



BOTANICAL FAMILY:	Ginkgoaceae
PARTS USED:	Leaf
OTHER COMMON NAMES:	Maidenhair tree, Ginkgoblatter (German), arbe aux quarante ecus/ forty coin tree (French)

OVERVIEW

Ginkgo is a deciduous tree that has survived unchanged since the Triassic period. An individual tree can live for up to 1000 years. These facts led Charles Darwin to name it a living fossil. It may have been saved from extinction by the Chinese who revered it and planted it around their temples.

Constituents	Mono, di and triglycosides of flavonols quercetin, kaemferol and rutin Terpenoids including bilobalide and ginkgolides A, B, C and J Biflavonoids, ginkgolic acids, sterols, procyanidins, polysaccharides
Major Actions	Anti-PAF activity, antioxidant, tissue perfusion enhancing
Other Actions	Circulatory stimulant, nootropic, neuroprotective, anxiolytic, adaptogen
Indications	Peripheral arterial disease, intermittent claudication, atherosclerosis, diabetic vascular disease; Memory and cognitive impairment, dementia; Dizziness, tinnitus, headaches, vertigo, acute cochlear deafness; Reduced cerebral blood flow; Anxiety, depression, chronic schizophrenia (adjunct), fatigue, stress; Glaucoma, macular degeneration; Dysmenorrhoea, premenstrual syndrome; Asthma, allergic reactions
Traditional Use	Ginkgo nuts were used in Traditional Chinese Medicine (TCM) as an anti-asthmatic and against polyuria. The leaves have only been in use since the 1960's, when scientists discovered their effects on circulation
Preparations	Liquid extract 2:1/50% ethanol or tablets
Applications	Practitioners can consider prescribing Ginkgo in the context of: Reduced peripheral blood flow; Impaired cerebral blood flow; Mood disorders; Eye diseases; Reduced tissue perfusion; Supporting healthy cognition and memory; Conditions involving platelet activating factor (PAF), including asthma, allergic responses, ischaemia, thrombosis, migraine headache

SUMMARY OF RESEARCH

Clinical Studies

Dementia	A review of 34 placebo controlled trials concluded that Ginkgo is an efficacious treatment in Vascular Dementia and Alzheimer's Disease. ²
	A meta-analysis found that there is evidence supporting the benefit of high dose Ginkgo extract, at least 240 mg per day for 16 weeks, in Alzheimer's Disease. Benefits were particularly noted in patient's coping with daily tasks. ³
	A 52 week placebo controlled trial investigated the effects of Ginkgo extract 120 mg per day in patients with Vascular Dementia or Alzheimer's Disease. The study found that the ginkgo group had slight improvements in cognitive assessment, daily living and social behaviour, while the placebo group showed significant worsening of all symptoms during the trial. ⁴
	A randomised controlled trial compared the effects of Ginkgo with placebo and with donepezil, a cholinesterase inhibitor in patients with dementia. The study concluded that Ginkgo was significantly more effective than placebo, with a similar efficacy to donepezil in attenuating the progression of dementia. ⁵
	A review article compared the results of a trial on Ginkgo with the results of eight trials on pharmaceutical medications used in the treatment of dementia. The review concluded that Ginkgo appears to have a similar efficacy to these medications in delaying the progression of cognitive impairment in Alzheimer's Disease. ⁶
Ischaemic Stroke	A Cochrane review involving 10 trials and 792 patients concluded that Ginkgo significantly improved functional outcomes in ischaemic stroke patients. ⁷
Peripheral Arterial Disease	A meta-analysis of eight randomised controlled trials found that Ginkgo significantly increased pain-free walking distance in patients with peripheral arterial occlusive disease compared to placebo. ⁸
	In a small randomised controlled trial, patients with Raynaud's disease were given Ginkgo or placebo daily for 12 weeks. At the end of the trial, patients in the herbal group had a significant reduction in the frequency and severity of ischaemic attacks compared to the placebo group. ⁹
Vascular Disorders	In two open observational trials, Ginkgo demonstrated significant anti-atherosclerotic activity, by reducing the formation of nanoplaque and lowering lipoprotein-a, and increasing antioxidant activity. ^{10,11}
Ear Conditions	Several trials have found that Ginkgo is as effective as or is more effective than pharmaceutical medications in the treatment of sudden acute hearing loss. ¹²⁻¹⁵
	A systematic review of five clinical trials concluded that Ginkgo extract is a beneficial treatment for vestibular and non-vestibular vertigo. ¹⁶
	A clinical trial investigated the effects of Ginkgo on dementia patients suffering with dizziness and tinnitus. After 22 weeks, dizziness was significantly improved in 86% of Ginkgo recipients versus 28% in the placebo group. Tinnitus was significantly improved in 84% of Ginkgo recipients versus 20% of placebo recipients. These results were statistically significant. ¹⁷
Eye Conditions	In a randomised controlled trial of 24 patients with reduced retinal blood flow, Ginkgo extract improved blood vessels, visual acuity, field of vision, near and far vision and colour recognition. ¹⁸
	In 2 open trials on diabetic retinopathy, Ginkgo extract daily for three months led to significant improvements in retinal capillary blood flow rate. Mechanisms included reduced lipid peroxidation, reduced clotting factors and red blood cell deformity, and improved blood viscosity. ^{19,20}
Anxiety	A randomised controlled trial investigated the effects of Ginkgo extract versus placebo in patients diagnosed with an anxiety disorder. The trial found a significant reduction in anxiety scores in the herbal group versus placebo after four weeks. ²¹
Schizophrenia	A meta-analysis examined the effects of Ginkgo as an adjunct therapy to standard antipsychotics in 828 patients with chronic schizophrenia. The review concluded that Ginkgo had a statistically significant, moderate therapeutic benefit alongside antipsychotics in chronic schizophrenia, with an acceptable safety profile. ²²
Diabetic Peripheral Neuropathy	Ginkgo supplementation improved peripheral nerve function, enhanced nerve conduction and thermal perception in patients with diabetic peripheral neuropathy in two clinical trials. ^{23,24}

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Asthma	In an uncontrolled study, Ginkgo improved asthma symptoms in adults, some of whom were able to reduce or cease their corticosteroid therapy. It also improved pulmonary function in children with asthma. ²⁵
	In a controlled trial, ginkgo extract significantly reduced airway hyper-reactivity, reduced clinical symptoms and improved pulmonary function in asthmatic patients, compared to placebo. ²⁶
Multiple Sclerosis	A small clinical trial found that Ginkgo improved measures of fatigue, symptom severity and functionality in patients with Multiple Sclerosis. ²⁷ Another small trial found that Ginkgo significantly improved cognitive function in Multiple Sclerosis patients compared with placebo. ²⁸
Premenstrual Syndrome	In two randomised controlled trials, women with premenstrual syndrome (PMS) were given Ginkgo from day 16 to day 5 of the next menstrual cycle. Both studies found that Ginkgo significantly reduced both somatic and psychological symptoms of PMS. ^{29,30}
Cancer	An epidemiology study found that Ginkgo use was associated with a reduced risk of ovarian cancer. ³¹
	In an uncontrolled trial, Ginkgo supplementation improved cognitive function, mood and quality of life in brain cancer survivors who had undergone radiotherapy. ³²
Anti-Aging Effects	An epidemiology study followed 3534 elderly people for 13 years. Participants who took Ginkgo had a significantly lower rate of mortality in this period than non-users, even after adjusting for multiple confounding factors. ³³
Experimental Studies	
Blood Perfusion and Ischaemia	In mice, Ginkgo supplementation provided protection against hypoxia-induced brain damage, and inhibited the breakdown of brain energy metabolism. ³⁴
	A review of experimental studies concluded that Ginkgo provided protective effects against brain ischaemia/reperfusion injury via antioxidant activity, enhanced free radical clearance, inhibition of excitatory neurotransmitters and amino acids, reduction of inflammation, and inhibition of neural apoptosis. ³⁵
	In a randomised controlled trial, Ginkgo was given to healthy middle aged participants, and blood flow to the skin on their extremities was measured. Ginkgo was found to have a modulating effect on haemodynamics, increasing blood flow to the skin in participants with impaired circulation, reducing it in participants with hypercirculation, and having no effect in those with normal circulation. ³⁶ A similar trial found Ginkgo increased forearm blood flow without affecting arterial blood pressure. ³⁶
	An early crossover trial found that Ginkgo significantly decreased erythrocyte aggregation and increased blood flow in nail fold capillaries in healthy volunteers. ³⁷
Anti-PAF Activity	Platelet Activating Factor (PAF) is a phospholipid formed by platelets and white cells. It is a potent platelet-aggregating factor, inflammatory mediator, and anaphylaxis inducer. Ginkgolides potently antagonise PAF and inhibit its activity, with long-lasting effects. ³⁸
	In an <i>in vivo</i> study, ginkgolides partially counteracted PAF-induced bronchoconstriction and airway hyper-reactivity. ^{39,40}
	Both ginkgolides and whole Ginkgo extract have demonstrated strong thrombolytic activity against PAF-induced thrombus <i>in vivo</i> . ^{41,42}
Neuroprotective Effects	A review of experimental studies found that Ginkgo protects against β -amyloid aggregation, attenuates amyloid-induced oxidation, and reduces β -amyloid neurotoxicity <i>in vitro</i> and <i>in vivo</i> . ⁴³
	In an animal model of Alzheimer's Disease, Ginkgo given orally for 16 months significantly lowered amyloid precursor protein levels in the cerebral cortex. ⁴⁴
Antioxidant Activity	Ginkgo shows direct free radical quenching activity, by scavenging reactive oxygen species, hydroxyl and superoxide radicals and peroxy radicals. ⁴⁵ More importantly, it increases the activity of endogenous antioxidants such as catalase and superoxide dismutase, via activation of the Nrf2/ARE pathway. ⁴⁶
	Oral Ginkgo supplementation prevented oxidative stress in the brains of rats exposed to mobile phone radiation for seven days. ⁴⁷

SUMMARY OF RESEARCH

Antioxidant Activity (continued)	Red blood cells collected from healthy volunteers after seven days of Ginkgo supplementation were more resistant to oxidative damage. ⁴⁸
	Ginkgo supplementation decreased markers of oxidative stress in personnel working on the Chernobyl reactor accident. ^{49,50} After 2 months, oxidative stress markers had returned to control levels and remained there for at least 7 months. ⁵⁰
Mitochondrial Function	Enhancement of mitochondrial function is thought to be a key mechanism underlying Ginkgo's effects on Alzheimer's prevention, neuroprotection, cardioprotection, reduction of ischaemic injury and antioxidant activity. ^{51,52} Beneficial effects on mitochondrial function have been observed only in older animals in a number of studies. ⁵³⁻⁵⁵
CNS Effects	<i>In vitro</i> and <i>in vivo</i> studies show that Ginkgo can modulate glutamate and GABA levels in the brain, ⁵⁶ increase extracellular norepinephrine and dopamine levels in the brain ⁵⁷ and improve serotonergic receptor function. ⁵⁸ Additionally, Ginkgo inhibited the degeneration of dopaminergic neurones in Parkinson's models, and ameliorated age-related decline in acetylcholine receptors. ⁵⁸
Anti-Stress and Anxiolytic Effects	Ginkgo showed anxiolytic effects comparable to diazepam in stressed rats. ⁵⁹
	A review of experimental studies found that Ginkgo modulates adrenal activity, reducing circulating levels of epinephrine, norepinephrine and corticosterone in stressed rats. ⁶⁰
	In acutely stressed rats, oral Ginkgo normalised elevated levels of catecholamines, serotonin and corticosterone. ⁶¹
	Ginkgo extract at 120mg per day for 3 months reduced cortisol levels in response to an acute stressor, namely a glucose tolerance test, in healthy volunteers. ⁶⁵
Cognitive Function	A review of animal studies found that Ginkgo can enhance cognitive function and learned responses, enhance short term memory and increase brain neuronal membrane fluidity in a number of models. ⁶⁰ The greatest improvements have been seen in older animals, with longer treatment times. ^{66,67}

SAFETY PROFILE

Drug Interactions	Use cautiously alongside anticoagulant and antiplatelet medications, due to possible additive effects.
	Not recommended alongside anticonvulsants, due to reports of increased seizures with Ginkgo use.
Cautions	Use cautiously in patients with clotting disorders, as Ginkgo may theoretically increase bleeding risk.
Contraindications	Contraindicated in individuals with known sensitivity to Ginkgo.
Adverse Events	Very low risk of blood clotting problems.
Pregnancy	Best avoided in the final month of pregnancy due to possible risk of bleeding during childbirth.
Lactation	No known cautions.
Children (3-12 years)	No known cautions.

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