced memory impairment in male ICR mice. The extract showed significant neuroprotective action at doses of 50 and 100 mg/kg [52].

4.7 WITHANIA SOMNIFERA(L.)DUNAL

Withania somnifera (L.) Dunal (WS) belongs to the bonsai family. WS, commonly known as Ashwagandha, is considered by many to be Indian ginseng. In Ayurveda, it is classified as rasayana (rejuvenation) and is said to promote physical and mental health, rejuvenate the body in a state of weakness, and increase longevity. The major biochemical constituents of Ashwaganda root are steroid alkaloids and steroid lactones in a group of constituents known as withanolides [53]. Much of the pharmacological activity of Ashwaganda is attributed to two major withanolides, withaferin A and withanolide D. WS has several therapeutic activities including anti-inflammatory, sedative, hypnotic, anesthetic, general tonic, diuretic (Fruits & Seeds), aphrodisiac [54]. WS has antioxidant effects in the brain. WS extract was able to prevent the increase of LPO [55]. Biochemical studies revealed a significant increase in the major free radical scavenging enzymes, levels of superoxide dismutase, catalase and glutathione peroxidase in the rat brain [56]. When administered orally (50-200 mg/kg orally), the compounds sitoindosides IX and X also produced significant anti-stress activity in albino and rat rats. They also increased learning, acquisition and memory retention in young and old mice [57].

4.8 ASAFOETIDA (F. ASAFOETIDA L.)

This is a plant in the Apiaceae family, derived from the secretions of rhizomes or tap roots that live underground. F. asafetida. E-1-propyl sec-butyl disulfide is a major component and 25 compounds have been identified in hydrogen distillate oil. E-1-propenyl sec-butyl disulfide (0.0%) and germacrene B (7.8%) are the main components of Ferula asafetida [60]

Medicinal properties of F. Asafoetida: F. asafoetida resin has the ability to inhibit monoamine oxidase B (MAO-B) and it can be used in the treatment of neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease. Meanwhile, Ferula asafoetida has been reported to have acetylcholinestrase (AChE) inhibitory properties in in vitro and in vivo snail nervous system tests. Researchers have suggested that the memory-enhancing effects of Ferula asafoetida may be due to the herb's inhibitory effect on AChE in the rat brain [60] Acute and subchronic oral toxicity: In the oral acute toxicity test of F. asafoetida extract, three groups of five mice were given 10, 100, and 1000 mg/kg of extract orally. Studies on the safety of this extract using mice revealed a large safety margin of the extract LD50>5 g/kg. Based on previous research, a dose of 250 mg/kg of F. asafoetida extract was chosen.

In rats, oral administration of F. asafoetida extract for 28 days resulted in no significant changes in body weight or weight gain. Acute oral toxicity studies revealed no mortality or toxicity up to 5000 mg oral dose[61]

5. CONCLUSIONS

Herbs are often excellent substitutes for many ailments and ailments they are inexpensive tend to have fewer side effects are relatively safe environmentally friendly and readily available traditionally many herbs have been used for ailments associated with neuroprotection products have become a symbol of safety in contrast to synthetic drugs considered unsafe for humans and the environment behavioural factors promote nervous system health by placing a moderate burden on neural stem cells ethno-botanical and ethno-pharmaceutical research and other natural compounds provide most of the current knowledge about CNS active plants of cultural and traditional relevance various herbs may produce additive and or synergistic effects in vivo enhancing or reducing inhibiting their activity a number of herbs have recently been reported to exert neuroprotective effects in various experimental models of neurological disorders a number of herbal extracts and components have therapeutic effects in animalin vitro cell culture models of neurological disorders the knowledge gleaned in this review article can be used in the search for new medicinal plant-derived pharmacotherapies for these diseases the pharmacological actions of many phytochemicals and herbal extracts incorporate to some extent mechanisms known to be involved in inducing neuroregenerative effects demand for herbal medicines is on the rise but scientific validation is required before plant extracts are widely accepted and used during this communication we only studied herbs with neuroprotective activity and reported their impact on the irreversible effects of cognitive impairment

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