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REVIEW ARTICLE

Medicinal Plant for Curing Alzheimer's Disease

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ABSTRACT

Neurodegenerative diseases of the human brain comprise a variety of disorders that affect an increasing percentage of the population. Some of these are age dependent (e.g. Alzheimer's and Parkinson's diseases) and some are infection dependent, e.g. human immunodeficiency virus (HIV/AIDS). Alzheimer's disease (AD) is a complex, multifactorial, heterogeneous mental illness, which is characterized by an age-dependent loss of memory and an impairment of multiple cognitive functions. It is the most common type of dementia in the ageing population due to a severe loss of cholinergic neurons in selected brain area. In traditional practices of Ayurvedic and Chinese medicine, numerous plants have been used to treat cognitive disorders, including neurodegenerative diseases such as Alzheimer's disease. An ethno-pharmacological approach has provided leads to identifying potential new drugs from plant sources, including those for cognitive disorders. Herbal remedies that have demonstrable anti-alzheimer activities have provided a potential to psychiatric pharmaceuticals and deserve increased attention in future studies. This article reviews different plants and their active constituents that have been used in traditional Ayurvedic medicine and for their reputed cognitive-enhancing or anti-ageing effects.

Key Words: Ethno-botanical herbs, Active constituent, Alzheimer's disease.

INTRODUCTION

Alzheimer's disease (AD), is a complex, multifactoral, progressive, neurodegenerative disease primarily affecting the elder population and is estimated to account for 50–60% of dementia cases in persons over 65 years of age [1-2]. The impairment of central acetylcholine (ACh) neurotransmission due to neural degeneration is believed to be a principal neuropathological feature of Alzheimer's disease [3-4]. AD occurs in two forms: familial and sporadic. In familial AD, mutations in the amyloid precursor protein (APP), presenilin 1, and presenilin 2 genes are the currently known causal factors [5-6]. Familial AD constitutes only a small portion (2-3 %) of all AD patients [7] and it has an early age of onset (younger than 65 years). On other hand, sporadic AD, constitutes a vast majority of AD cases and is associated with a late age of onset (65 years and older). Although the specific causes of sporadic AD are still unknown [5] many causal factors seem to be involved in sporadic AD, including aging [5], mitochondrial defects [8], insulin-dependent diabetes [9-10], environmental conditions [11], and diet [12-13]. In familial AD, genetic mutations accelerate the disease process [5], whereas in sporadic AD due to absence of genetic mutation, cellular changes that control AD progression take more time to develop [14].

Histological, pathological, molecular, cellular, and gene expression studies of AD have revealed that multiple cellular pathways are involved in AD progression [14]. The pathological features identified in the central nervous system (CNS) in AD are amyloid plaques, neurofibrillary tangles, inflammatory processes and disturbance of neurotransmitters [5-6]. Pathologically, there are no differences between familial AD and sporadic AD [5]. In patients with sporadic AD, pathological changes occur latter than in patients with familial AD [10, 15-23]. Studies with AD brains and AD mouse models show that abnormal metabolism of amyloid precursor protein (APP) is a key mecha-

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nism of AD pathogenesis [7-8]. Cells in the brains of AD patients exhibit abnormally high amounts of oxidatively modified proteins, lipids and DNA; such free radical-mediated molecular damage is particularly prominent in the environment of senile plaques and in neurofibrillary tangle-bearing neurons, suggesting roles for reactive oxygen species in amyloid-mediated neuronal damage and neurofibrillary pathologies [24]. Amyloid precursor protein (APP) is an integral membrane protein of uncertain function. The cellular proteolytic processing of amyloid precursor protein (APP), can lead to the generation of amyloid β-protein (Aβ) that readily form aggregates and that have neurotoxic activities under certain conditions in vitro and in vivo [25-26].The deposition of Aβ, a peptide that varies in size from 39 to 43 amino acids, in the senile plaques in the AD brain is believed to be the crucial step in AD pathogenesis (amyloid cascade hypothesis) [5]. The imbalance between Aβ production and Aβ clearance is the basis for the formation of amyloid plaques [5]. Amyloid β-protein (Aβ) acts as one of the various sources of reactive oxygen species. During the process of aggregation Aβ generates hydrogen peroxide; a process that requires oxygen and that is greatly potentiated by Fe^{2+} and Cu^{+} [27, 28]. Lipid peroxidation induced by Aβ impairs the function of ionmotive ATPases, glucose and glutamate transporters, and also GTP-binding proteins [29]. By disrupting cellular ion homeostasis and energy metabolism, relatively low levels of membrane-associated oxidative stress can render neurons vulnerable to excitotoxicity and apotosis. The dysfunction and degeneration of synapses in AD may involve Aβ-induced oxidative stress because exposure of synapses to Aβ impairs the function of membrane ion and glutamate transporters and compromises mitochondrial function by an oxidative-stress-mediated mechanism [30].

Medicinal plants having anti-Alzheimer's potential

Genus-species	Family	Parts extracted	Active component	Reference
Allium sativum	Alliaceae	Bulb	S-allylcysteine	15
Angelica sinensis	Umbelliferae	Root (Methanolic & Hexane extract)	Z-ligustilide, 11-angeloylsenkyunolide F, Coniferyl ferulate, Ferulic acid.	3, 31-33
Astragalus membranaceus	Fabaceae	Root (Aqueous extract)	Cycloastragenol	3, 34-36
Bacopa monniera	Scrophulariaceae	Aerial parts (Ethanolic extract)	Resperpine, chloromazine	3, 37-38
Biota orientalis	Cupressaceae	Seed (Ethanolic extract)	Pinusolides	3, 39
Camelliasinensis	Theaceae	Leaf	Epigallocatechin gallate	15
Caulis spatholobi	Leguminosaae	Whole herb (Water & ethanol extract)		40
Celastrus paniculatus	Celastraceae	Seed (Aqueous extract)	Criojot	3, 41-42
Centella asiatica	Apiaceae	Whole plant	Hydrocotylin, Hersaponin	15, 43
Clitoria ternatea	Fabaceae	Root (Aqueous extract)	Histidine, threonine	3, 44
Coptidis rhizoma	Ranunculaceae	Whole plant	Berberine	45
Curcuma longa	Zingiberaceae	Rhizome	Curcumin	15, 46
Dipsacus asper Wall	Dipsacaceae	Root (Ethanolic etract)	Dipsacus saponins	3, 47-48
Evodia rutaecarpa	Rutaceae	Fruit	Dehydroevodiamine (DHED)	3, 49
Galanthus nivalis L.	Amaryllidaceae	Crude extract	Galanthamine	50
Gastrodia elata	Orchidaceae	Root	p-hydroxybenzyl alcohol (HBA) and gastrodin (GAS)	3 , 51-52
Ginkgo biloba	Ginkgoaceae	Leaf extract	Kaempferol Quercetin	53-57
Heteropterys aphrodisiaca	Malpighiaceae	Root		3, 58
Huperzia serrata	Lycopodiaceae	Crude drug	Huperzine A	50, 59-63
Hypericum perforatum	Hypericaceae	Aerial parts	Hyperforin	3, 64-66
Indigo naturalis	Apiaceae	Plant-based powder	Indirubins	15, 67
Lycium barbarum	Solanaceae	Fruit	Lycium barbarum polysacharides (LBP)	68, 69-73
Lycoris radiata	Amaryllidaceae	Whole plant	Galanthamine	74-75

Melissa officinalis	Lamiaceae	Oil		76
Narcissus confusus	Amaryllidaceae	Crude extract	Galanthamine	50, 77
Nicotiana tabaccum	Solanaceae	Leaf	Nicotine	15, 78-80
Ophiopogon japonicus	Ruscaceae	Tuber		3, 81-82
Panax ginseng	Araliaceae.	Crude, extract / ginsenosides	Ginsenosides Rg1,Rg2,& Rg3	68, 83-85
Polygala tenuifolia	Polygalaceae	Root	Tenuifoilin, tenuigenin,	3, 86-87
Radix paeoniae alba	Paeoniaceae	Whole herb (Water & ethanol extract)		40
Radix paeoniae rubra	Ranunculceae.	Whole herb (Water & ethanol extract)		40
Radix etrhizome rhei	Polygonaceae	Whole herb (Water & ethanol extract)		40
Radix polygoni multiflori	Polygonaceae	Whole herb (Water & ethanol extract)		40
Radix salviae miltiorrhizae	Labiatae	Whole herb (Water & ethanol extract)		40
Rhizoma acori	Araceae	Leaf	Eugenol and h-asarone	15, 88
Schizandrae chinensis	Magnoliaceae	Fruit	Schizandrin	3, 89-90
Tripterygium wilfordii	Celastraceae	Whole plant (Ethanolic extract)	Celastrol	91-92
Uncaria tomentosa	Rubiaceae	Aerial parts	Uncarine E (UE)	3, 93
Vitis vinifera	Vitaceae	Seed	Resveretrol	94-96
Withania somnifera	Solanaceae	Root		3, 97-98

CONCLUSION

Most herbal medicines are complex mixtures of chemical components and have diverse biological and pharmacological actions. A number of medicinal plant have been used which demonstrate the properties of anti-aging herbs. According to the traditional theory, these herbs can help us to maintain the level of vital energy in our body; and they have multiple neuro-protective mechanisms that enable them to be used in different health stages for disease prevention and even curing. The information in this review explains number of herbal plants and their constituents that possess therapeutic effects of psychiatric illnesses may be used in a research for novel pharmacotherapies by the researchers.

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