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COVER STORY

Ginkgo Biloba

A Treasure from the Past

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If you were to pick one single herb for the enhancement of your health, you might want to choose ginkgo biloba. Both ancient healers and today's scientists have found the leaf extract from this unique and ancient tree to have a multitude of beneficial effects on the human body, from memory improvement to regained sexual potency. The brain depends on a steady supply of oxygen and glucose for proper functioning. It uses 20% of all the oxygen taken in through the lungs. Without enough oxygen, brain cells are irreparably damaged. "Cerebral vascular insufficiency," a reduction of blood flow to the brain that is caused by atherosclerosis, is very common in the elderly population in the West. It results in a lack of oxygen and sets off a sequence of harmful chemical changes including free radical production and swelling of the brain tissue (edema). Another consequence is a reduction of the nutrient supply to the cells. Ginkgo biloba has over the last three decades shown that it can help protect us from what we fear most about reaching old age: memory loss, confusion, fatigue and inability to take care of ourselves. These are symptoms associated with restricted blood supply and tissue damage from lack of oxygen and production of free radicals. Ginkgo's three major pharmacological features are of great value in these conditions: improving blood supply by dilating and toning blood vessels; reducing blood-clotting through antagonism of platelet-aggregating factor (PAF); and preventing membrane damage by means of its antioxidant and free radical scavenging activities. In an analysis and critical review of forty clinical studies using ginkgo extract (Kleijnen & Knipschild 1992) for "cerebral insufficiency" or age-related dementia, virtually all trials reported positive results. The methodological quality of the eight most well designed studies was found to be comparable to the best studies on a pharmaceutical drug (Hydergine) widely used for the same indication. In most of these well-designed studies, a daily dose of 120-160 mg of the ginkgo extract was given over a period of four to twelve weeks. Significant improvement compared to the placebo group was observed in typical symptoms such as memory difficulties, confusion, fatigue, anxiety, dizziness, tinnitus and headaches. No serious side effects were reported in any of the assessed 40 trials and the nonserious side effects were no different from those reported in patients treated with placebo. This satisfying fact confirms the conclusion of DeFeudis (1991) in his summary of the ginkgo literature, that there is generally very little risk associated with products containing a properly standardized Ginkgo extract.



Hope for Alzheimer's

In recent studies, progressive degenerative dementia, such as Alzheimer's disease, has been treated with ginkgo extract. The results of these European trials have been so impressive that the German government in 1994 approved ginkgo biloba extract for treatment of dementia. Free radicals are considered to be the reason for the excessive lipid peroxidation and cell damage observed in Alzheimer's disease (Blass, 1993). The main effect of

A Leading Prescription Drug in Europe

So effective is the extract from ginkgo biloba leaves that it has become one of the leading prescription drugs in Europe, accounting for 1% and 4% respectively of all prescriptions in Germany and

ginkgo extract in these conditions appears to be related to its potent antioxidant properties exerted by the synergistic actions of the flavonoids and terpenoids. An excellent U.S. study by LeBars et al., reported in JAMA in 1997, was designed to assess the efficacy and safety of ginkgo extract on Alzheimer's disease and multi-infarcts (vascular) dementia. This 52-week, randomized double-blind, placebo-controlled multicenter study included 202 patients with mild to moderately severe cognitive impairment. The daily dose given was 120 mg. Measures of outcome included the Alzheimer's Disease Assessment Scale-Cognitive subscale (ADAS-Cog), Geriatric Evaluation by Relative's Rating Instrument (GERRI) and Clinical Global Impression of Change (CGIC). Whereas the ginkgo group maintained its cognitive baseline over the year-long study and improved slightly in social functioning, the placebo group worsened over time in both aspects. The conclusion was that ginkgo appears capable of stabilizing and, in

a substantial number of cases, improving the cognitive performance and the social functioning of demented patients. This corresponds to a delay of six months to a year in the progression of the disease. Regarding the safety of ginkgo, there were no significant differences compared with placebo in either the number of patients reporting side effects or in the severity of these effects. A German double-blind placebo-controlled study (Maurer et al., 1997) provides further support. In this study, 20 outpatients aged 50-80 and suffering from mild to moderate dementia of Alzheimer's type were treated with a daily dose of 240 mg of ginkgo extract for three months. The patients' attention and memory performance (measured by SKT test) showed significant improvement after three months of treatment. The extract was well tolerated with no adverse effects. There has been a call for studies that include electroencephalograph (EEG) analysis to more accurately determine the degree of effect. In a pilot study in 1995, Itil and Martorano compared different ginkgo biloba extracts for CNS effects. They used a quantitative EEG method in a double-blind, crossover design on 12 healthy male volunteers, ranging in age from 18-65 years. Only the standardized pharmaceutical extract had a potent alpha-enhancing effect and could be classified as a cognitive activator. Pharmaceutical drugs that are claimed to be effective in the treatment of dementia all produce EEG changes with an increase in alpha wave activity and a decrease in slow waves. These EEG patterns are described as cognitive-activating and vigilance-enhancing profiles. Patients with dementia are known to have a decrease in alpha activity and an increase in slow waves compared with healthy age-matched norms.

Memory boost-even in youth

Interestingly enough there is now scientific support for memory enhancement not only in the aging population, but also in young healthy volunteers. Following just a single dose of 600 mg of ginkgo extract, a significant memory improvement was demonstrated in a randomized, double-blind crossover study (Subhan and Hindmarch, 1984) using Sternberg's memory scanning test. The effect lasted for several hours. Another study on healthy volunteers was just recently conducted by Rigney et al. (1999) to investigate the effects of ginkgo extract on memory and psychomotor function. In this randomized, double-blind and placebo-controlled crossover study 31 volunteers aged 30-59 years were given multiple doses of 50 or 100 mg, a single dose of 120 or 300 mg, or placebo during the day of testing. A psychometric test battery was administered before the first dose and at frequent intervals during the day until 11 hours after the last dose. The results show that the memory-enhancing effect of ginkgo in healthy volunteers were most evident with the 120 mg dose, more apparent in the oldest age group of 50-59 years, and more pronounced for short term memory than for other aspects of cognitive functioning. An interesting "side effect" of chronic ginkgo treatment of rats (Winter, 1998) was the observation that these animals lived significantly longer than the animals that received placebo. (The relevance of behavior studies on rodents in relation to their validity for man has been questioned. The consensus of recent critical reviews, however, is that rodents represent the closest approximation available to human memory!)

A natural antidepressant

Because patients treated with ginkgo extract for cerebral insufficiency often showed general mood improvement, it made sense to take a closer look at the antidepressive effects of ginkgo. Schubert et al. (1993) conducted a study with forty patients aged 51-78 and diagnosed with depression, who had not fully responded to standard antidepressant treatment. They were given either placebo or 80 mg ginkgo extract three times daily. After eight weeks of treatment, the assessment on the Hamilton Depression Scale showed a drop from 14 to 4.5 in the ginkgo-treated group, compared to 14 to 13 in the placebo group. These results suggest that ginkgo may be of significant value as an antidepressant.

France. In Germany alone, where ginkgo is the most prescribed herb, annual retail sales reach 280 million dollars (1993 figures). Ginkgo leaf extract has a remarkably broad spectrum of pharmacological effects, which makes many clinical applications possible. It is most widely prescribed, however, for age-related deterioration of mental function due to insufficient blood flow to the brain, and also used for peripheral vascular disease.



Ginkgo is the oldest tree species in the world, and individual trees can live to 1000 years and beyond. With its 200 million year history, ginkgo is known as a "living fossil." Ginkgo survived the last ice age only in China, from which it was brought to Europe and America in the eighteenth century. Since then the ginkgo tree has been widely planted in the U.S., particularly in large cities due to its hardiness.

Ginkgo has a remarkable resistance not only to time, but also to pollution, insects, fungi and diseases. A powerful demonstration of its hardiness is the fact that ginkgo seeds survived the atomic blast over Hiroshima and later sprouted, the only tree to survive. This tree can still be seen today standing near the epicenter of the blast. Ginkgo can grow 120 feet high and is easily recognizable from its unique fan-shaped leaves with two lobes ("biloba"), growing in clusters from a common stalk.



Peripheral vascular insufficiency

Leg cramps and reduced walking capacity due to atherosclerosis in the arteries of the leg-claudicatio intermittens-occurs in about 3% of the population over age 50. The symptoms are caused by reduced blood flow and oxygen delivery to the muscles, which results in production of free radicals and other toxic metabolites. Ginkgo biloba extract is approved as a drug treatment in Germany for this condition. Several clinical studies have confirmed the effect of long-term (six to twelve months) treatment with ginkgo extract, showing statistically significant improvement of walking performance measured in standardized treadmill exercise (DeFeudis, 1991; Schneider, 1992).

Ginkgo for the heart

Heart attacks being the number one cause of death in this country, there is a need for effective preventative and therapeutic measures. There is a great deal of evidence that oxygen-derived free radicals contribute to the progress of ischemia-reperfusion injury of the heart by inducing an accumulation of lipid peroxidation products. In one in vivo study Ginkgolide B infusion suppressed arrhythmias (irregular heart rhythm) caused by ischemia. The anti-arrhythmic effect of Ginkgolide B was comparable to standard antiarrhythmic drugs (Koltai et al, 1989). Cardiac-protecting mechanisms of Ginkgo extract were demonstrated in several other experimental (animal) studies. Shen et al (1994) and Haramaki et al. (1994) studied the effects of ginkgo on myocardial ischemia followed by reperfusion. Ginkgo treatment significantly inhibited the increase of lipid peroxidation during reperfusion compared to a placebo group. In a study by Akiba et al. (1998) it was demonstrated that ginkgo extract caused a dose-dependent inhibition of platelet aggregation induced by oxidative stress. The authors suggest that this effect is related to ginkgo's protective effect on myocardial as well as cerebral injuries. These results indicate that ginkgo protects the heart by its antioxidant properties as well as by its suppressive effect on platelet aggregation.

Medicinal Use

An ancient Chinese medical text, the Pen T'sau Ching dating to 2,800 B.C., notes ginkgo's ability to benefit the brain and ease breathing difficulties. In traditional Chinese medicine, ginkgo has also been commonly used in heart and peripheral vascular conditions. Since the 1960s, standardized ginkgo leaf extract has been used in research and clinical studies all over the world. Laboratory research and clinical studies over the last three decades have validated the ancient use of the ginkgo tree as a medicinal remedy. Ginkgo biloba extract has demonstrated effectiveness in improving circulation, particularly in the brain. It is a registered drug in Germany where its major therapeutic applications are "cerebral insufficiency," degenerative dementia, such as Alzheimer's disease, neurosensory problems (e.g. ringing ears, dizziness and impaired vision) and peripheral circulatory disturbances (e.g. leg cramps). It has also been found to be useful in a variety of other conditions, such as impotence due to impaired blood circulation, and fluid retention and breast tenderness in premenstrual syndrome (PMS).

Ginkgo is also known to prevent damage from radiation exposure (tested in Chernobyl) and has demonstrated exceptional effectiveness in preventing acute mountain sickness and vascular reactivity to cold exposure and high altitudes (Roncin et al, 1996). Besides being used as a prescription drug in Europe, ginkgo is also sold over the counter in lower dosages and used in the prevention of various symptoms of aging, such as decline of hearing, vision and memory.



Impotence

There are many possible causes of impotence (erectile dysfunction), including emotional stress, fatigue and anxiety. Most cases of chronic (long-term) impotence, however, have an organic origin, including circulatory problems, nerve damage, side effects of medication and hormone imbalance. Some studies indicate that ginkgo biloba extract can be beneficial when the cause is impaired blood flow. A study by Sikora et al. (1989) involved 60 patients with erectile dysfunction, who had not responded to other treatments. After six to eight weeks of treatment with ginkgo biloba extract at 60 mg/day, signs of improved blood supply could be seen. After 6 months of therapy, in spite of the small dose, 50% of the patients had regained potency. No change in systemic blood pressure was observed.

PMS

Interesting results have also been demonstrated in the treatment of premenstrual syndrome (PMS). A total of 165 women aged 18-45 were given 160 mg of ginkgo extract daily or placebo from day 16 of one menstrual cycle to day 5 of the next. Symptoms of fluid retention, particularly breast tenderness, were improved as were psychological parameters (Tamborini et al., 1988).

Ginkgo and the senses-eyes and ears

Senile macular degeneration and diabetic retinopathy are the leading causes of blindness among the elderly in the United States. Experimental studies have found reasons to believe that ginkgo extract might be useful in prevention and treatment of macular degeneration, diabetic retinopathy and glaucoma (Doly et al., 1986; DeFeudis, 1991; Baudouin et al., 1999; Chung et al., 1999), thanks to increased blood flow and free radical scavenging action. The ear, like the eye, is a delicate organ that is sensitive to oxygen deprivation and other injuries. For a certain kind of hearing loss, acute cochlear deafness, ginkgo extract has been effective in restoring hearing (Bascher et al, 1988). The extract has also shown a protective effect against toxic injury from the ototoxic drug gentamicin (Jung et al., 1998). Tinnitus (ringing in the ear) is a common symptom in the elderly population. It is considered a symptom of poor circulation and very difficult to treat. Ginkgo biloba treatment has been successful in cases with recent onset (less than one year) of tinnitus (Meyer et al., 1988).

Future allergy treatment?

Ginkgolides are known to block PAF, which is involved in allergic reactions. This component of the ginkgo biloba extract in its pure form is used as an investigational drug in Europe to determine whether it could be clinically effective in asthma, eczema and allergies.

Mechanisms of action

Improves circulation

A main reason why ginkgo biloba has such a broad variety of effects on the body is that it makes the whole circulatory system more efficient. By improving both the elasticity and the tone of the blood vessels it enhances the blood flow. Ginkgo is unique because it affects all parts of the circulatory system, arteries, veins and capillaries, and is therefore called a trivasoregulator, able to harmonize the total function of the circulation. A healthy circulatory system will provide nutrients including oxygen to all parts of the body and thus improve its function. This is particularly critical in the brain, where the cells are extremely susceptible to a lack of oxygen (hypoxia, cerebral ischemia). In vitro studies (on isolated blood vessels) and in vivo studies (animal studies) are important to obtain basic information on mechanisms of action that cannot be acquired in human clinical studies. Such studies (DeFeudis FV, 1991) have revealed that standardized ginkgo biloba extract:

- Has a spasmolytic (relaxing) action on the arterial wall, which dilates the blood vessels. This vasodilating effect is due to release of endothelium-derived relaxing factor (EDRF).
- Increases capillary perfusion without increasing capillary permeability, thus preventing edema.
- Enhances venous tone and mobility and thus supports the return of the venous blood and helps clear toxic metabolites that accumulate in the tissues when oxygen supply is insufficient.

Ginkgo biloba is truly unique in its capacity to simultaneously reduce vascular spasm in one area and restore tone in another area when needed. This is an extremely beneficial feature that vasodilating drugs lack. Those drugs may sometimes worsen a condition of constricted circulation by dilating mainly the healthy vessels and leaving the constricted vessels with even less blood and oxygen.

Other fundamental mechanisms involved in the therapeutic action of ginkgo extract:

- Antioxidant effects: prevents and reduces free radical damage.
- Inhibition of platelet-activating factor: reduces blood clotting.
- Membrane stabilizing effects: prevents cell damage.
- Inhibition of glucocorticoid synthesis: reduces stress.

Mitochondrial antioxidant

According to the free radical theory of aging, oxygen-derived free radicals are responsible for the age-associated decline in cellular function. Mitochondria have recently been shown to play a key role in cellular aging since these "energy factories" of the cell are major targets for free radical attack. Mitochondrial DNA (mtDNA) is particularly vulnerable and accumulates genetic damage over time. There is abundant experimental evidence that oxidative damage to mtDNA accumulates within both liver and brain mitochondria. Ginkgo biloba extract is a potent antioxidant and scavenger of most free radical species, such as hydroxyl and peroxy radicals and superoxide anions, which is likely to enhance its wide-ranging therapeutic benefits. It is known to protect the energy-producing mitochondria within the cells (Du et al., 1999), thus enhancing oxygen utilization and cellular respiration. The aim of an experimental study by Sastre et al. (1998) was to test whether ginkgo extract could prevent age-associated changes in mitochondria and, if so, to determine whether this effect was due to protection against oxidative stress. In this study, the brain and liver mitochondria of old mice fed Ginkgo extract in their drinking water was compared to those of young and old control mice. The results confirmed that ginkgo prevents age-related changes in mitochondria. Mitochondria from the rats given ginkgo exhibited significantly less genetic damage, peroxide generation and oxidation of the crucial antioxidant glutathione than the untreated old rats. In addition, mitochondria from the old rats given the ginkgo extract resembled those of the young rats much more closely, being similar in size and morphology. The study concluded that standardized ginkgo extract prevents age-related decline in mitochondrial structure and function by protecting mitochondria from oxidative damage. Membrane-stabilizing activities are also important in the prevention of cell damage and aging, as the health and stability of cell membranes are crucial to the function of the cell. The membranes are vulnerable to lipid peroxidation induced by free radicals. Oxygen deprivation produces free radicals that can overwhelm the body's own free radical scavengers, such as superoxide dismutase (SOD) and glutathione peroxidase. This leads to peroxidation and damage of membrane lipids. PAF (platelet-activating factor), which also accumulates in the brain during ischemia, stimulates production of additional free radicals. The reperfusion stage, when blood comes back to the oxygen-deprived area, has been shown to cause even more cell damage due to increased lipid peroxidation.

Preventing brain damage from lack of oxygen

The above-mentioned effects are highly useful in the nervous system. Brain cells are even more susceptible to free radical damage than other cells, because their membranes have a higher content of unsaturated fatty acids (phospholipids) and are particularly vulnerable to peroxidation. Brain cells are also more susceptible to hypoxia (cerebral ischemia) than any other cells. They require large amounts of energy to function, and when blood supply is restricted there is not enough oxygen and glucose for membrane function and energy production. The result is usually a variety of metabolic changes, such as acidosis, electrolyte shifts, free radical production and increased release of free fatty acids, prostaglandins and neurotransmitters. Ginkgo extract has shown a remarkable ability to prevent such metabolic disturbances in experimental studies of insufficient oxygen supply to the brain (DeFeudis 1991, Schaffler et al., 1985). An interesting study on the biochemical events in the rat brain after ischemia (Sief-el-Nasr, 1995) suggests that lack of oxygen alone cannot initiate peroxidation. This process requires restoration of oxygen supply. It is therefore concluded that the more severe brain damage happens during the reperfusion phase (restoration of circulation) after ischemia. It was shown that administration of ginkgo extract before the ischemic injury prevented reduction of SOD activity and reduced lipid peroxide contents of the mitochondria in the rat brain. This was a clear indicator of the extract's protective effect against post-ischemic injury due to free radical production.



Additional neuroprotective actions

A condition common to many chronic and acute neurological disorders is excitotoxicity-oversensitivity of neurons to the excitatory neurotransmitter glutamate. A series of laboratory experiments (Kobayashi et al., 2000; Zhu et al., 1997; Oyama et al., 1993) suggests that Ginkgo extract can protect neurons from excitotoxicity, preventing glutamate-induced calcium influx leading to cell death. A recent study in mice (Wu et al., 1999) showed the protective effect of ginkgo extract on mice injected with a neurotoxin known as MPTP. This neurotoxin brings about a close approximation of Parkinson's disease in humans, monkeys and mice. When the mice were pretreated with Ginkgo, the neurotoxicity of MPTP was prevented in a dose-dependent manner. MPTP selectively damages the dopamine system in the nigrostriatal region affected by Parkinson's disease. When the mice were treated with ginkgo extract after exposure to the toxin, dopamine levels recovered more rapidly. Other studies have shown that ginkgo improves dopamine uptake under conditions of oxidative stress. Brain metabolism generates hydrogen peroxide, a cytotoxic agent that generates oxidative stress in the brain, contributes to cerebral injury and edema following ischemia, and causes programmed cell death (apoptosis) in cortical neurons (nerve cells). Hydrogen peroxide damages DNA and oxidizes lipids and proteins through reactions that have not been entirely clarified but are thought to involve iron and copper ions. Interesting studies by Oyama et al. (1996) and Ni et al. (1996) demonstrated that ginkgo extract is able to protect neurons from oxidative stress induced by hydrogen

peroxide. When neurons were treated with ginkgo extract for one hour before adding hydrogen peroxide, it was highly effective in protecting nerve cells from damage and death. A new study (Wei et al., 1999) suggests that hydrogen peroxide activates nuclear factor kappa beta in bovine endothelial cells, thus contributing to atherosclerosis-and demonstrates that ginkgo extract blocks this activation.

Preventing blood clotting

Another interesting action of ginkgo extract is its inhibition of platelet aggregation and adhesion, which may reduce the risk for thrombus formation. This effect is at least partly exerted by the Ginkgolide terpenes in the extract, which have been shown to be potent inhibitors of platelet-activating factor (PAF). Platelet-activating factor is known to be involved in many inflammatory and allergic processes including bronchial constriction, besides being an activator of platelet aggregation and release of inflammatory components.

What makes ginkgo so effective?

Ginkgo leaf extract is a complex mixture containing substances with several active components: flavone glycosides (flavonoids with attached sugar molecules unique to ginkgo), terpenes (Ginkgolides and bilobalides), and organic acids. Flavonoids are a group of substances common in the plant kingdom, occurring as pigments in flowers and fruits. They have a wide range of biochemical functions as antioxidants, free radical scavengers, enzyme inhibitors, enzyme inducers and more. Flavonoids are known to make vitamin C more effective, to increase the strength of capillary walls, and to improve microcirculation. The three major flavonoids in ginkgo are quercetin, kaempferol and isorhamnetine. In addition there are some proanthocyanidins, which also can be found in grape seed, pine bark and bilberry extract. The bilobalides and Ginkgolides have not been found in any other plants. Their unique molecular structure was discovered by the Japanese chemist Nakanishi in 1966, and it has so far been impossible to synthesize them in the lab. The range of their biochemical actions include anti-aggregatory blood platelet activity and reduction of blood viscosity.



The stress antidote

Imagine the potential in our modern world for a compound that reduces the negative effects of stress on the body with no side effects. Ginkgo biloba shows great promise in this direction.

Stress give rise to stress hormones that are both good and bad for us. They are essential for adaptation to acute physical stressors-as in fight or flight situations (Chrousos et al., 1992; Munck et al., 1994). In our mental and emotional stress situations today, however, we usually do not have much use for these hormones. They therefore accumulate in the body and give rise to disease through their immunosuppressive and neurotoxic effects. One of the detrimental effects of glucocorticoid excess is its ability to damage the hippocampus area of the brain. This part is a structure in the limbic system that is critical to cognitive functions such as learning and memory. Recent behavioral studies on rats and mice (whose response patterns are very similar to humans) demonstrated that repeated oral administration of ginkgo extract had significant anti-stress effects, determined in several kinds of stress tests (Porsolt et al., 1990; Rodriguez de Turco et al., 1993; Rapin et al., 1994). Amri et al. (1996) demonstrated that

there is a dose-dependent effect of ginkgo biloba extract on serum glucocorticoid levels. Also Ginkgolide A and B reduced the corticosteroid levels, which as expected resulted in increased ACTH secretion from the pituitary gland. Treatment with the full extract, however, did not affect ACTH levels, which again demonstrated that the full extract has different and more beneficial effects than its single components, in this case protecting against the negative effects of high ACTH levels. The molecular target for the extracts was identified as the mitochondrial "peripheral-type benzodiazepine receptor" (PBR), known to have a key role in the production of steroids. The fact that ginkgo extract can be pharmacologically used to regulate the synthesis of glucocorticosteroids appears to be a very interesting discovery. In a follow up study by Amri et al. (1997) it was demonstrated that treatment with ginkgo extract decreased serum corticosteroid levels by 50%. The remaining 50% may be the normal level in conditions without stress. This theory is supported by the fact that no detrimental effects on either animal or human health have been observed. The results indicate that ginkgo does not affect the basal adrenal function but controls the stress-induced excess of corticosteroid levels. In vivo findings that ginkgo extract can enhance adaptation under stressful conditions supports its extensive use in the elderly to improve their capacity to cope with the demands of everyday living (Wesnes et al., 1987).



Side effects and toxicity

In most of the studies conducted any adverse effects reported have been no more severe or frequent than from placebo. Gastrointestinal irritation and headache are among the rarely observed side effects. A few cases of bleeding complications,

however, have been reported with ginkgo biloba use. As the extract may interact with blood-thinning drugs, it should only be used in cooperation with a physician when under such medication. Ginkgolic acid and related alkylphenols are major components of the fruit pods of the ginkgo tree, and they can also be found in small amounts in the leaves. These substances most likely contribute to the remarkable resistance of the ginkgo tree to various damaging environmental influences. However, they can also cause an allergic skin reaction, which is why great care is taken to guarantee their removal from the medicinal extract. The German Commission E has established a limit value of 5 ppm as a maximal concentration of Ginkgolic acids in the leaf extract (Jaggy et al., 1997). Although most preparations now on the market fulfil this requirement, it might be wise to check your product in this regard. Those who are concerned about this issue should consider a preparation with an even lower level of the undesired Ginkgolic acids, 1 ppm or less, now available in the U.S.

Dosage

The most commonly used dosages in the clinical trials are 120-240 mg daily. Short term treatment with single doses of 120 mg has shown immediate memory-enhancing effect in healthy volunteers. Normally, however, a treatment period of four to six weeks is needed to see results, sometimes even longer.

Prevention is key

Ginkgo biloba is truly a treasure from the past, a nature's gift that has survived millennia to bring us health and healing in our older days. Hundreds of scientific studies have confirmed its beneficial effects on the human body. There are still many unexplored areas where the ginkgo leaf extract is likely to bring healing, due to its known mechanisms of action. We have much to gain from using ginkgo biloba extract as a preventative measure to help maintain neurological and circulatory health in old age.

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