

## Ginseng: a potentially effective Tcm for Alzheimer's disease

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**Abstract:** Aging is a serious problem which is challenging the entire human race. With the longer life of people, more and more people are suffering from Alzheimer's disease (AD), which is suffering from not only for the patients themselves but also for the society. To be the king herb of Traditional Chinese Medicine (TCM), ginseng had been used as a treatment for dementia with a long history. Based on the traditional effect of "Reinforcing Intelligence" of ginseng, we reorganized the literatures and references about ginseng on the treatment of AD.

**Keywords:** Ginseng; Alzheimer's disease; Traditional Chinese medicine

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### 1. Introduction

Alzheimer's disease (AD) is the most common dementia, which is a chronic neurodegenerative disease. The mechanism of AD is not well understood because of complex pathogenic factors. And with the progress of disease pathology, it usually gets deterioration. With the progress of AD, it's clinical symptoms will occur in inarticulate speech, disorientation, mood swings, loss of motivation, not managing self-care and abnormal behavior[1-2]. Now there is no certain well effective treatment to AD, but TCM could slow down the progression of disease, especially ginseng has antioxidant, protects the damage neuron cell and has been used in treating AD for thousands of years in clinical treatment.

What is about of the treatment on AD?

Base on the fundamental theory of traditional Chinese medicine, Qi and Blood are the fundamental substances constituting of the human body, which could maintain life activities. The original Yang of the body can not only promote hemokinesis, but also warm the body. If there are troubles about renal function in warming and moving (Qi Hua) such as fatigue, amnesia, cold-limbs, soreness of waist, dry eyes, urorrhagia and other clinical manifestations would lead into occurrence of disease. With the aging process, deficiency of Qi and Blood, disharmony between Ying and Wei, five zang-organs imbalances can all lead to the clinical manifestations of Qi Stagnation and Blood Stasis. Then the lucid Yang fails to rise and the turbid Yin fails to descend. When the body comes to this pathology phase, the mind has been damaged, which is Traditional Chinese Medicine explains the occurrence of Alzheimer's disease.

TCM clinical AD belongs to the category of

dementia and amnesia. The lesion location of Alzheimer's disease is brain and also is closely relate to the kidney, heart, spleen and liver. The key organ of body focus on the kidney. TCM about the basic pathological factors of AD are phlegm, dampness and stasis which has three factors influence each other. TCM usually use the treatment like removing phlegm and blood stasis, nourishing heart, tonifying spleen and restoring normal coordination between heart and kidney as adjuvant therapies. There are many kinds of traditional Chinese medicine, such as ginseng, hookwood, gardenia, ginkgo and so on, which can treat Alzheimer's disease[3-5].

What is Ginseng ?

As the king herb of TCM, Ginseng is the slow-growing perennial plants with fleshy roots, belonging to the genus *Panax* of the family Araliaceae. Ginseng mostly grows up in the northeast of China and North America, typically in cooler climates areas. The chemical components of ginseng is more rich and more high quality especially in Jilin province.

The root of ginseng is most available in dried form, either whole or sliced. Its leaf is rich in some saponins which could sometimes also used in saponins extraction and separation. Folk medicine attributes various benefits to oral use of American ginseng and Asian ginseng (*P. ginseng*) roots. It also has promoting aphrodisiac, strength the energy, enhancing immunity, helping type II diabetes treatment, or the treatment for sexual dysfunction in men[6].

Ginseng may be used in the health food or drug such as in energy drinks, herbal teas[7], ginseng coffee[8]. It has effects on some hairdressing and cosmetics supplies such as in hair tonics and cosmetic preparations, etc.

The pharamology of the Ginseng

People have used ginseng to keep healthy for

many years in Asian countries. Researchers have shown that ginseng has certain effects on central nervous system, hematopoiesis, metabolism, platelet, blood pressure and so on. More and more evidence has shown that Panax ginseng can improve the function of learning and memory[9-11]. Recently researches indicate that ginseng has shown well effects on the protecting the neuron cell and the treatment of AD, which's mechanism is related to anti-inflammation, antioxidant, anti-apoptosis and anti-aging, etc.

## 2. Anti-amyloid A ( $A\beta$ ) aggregation

$A\beta$  is the main pathogenesis-related proteins of AD according to recently researches. As reported,  $A\beta$  concentration in neuron cell is obvious reduction after taking oral ginseng[12]. Zhang et al. reported that ginseng could alleviate  $A\beta$  aggregation in ovariectomized (OVX) and D-galactose-injected rats by decreasing  $\beta$ -secretase and upregulating  $\alpha$ -secretase[13]. Ginseng Rg1 can inhibit the aggregation of  $A\beta$  by up-regulate the expression of PPAR $\gamma$  and increase the content of IDE in hippocampus. Hippocampal histopathological abnormalities can improve learning and memory in a rat model of AD[14]. Ginsenoside Rd attenuates  $A\beta$ -induced pathological phosphorylation by affecting the activities of GSK-3 $\beta$  and PP-2A[15]. Ginseng Rh2 treatment increases soluble APP $\alpha$  (sAPP $\alpha$ ) levels and reduces amyloid beta 40 and 42 concentrations by increasing CTF $\alpha/\beta$  ratios[16]. In vitro, it had proved that ginseng could inhibit  $\beta$ -secretase activity and increase  $\alpha$ -secretase activity[17-18]. It also reported that ginseng could inhibit the activity of  $\gamma$ -secretase in TgmApp mice and B103-APP cells[19].

## 3. Anti-apoptosis

The apoptosis of neuron cell is also a damage factor of AD[20]. Li et al. reported that ginseng could increase neuron viability and decrease lactate dehydrogenase[21]. Gong et al. used real-time RT-PCR, flow cytometry and western-blot to confirm the effect of ginseng on hippocampal neurons. The result showed that ginseng could increase neuronal viability, decrease LDH and reverse the apoptosis[22]. Another research showed that SHSY5Y cell apoptosis induced by MPP $^+$  could be inhibited by ginseng and the anti-apoptosis function may work through alleviating activities of intracellular reactive oxygen species(ROS) and C-jun N-terminal protein kinase(JNK) and subsequently intimating activation of caspase3[23].

## 4. Anti-oxidation and Anti-inflammation

Excessive oxidants and neuro-inflammation are two pathological alterations in AD. Microglia which is found to be a mediator in the neuronal immune

system, plays an important role of AD in many pathological processes[24-26]. It has been proved that many proinflammatory cytokines like IL-1 $\beta$ , IL-6 and TNF- $\alpha$  are released from activated microglia[27]. Recently research showed that the antioxidant effect of ginseng could protect the nervous system in vitro[28]. In vivo, it had been proved that ginseng could regulate immunity[29]. Ginseng Rg5 can decrease  $A\beta$  deposits, improve STZ-induced learning and memory impairments in rats by increasing expressions of BDNF and IGF-1[30]. Compound K can overcome scopolamine-induced memory impairment by the induction of Nrf2-mediated antioxidant enzymes[31].

Clinical studies have shown that taking ginseng in young and middle-aged people can improve memory and cognitive function[32,33]. More and more researchers found that ginseng has certain effects on neurotransmitters, calcium channel inhibition, mitochondrial dysfunction, signaling pathways, etc.

Other Effects about Ginseng:

### 1. Effects on cardiovascular system

Ginseng has been proved hypotensive effect in hypertensive rats, and also in patients with essential hypertension. Rg1 and Rg3 can relax vascular smooth muscle and inhibit endothelin production and platelet aggregation.

### 2. Effects on central nervous system

The active ingredients in ginseng, such as Rb1, Rg1, can enhance the activity of the central nervous system. For instance, ginsenoside Rg1 can improve the whole process of memory. And ginsenoside Rb1 can only improve the acquisition and retention ability of memory but has nothing to do with the consolidated function of memory.

### 3. Effects on anti-tumor

Rh2 and Rg3 have inhibitory effects on breast, prostate, liver and small bowel tumors in animals and human trials. Ginseng can improve the protective effect on the human anti X-ray radiation. Long term use of Ginseng can reduce the incidence of lung, stomach, liver and colon cancer. The main mechanism of all above is to enhance immunity, inhibit tumor angiogenesis and induce tumor cell apoptosis.

### 4. Effects on immune system, inflammation and allergy

Rb1, Rg1, Rg3 can suppress cytokine production, the expression of COX-2 gene and the release of histamine. Polysaccharide can increase the production of interferon, enhance the activity of phagocytic cell, natural killer cells, B and T cells. Rg1 can increase the function of t-helper cells and improve the immune function of the elderly.

## 5. Conclusion

Ginseng has been proved to have certain effects in treating Alzheimer disease. There are hundreds of prescriptions in TCM about ginseng treating AD. But

some mechanism and treatment of AD is still a problem. We would try our best to resolve the problem of ginseng mechanism and finding out some certain kinds of chemical substances. Make ginseng a new therapeutic strategy in preventing and treatment for AD.

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