

A Review of Utilising Medicinal Plants in Cerebrovascular Illness

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Abstract

The majority of herbal medicines come from plants, making them a priceless asset for the creation of cutting-edge therapeutic agents for a variety of human ailments. The "science of life" in Ayurveda, an Indian medicinal system that traces its roots to between 4500 and 1500 BC, is the oldest medical treatise in existence. A number of home cures, the ratio of each component, and the production method are all examined. Neurodegenerative diseases such as Parkinson's disease (PD) and Alzheimer's disease (AD) cause neurons to gradually lose their structure and function, and in extreme cases, to totally disappear. These diseases have a profound effect on the individual as well as society. Numerous environmental factors such as aberrant protein accumulation in neurons, oxidative stress, inflammation, protein breakdown anomalies in the mitochondria and family history, are often investigated as potential causes of neurodegenerative disorders. These medications include Rhizoma Chaunxiong, Salvia Miltiorrhiza, Panax Notoginseng, Gardenia and so on. In the present review we have looked into the potential efficacy of the plant nutrients in treating neurological disorders.

Keywords: Herbal Medicines, cerebral blood volume, Alzheimer's disease, Parkinson's disease

Introduction

Observational studies are increasingly supporting the idea that diet and other lifestyle factors play a major role in preventing strokes. (Qian et al., 2021) Cerebral vascular reactivity (CVR), which characterises the blood vessels' ability to expand in response to an increase in tissue blood supply, can be assessed through measurements of the change in cerebral blood flow (CBF) or cerebral blood volume (CBV) that vasodilation produces. Plant-based herbal remedies are a useful resource for the development of novel therapeutic agents for a wide range of human illnesses. For chronic health issues like stroke, herbal remedies are thought to be more beneficial. Numerous therapeutic plants and their active ingredients exhibit encouraging outcomes in lab studies. Ischemic stroke is classified in Traditional Chinese Medicine as a Wind-induced condition. Currently, the majority of therapy approaches for cerebrovascular illnesses are failing. Oxidative stress and inflammation are two key pathophysiological pathways in cerebrovascular disorders. (Manzoor, 2019)

By preventing oxidative stress, calcium overload, and neuroinflammation, ginsenoside Rg1 reduces cerebral ischemia-reperfusion injury. (Bhakta Prasad Gaire, 2018). By interfering with the breakdown and redistribution of tight junctions, notoginsenoside R1 reduces blood-brain barrier permeability following an ischemic stroke. (Longfei Wu et

al.,2023). In clinical practice, cerebral infarction, or CI, is a frequent brain disease that is primarily produced by a pathologic environment of ischemia and hypoxia brought on by a problematic cerebral circulation perfusion function. (Xietao Ye et al., 2022). This leads to ischemic necrosis of local brain tissue. Treatment of CI with *Salvia miltiorrhiza* Bunge (SMB), a type of traditional Chinese medicine, is a viable approach because of its strong efficacy in reducing blood stasis and improving blood circulation. (Dan-Li Hao et al., 2023)

Withania Somnifera's combination neuroprotective and neuroregenerative potential is one such technique that may improve stroke recovery by reducing cell death while also boosting repair. (Bhakta Prasad Gaire, 2018). For millennia, the Chinese have utilised *Gardeniae fructus* and *Bovis calculus artifectus*, two Chinese remedies, to extract Jasminoidin (JA) and Ursodeoxycholic Acid (UA), respectively, for the treatment of stroke. A herbal polypill can be constructed for the prevention of heart illnesses and cerebrovascular disorders by integrating Ayurvedic herbs with known and proven benefit such as Guggulu, Arjuna, Pushkarmoola, Lasuna, Amalaki, and Jatamansi for regulating risk factors of cardiovascular ailments. (Dilipkumar Pal & Padum Lal. 2023)

P. Notoginseng (Sanqi)

P. Notoginseng (Sanqi) is a well-known Chinese plant that is a member of the *Araliaceae* family. It's both bitter and delicious. *P. Notoginseng*, also known as Sanqi in China, has been the focus of much pharmacological research in recent years. It suggests that *P. Notoginseng* has an optimistic future. *P. Notoginseng* saponins, according to pharmacological studies, may aid with blood viscosity, learning, and memory loss in ischemic brains by protecting neurons from oxidative stress. (Jing Xiong et al., 2008)



Figure 1 – P. Notoginseng (Sanqi)

S. Miltiorrhiza (Danshen)

In China, the plant *Salvia Miltiorrhiza*, often known as "Danshen," is used to treat chiliads. It is the dried root of *S. Miltiorrhiza*. *S. Miltiorrhiza* and its active components are known for improving erythrocyte flexibility, blood viscosity, and microcirculation. It is widely utilised

in the treatment of cerebrovascular accidents and is used to alleviate blood stagnation during cerebral infarction treatment. (Panel Mingfei Zeng et al., 2013; 11. Hye Young Son 2009)

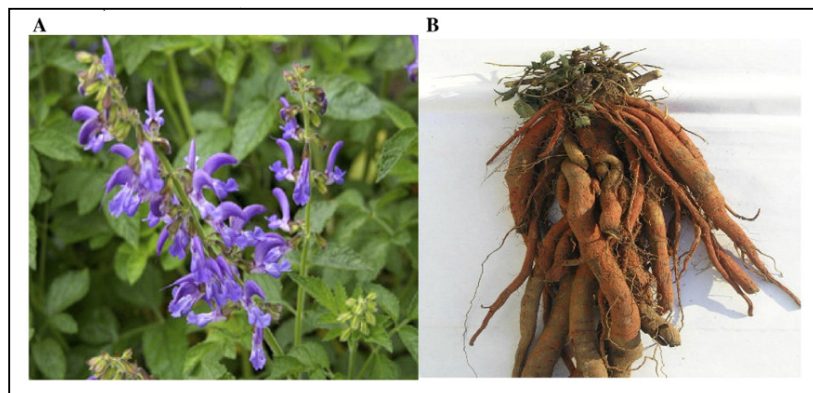


Figure 2- S. Miltiorrhiza (Danshen)

Rhizoma Chuanxiong (Chuanxiong)

Rhizoma Chuanxiong, or Chuanxiong, is the dried rhizome of the Umbelliferae plant *Ligusticum wallichii* Franchat. The rhizome of *L. wallichii* Franchat contains a high concentration of essential oil, alkaloid, organic acid, and other compounds. Ingredients are classified into three types: phenolic compounds (ferulic acid), phthalide compounds (ligustilide), and alkaloids compounds (ligustrazine). The principal active constituents of *Ligusticum* are ligustilide, ferulic acid, and ligustrazine. (Panel Mingfei Zeng et al., 2013)

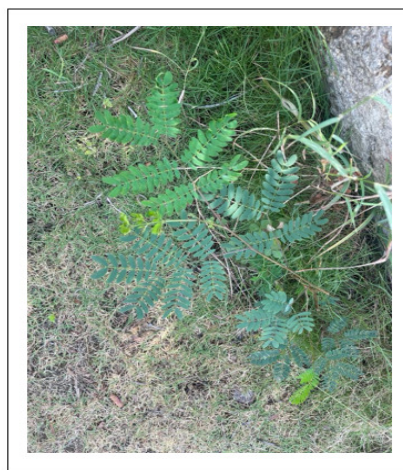


Figure 3- Rhizoma Chuanxiong

Gardenia (Zhizi)

Gardenia (Zhizi) is the fully formed fruit of *Gardenia Jasminoides* Ellis. Gardenia plants have been used by physicians for millennia in traditional Chinese medicine. Recent research has established the extensive pharmacological activities of Gardenia and its constituents. It is an essential component of well-known traditional Chinese medicine prescriptions such as Huang-Lian-Jie-Du-Tang and Qing-Kai-Ling injection, both of which are intended to prevent cerebral ischemia injury. (Panel Mingfei Zeng et al., 2013)



Figure 4- Gardenia (Zhizi)

AntirheaBorbonica

The effects of a polyphenol-rich extract of the medicinal plant Antirheaborbonica and its main constituent caffeic acid on mouse bEnd3 cerebral endothelial cells in high glucose conditions, as well as an obesity mouse model induced by a High-Fat Diet (HFD) during an ischemic stroke, were investigated in this study. Polyphenols administered orally over a 12-week period reduced the effects of a high-fat diet on insulin resistance, hyperglycemia, hyperinsulinemia, and dyslipidemia in vivo. Following a stroke, polyphenols reduced hemorrhagic transformation, cerebral infarction, and BBB disruption, which was increased by obesity. Polyphenols displayed anti-inflammatory and antioxidant properties in obese mice by reducing the overproduction of IL-1, IL-6, MCP-1, TNF-, and Nrf2, as well as increasing total SOD activity at the brain or peripheral levels. (TaileJ et al., 2022)



Figure 5- AntirheaBorbonica

Ginkgo Biloba Leaves

Cardiovascular diseases (CCVDs) are the leading cause of death worldwide, hence there is an urgent need to develop new strategies for both preventing and treating these ailments. Traditional Chinese Medicine (TCM) has been used for millennia in Asia and other parts of the world, and it has shown promise in treating a variety of disorders. Ginkgo Biloba Leaves (GBLs) are a traditional Chinese medicine herb that has long been used to treat a variety of ailments, including CCVDs. It is still unknown what the underlying molecular mechanisms of medicinal plants are for treating specific disorders. By combining network analysis, pharmacokinetic pre-screening, and target fishing, a novel systems-pharmacology platform has been developed to systematically elucidate the pharmacological mechanism of action of GBLs for the treatment of CCVDs. The data show that GBLs protect against CCVDs, most likely by regulating a number of pathways and striking a number of targets involved in a variety of biological pathways. (Yinfeng Yang et al., 2017)



Figure 6- Ginkgo Biloba Leaves

Jasminoidin

The effects of Jasminoidin were studied in rats with localised cerebral ischemia. According to studies, Jasminoidin can effectively reduce the expression of tumour necrosis factor-alpha, interleukin 1 beta, and von Willebrand factor in the aftermath of cerebral ischemia. By slowing the inflammatory process, this can reduce damage to vascular endothelial cells and slow the advancement of cascade damage produced by cerebral ischemia. (Ye R et al., 2009)



Figure 7- Jasminoidin

Ginseng / Siberian ginseng

Panax ginseng root is a well-known traditional Chinese herbal medicine. It is a slow-growing perennial plant in the Panax genus of the Araliaceae family with thick roots. Panax ginseng demonstrated exceptional neuroprotection when subjected to oxygen glucose deprivation and reoxygenation. This is due to its anti-oxidative properties, which include decreasing the production of intracellular reactive oxygen species and malondialdehyde, increasing glutathione levels, and increasing the antioxidant enzymatic activities of catalase, superoxide dismutase, and glutathione peroxidase (GPx). These findings suggest that GSRd may be a neuroprotective medication for cerebral ischemia injury, although more research is required to determine GSRd's potential neuroprotective efficacy. Panax notoginseng (PN) roots are commonly used as a medicinal component in traditional Korean medicine to stop bleeding. (Yinfeng Yang et al., 2017). Radix salviaemiltiorrhizae (RSM) is a powder made from the dried roots and rhizome of Salvia miltiorrhiza Bunge, a member of the Labiatae family. It has the potential to prevent cerebral ischemia because it has been used to increase cerebral blood flow. It has been tested against numerous models of cerebral ischemia, including the 4-vessel occlusion model in rats and the carotid artery ligation model in gerbils, and it has been demonstrated to be effective. Miltiorrhizae protected the brain from reperfusion injury by decreasing lipid peroxidation. (Xiao-lei-Zhu et al., 2004). Eastern countries such as China and Russia have used Siberian ginseng, also known as eleuthero, for millennia. While Siberian ginseng shares some applications with Asian (Panax ginseng) and American (Panax

quinquefolius) ginseng, it is a unique plant with different active chemical components. Traditional Korean medicine has utilised Siberian ginseng, which is the root and stem bark of *Acanthopanaxsenticosus*, as a tonic and adaptogen to strengthen. Research has demonstrated the neuroprotective benefits of *Acanthopanaxsenticosus* (ASW) water extracts in cases of temporary middle cerebral artery blockage. (Ye R et al., 2009)



Figure 8- Ginseng

TianmaGouteng Fang

The effect of TianmaGouteng Fang (TGF) on amino acid transmitters in the extracellular fluid of the hippocampus has been studied in free-ranging rats that have had partial cerebral ischemia. TGF was discovered to raise the concentration of inhibitory amino acids, limit the overabundance of excitatory amino acid release, and increase the concentration of inhibitory amino acids during ischemia-reperfusion periods in rat hippocampus extracellular liquids. (Kuang P. et al., 1996)

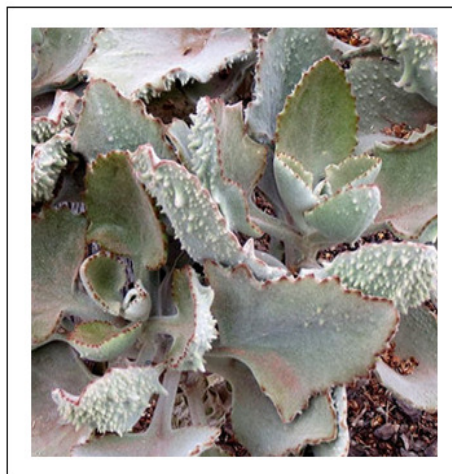


Figure 9- TianmaGouteng Fang

Bacopa Monnieri

This annual creeper, commonly known as Brahmi, can be found in marshy, wet areas throughout India. In ancient Indian literature, it was described as a memory-improving drug. It has also been shown in experiments to enhance learning in both humans and animals. An analysis of the effects of chlorpromazine and alcoholic Brahmi extract on learning was done in one comparison study. In addition to its CNS effects, it has been shown in studies to have antioxidant properties. (Tripathi YB et al.,1996)



Figure 10- Bacopa Monnieri

WithaniaSomnifera

Aswagandha is supposed to help with intelligence and memory in Ayurvedic medicine. Withaniasomnifera has been found in studies to have substantial anxiolytic and depressive qualities, as well as antiaging advantages in aged subjects. Withaniasomnifera also has anti-inflammatory, immunostimulatory, and antioxidant properties. Free radicals play a role in the late-phase inflammatory response that results in delayed cytotoxicity and the pathophysiology of cerebral ischemia. Given the anti-inflammatory and antioxidant properties of the CNS-active plant Withaniasomnifera, it is impossible to rule out the possibility of this plant having stroke potential. (Dhuley JN.1998)



Figure 11- WithaniaSomnifera

Jatamansi

This well-known Ayurvedic medicine is known as jatamansi. It is an erect perinneal herb that grows in the upper Himalayas. Its use in Ayurveda for convulsions, hysteria, leprosy, and epilepsy indicates that it is a CNS active plant. A pharmacological study discovered that alcoholic and hexane extracts of jatamansi prevented the lipid peroxidation caused by FeSO₄. This observation could be attributable to jatamansi's antioxidant phytochemicals. (Y. k. Gupta et al., 2010)

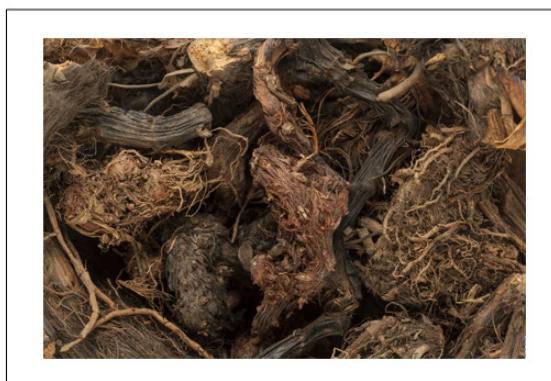


Figure 12- Jatamansi

Shilajit

Shilajit is a pale-brown to blackish-brown fluid that varies in consistency and is discharged from rock layers in many mountain ranges across the world, particularly the Hindukush and Himalayan peaks of the Indian subcontinent. Its complex makeup of organic humic chemicals and plant and microbial metabolites found in its native rock rhizospheres has been uncovered

(Agarwal SP et al., 2007). Many organic acids, including fulvic acid, humic acid, and hippuric acid, are present in it. Benzoic acid traces are also detected. In addition, there is a distinct class of chemicals known as benzopyrones. Tannoids, phenolic lipids, and tirucallane triterpenes have also been identified. (Ghosal S et al., 1976)



Figure 13- Shilajit

TinosporaCordifolia

It is commonly used in botanical preparations in China and India. It also displayed powerful free radical scavenging capabilities against reactive oxygen and nitrogen species by lowering the expression of the iNOS gene, as proven by electron paramagnetic resonance spectroscopy. As a result, TinosporaCordifolia decreases oxidative stress-induced cell damage during Oxygen-Glucose Deprivation (OGD) and scavenges free radicals at the cytosolic and gene expression levels. It may potentially be useful as a treatment for ischemic brain injury. (Rawal A et al., 2004)



Figure 14- TinosporaCordifolia

Table 1-Phytochemical Properties of Medicinal Plants

S. No.	PLANT NAME	GLYCOSIDES	FLAVONOIDS	SAPONIN	TERPENOIDS
1.	Panax Notoginseng (Sanqi)	+	+	+	+
2.	Salvia Miltiorrhiza (Danshen)	+	+	-	-
3.	Rhizoma Chuanxiong (Chuanxiong)	+	+	-	-
4.	Gardenia (Zhizi)	+	+	-	+
5.	Antirhea Borbonica	-	+	+	+
6.	Ginkgo Biloba Leaves	+	+	+	+
7.	Jasminoidin	+	+	+	+
8.	Ginseng / Siberian ginseng	+	+	+	+
9.	Tianma Gouteng Fang	+	+	+	+
10.	Bacopa Monnieri	-	+	+	+
11.	Withania Somnifera	+	+	+	+
12.	Jatamansi	-	+	+	+
13.	Shilajit	-	+	-	+
14.	Tinospora Cordifolia	-	+	+	+

Conclusion

The cerebrovascular illness is very common neurological disease in the world. In this disease most of the patients undergoes through various difficulties like Parkinson's Disease, Alzheimer's Disease. There are many herbal medicines which treat the patients with these diseases. Herbal drugs like Ginkgo Biloba leaves, WithaniaSomnifera, etc treat patients not only for cerebrovascular illness but also for CNS and CCVDs. Nowadays, these herbal drugs are showing highly positive result and are highly used by the patients.

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LIST OF ABBREVIATIONS

S. no.	Abbreviations	Full Form
1	PD	Parkinson's Disease
2	AD	Alzheimer's Disease
3	CVR	Cerebrovascular reactivity
4	CBF	Cerebral Blood Flow
5	CBV	Cerebral Blood Volume
6	SMB	Salvia Miltiorrhiza Bunge
7	JA	Jasminoidin
8	UA	Ursodeoxycholic Acid
9	HFD	High- Fat Diet
10	BBB	Blood Brain Barrier
11	SOD	Superoxide Dismutase
12	CCVDs	Cardiovascular Diseases
13	TCM	Traditional Chinese Medicines
14	GBLs	Gingko Biloba Leaves
15	GSRD	Ginsenoside Rd
16	RSM	Radix salviae miltiorrhizae
17	ASW	Acanthopanax senticosus
18	TGF	Tianma Gouteng Fang
19	CNS	Central Nervous System
20	OGD	Oxygen-Glucose Deprivation

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