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Abstract
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DESIGN: Retrospective literature review.

METHODS: Studies and information found in published journals, reference texts, and selected websites were researched to find commonly cited CAM supplements used in the prevention and treatment of cataracts, glaucoma, age-related macular degeneration (ARMD), diabetic retinopathy (DR), and common "red eye" conditions. The literature was concisely reviewed to extract indication of use, mechanism of action, condition specific dosages, the recommended dietary allowance (RDA) if available, drug interactions, and absolute contraindications for each CAM supplement.

RESULTS: Available evidence of CAM use for the ocular conditions described is variable. Therefore, "gold standard" routine CAM treatments for most of the specific ocular conditions described do not exist. Information and recommendations provided herein are simply a compilation of the literature, and are in no way supported or refuted by the authors.

CONCLUSION: The use of CAM therapies in the United States is a multi-billion dollar industry. It is the aim of this review to equip eye care providers with essential knowledge of the common vitamins, minerals, and herbs used for eye disease to properly counsel patients in making appropriate and safe choices.

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REVIEW OF COMPLIMENTARY THERAPIES FOR COMMON OCULAR DISORDERS

By

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A thesis submitted to the faculty of the
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Abstract

PURPOSE: To inform eye care providers of the complimentary and alternative medical (CAM) supplements used by patients for the prevention and treatment of common ocular conditions.

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Introduction

Complementary and alternative medicine (CAM) is a group of diverse medical and health care systems, practices, and products that are not presently considered part of conventional medicine. As defined by the National Center for Complementary and Alternative Medicine (NCCAM), complementary medicine is that used together with conventional medicine whereas alternative medicine is used in place of conventional medicine. The NCCAM classifies CAM therapies into the following categories: alternative medical systems, mind-body interventions, manipulative and body-based methods, energy therapies, and biologically based therapies. The CAM therapies investigated herein are biologically based and include substances found in nature, such as food, herbs, and vitamins.

In recent years, there has been a tremendous growth in the use of vitamin and herbal supplements by consumers. Between the years 1990 and 1997, Eisenberg et al documented increased CAM use among the United States population from 34% to 42%, with nearly a four-fold rise in herbal remedy use during that time period. In a follow-up study performed by Tindle et al, it was found that an estimated 72 million U.S. adults use CAM therapies.

As a result of such increased popularity, allopathic medicine has turned attention to the scientific investigation of CAM. In the fiscal year 2004, the National Institutes of Health (NIH) allocated over 116 million dollars for the study of alternative medicine at the NCCAM. So far, the majority of research has been performed in the fields of internal medicine and family practice evaluating potential risks, benefits, side effects, and interactions of related CAM therapies. However, little has been done to evaluate CAM use in the ophthalmic community.

Patients cite various reasons for their consideration and use of CAM remedies. Reasons include use of CAM as an adjunct to traditional medical treatments, use of CAM as a complete
replacement for traditional medical treatments, and belief that natural products are “better.”

While little or no scientific evidence exists regarding most CAM therapies, some use of dietary supplements has been incorporated into modern conventional medicine. Our purpose was to review the literature and collect information to ultimately inform eye care providers of commonly cited CAM supplements used by patients in the prevention and treatment of cataracts, glaucoma, age-related macular degeneration (ARMD), diabetic retinopathy (DR), and common “red eye” conditions.

**CATARACT**

Cataracts are opacities found within the crystalline lens. They are the leading cause of blindness worldwide. According to the World Health Organization, age related cataracts are responsible for 48% of blindness in the world. In the 2000 U.S Census, an estimated 20,476,040 cases of cataracts have occurred in individuals aged 40 and older. Although modern cataract surgery is a greatly successful procedure, it imposes a significant financial burden on society. Amongst U.S. Medicare recipients, cataract surgery has become the largest single item expenditure. Therefore, the delay of cataracts is an important goal not only for the patient, but also as a public health consideration.

**Prevention and Treatment:** Age is the major risk factor for cataract development. However, loss of lenticular transparency is also caused by trauma, medications, ocular inflammations, and congenital opacities. Much of the damage described is a result of accumulated oxidative damage to lens proteins. It is believed that certain dietary supplements, including vitamins and minerals, are involved in protection against oxidative stress, hence slowing cataract
progression. Common CAM supplements used by patients to delay cataract progression include bilberry, lutein/zeaxanthin, cineraria, conium, zinc and vitamins A, C and E.

- **Bilberry** became popular after World War II British pilots noticed that eating bilberry before nightly bombing raids improved their night vision, visual acuity, and ability to adjust to glare. Investigations since have demonstrated that bilberry contains more than 15 different anthocyanosides which are important for the treatment of many eye disorders, including cataracts. Anthocyanosides are botanical relatives of blueberries, cranberries, and huckleberries. They are known for their ability to stabilize collagen, rebuild capillaries, inhibit platelet aggregation, reduce hyperglycemia, relax smooth muscle, and increase gastric mucus. In the eye, it improves the delivery of oxygen and blood to different tissues and acts as a powerful antioxidant, both of which are necessary for the prevention of eye disorders, including cataracts. A recent study demonstrated that 25% bilberry extract was proven effective in the prevention of cataract in rats. Bilberry is possibly unsafe when used in high doses or for extended periods of time. Death has been reported to occur with chronic use of 1.5g/kg/day.

- **Lutein** and **zeaxanthin** are oxygenated carotenoids, known as xanthophylls, which form the macular pigment. They are the only carotenoids found within the human lens, however, at much lower concentrations than in the macula. Recent epidemiological studies have associated high levels of dietary lutein intake with reduced risk of developing cataracts. The Wisconsin Beaver Dam Eye Study demonstrated an association between lutein intake and lower risk for nuclear sclerosis development in younger patients. Additionally, the Health Professionals Study and Nurses Health Study demonstrated decreased risk of cataract extraction with use of zeaxanthin and lutein. For
the reduction of cataracts, 6mg of lutein per day, either through diet or supplementation has been suggested.\textsuperscript{16} According to recent studies, those who consume 6.9-11.7mg of lutein daily through diet had the lowest risk of developing cataracts.\textsuperscript{16,19,20} Commercial products containing 6-20mg of lutein are available. Additionally, Centrum and Centrum Silver only contain 0.25 mg of lutein per tablet.\textsuperscript{16}

- **Selenium** is a trace mineral that comprises an important part of the antioxidant enzyme glutathione peroxidase.\textsuperscript{21,22} In the human lens, selenium-dependent glutathione peroxidase is responsible for the breakdown of hydrogen peroxide. In excess, hydrogen peroxide is associated with lipid peroxidation and altered lens permeability. This ultimately leaves the lens unprotected against free radical damage and causes cataract formation.\textsuperscript{21,23} In a recent study, the selenium levels of serum and aqueous humor were found to be significantly lower in cataract patients.\textsuperscript{18} Additionally, hydrogen peroxide in the aqueous humor was found in excess, up to 25 times the normal levels. Although this study suggests a link between selenium and reduced cataract formation, there is insufficient evidence to support the inclusion of selenium supplements to one's dietary intake. In patients with cataracts, the recommended dosage is 200-400mcg daily.\textsuperscript{21,22} The RDA for selenium is 55mcg daily.\textsuperscript{24}

- **Similasan Cataract Care**\textsuperscript{TM} eye drops are marketed to those patients who have been diagnosed with cataracts which are not advanced enough for surgical removal.\textsuperscript{25} According to the manufacturer, using the drop on a regular basis, consumers are expected to experience temporary relief of symptoms associated with cataracts such as cloudy/blurry vision, glare and halos around light, and gray or faded colors. The homeopathic active ingredients in the drop include: cineraria maritime 6x, conium
maculatum 6x, and phosphorus 12x. These ingredients undergo a process of serial
dilution prior to inclusion in the product. The dilution level of each component is
represented by an “x.” For example, an ingredient diluted to the level of 6x, contains only
0.0000001% of the active ingredient, just enough to trigger an immune response. Because
the active ingredients are very dilute, this drop is promoted to be safe for all ages without
known side effects. No studies have been performed to date on Similasan Cataract
Care™ to prove efficacy of the drop.

- **Cineraria maritime**, also known as silver ragwort, is an evergreen shrub. The
  juice from the whole plant is used in the treatment of a variety of eye problems,
  including cataracts. When applied to the eyes, it has a mildly irritating effect that
  increases blood flow and immune response to the area, helping to strengthen
  resistance and eliminate infection. Cineraria should not be ingested internally, as
  it contains tannins and pyrrolizidine alkaloids which are highly toxic to the liver.
  Consumers are advised to use the fresh juice only under the supervision of a
  health care professional.

- **Conium maculatum** is a biennial flowering plant more commonly known as
  hemlock. Only the leaves and seeds of the plant are used for medicinal
  purposes. In extremely small quantities, conium works as a sedative and
  analgesic. In larger doses, it has caused paralysis and death, and thus is rarely
  used today. Because this treatment can be deadly when used at the wrong dosage,
  it is suggested to be used topically and only under professional supervision. In
  some countries, use of this medication is subject to legal restrictions.
- **Phosphorus** is the second most abundant mineral in the body next to calcium, comprising about 1% of the total body weight.\(^{21}\) Important to the prevention of cataracts, phosphorus plays a role in maintaining the body’s pH as well as for growth and repair of all tissues and cells in the body. Phosphorus is not to be used in individuals with renal dysfunction.

- **Vitamin B2**, riboflavin, is required by the body to use oxygen and metabolize amino acids, fatty acids, and carbohydrates.\(^{23}\) In the eye, riboflavin is necessary for the regeneration of active glutathione in the lens and hence the prevention of cataract formation. In the Lens Opacities Case Control and Blue Mountains Eye Studies (BMES), higher intake of riboflavin was associated with reduced prevalence of nuclear cataract formation.\(^{5,28,29}\) Additionally, in two recent studies an inverse association between riboflavin and presence of age-related nuclear lens opacities was observed.\(^{29,30}\)

Riboflavin deficiency is common in the geriatric population as 33% of people over age 65 show evidence of low levels of riboflavin.\(^{31}\) Caution is advised in treating deficient persons with cataracts, as riboflavin is a photosensitizing substance (reacts with sunlight to produce free radicals) and excess amounts can lead to further cataract formation. Therefore, no more than 10 mg per day is recommended in patients with cataracts. The RDA for vitamin B2 is 1.3mg daily for adult males and 1.1mg daily for adult females.\(^{24}\)

- **Vitamin C** is a water-soluble vitamin which cannot be manufactured by humans, and thus must be supplemented in one’s diet.\(^{22}\) It is involved with various oxidation-reduction reactions, energy production, tyrosine metabolism, the reduction and storage of iron, and activation of folic acid. It works as the body’s first line of defense against invading pathogens alongside vitamin E and carotenoids, as well as the antioxidant
enzymes, glutathione peroxidase, superoxide dismutase, and catalase. The antioxidant property of vitamin C proves valuable to cataract patients, as it prevents damage to lenticular fibers caused by unchecked free radicals.

Several studies have been conducted over the years to examine the effects of various antioxidants on cataract development and progression. The Second National Health and Nutrition Examination Survey (NHANES II) and Nurses Study demonstrated positive effects of vitamin C on cataract development and progression. Others, including the BMES, Beaver Dam Eye Study (BDES), and Physicians Health Study indicated no association between vitamin C supplementation and cataract development and/or progression. The range of safe vitamin C intake is broad, as studies have shown that dosages exceeding 10g for extended periods of time are usually well tolerated, but may cause gastrointestinal disturbances. Vitamin C is considered a non-toxic vitamin, as excess is excreted by the body. The RDA is 60 mg/day, but physical stresses warrant increased supplementation.

- **Vitamin E** is the body’s primary fat-soluble antioxidant. It protects cells from free-radical damage prolonging cell life and slowing the aging process. Several studies have been conducted to investigate the efficacy of vitamin E supplementation in preventing or delaying cataract formation with mixed results. The Nutritional Factors in Eye Disease Study and Kuopia Atherosclerosis Prevention Study indicated increased risk of cataracts with supplementation. Studies in favor of vitamin E supplementation include the Longitudinal Study of Cataract, the Baltimore Longitudinal Study on Aging, and the Lens Opacities Case Control study. The studies in support of supplementation recommend a dose between 400-800IU daily. The RDA for vitamin E is 30IU daily.
GLAUCOMA –

Glaucoma is a multifactorial disease characterized by a slow, progressive loss of retinal optic nerve fibers, ultimately leading to vision loss.\textsuperscript{112} Glaucoma has been shown to be the second leading cause of blindness in the United States.\textsuperscript{32} In 2000, there were 2.47 million people in the U.S. estimated to have primary open angle glaucoma (POAG).\textsuperscript{33} By the year 2020, it is estimated that 3.6 million people will have POAG due to an aging U.S. population.\textsuperscript{34}

In a study of 1,027 patients from two urban glaucoma practices, it was found that 5.4% reported use of CAM and only 40-50\% of these patients discussed their CAM therapy with a physician.\textsuperscript{35} The most common CAM methods reported in this study were megavitamin therapy (62.9\%) and herbal therapy (57.4\%). Supplements frequently used for the prevention and treatment of glaucoma include bilberry, gingko biloba, magnesium, omega-3 fatty acids, and vitamin C.

**Prevention and Treatment:** The exact mechanism behind vision loss in glaucoma is still not fully understood. Both conventional and naturopathic treatment options are targeted at treating one or more of the following theories. The *mechanical theory* states that increased intraocular pressure (IOP) causes nerve fiber axon death.\textsuperscript{36-38} This increased eye pressure is thought to either directly damage nerve fibers and/or damage capillaries around the optic nerve. The damage leads to insufficient blood flow which then causes nerve cell death, enlargement of the optic cup, and eventual vision loss.\textsuperscript{37} The *vascular theory* proposes that inadequate blood flow to the retinal nerve fibers causes nerve fiber axon death. The reduced blood supply is thought to be due to poor perfusion or obstructed vessels.\textsuperscript{36-38} *Apoptosis* is another theory which
hypothesizes cell death based on elevated glutamate found in the vitreous of some glaucoma patients. High levels of glutamate causes ganglion cells to increase their intracellular calcium to toxic levels, initiating cell death.\textsuperscript{38,40}

- **Bilberry**, also known as huckleberry, is a popular bioflavonoid used for treating glaucoma.\textsuperscript{23,31,37,38,41,43} Bioflavonoids all contain anthocyanosides, which are thought to aid in collagen metabolism by stabilizing free radical damage, therefore improving capillary wall strength.\textsuperscript{23,31,37,41,44} This hypothesis indicates that the vascular theory is the aim of treatment with the bioflavonoids. It has been reported that they are useful in preventing damage to the optic nerve and in maintaining a stable IOP.\textsuperscript{41,44} The recommended dosage is 80mg three times a day, or 100mg 1-2 times daily, with 25% anthocyanoside content.\textsuperscript{23,31,37,38,45} Bilberry is possibly unsafe when used in high doses or for extended periods of time. Death has been reported to occur with chronic use of 1.5g/kg/day.\textsuperscript{16}

- **Cannabis sativa**, commonly known as marijuana, is cultivated from the leaves, stems, and flowering tops of the hemp plant.\textsuperscript{46} Its description dates back to a Chinese medical compendium from 2737 BC. Marijuana has been used since ancient times for achieving euphoria. Today, it is the most widely used substance in the world, only after caffeine, nicotine, and alcohol. The primary active component in marijuana is delta-9-tetrahydrocannabinol (THC). THC binds to nerve cell receptors, and results in feelings of well-being when used in small doses. High doses of THC can cause tachycardia, paranoia, and delusions.

THC has been found to lower IOP in animals and humans.\textsuperscript{47-51} While the mechanism by which marijuana decreases IOP remains unclear, it is thought to work primarily by
increasing uveal outflow. However, other sources propose a decrease in aqueous outflow as well. Although cannabinoids have been shown to significantly lower IOP, sources find that the systemic side effects and toxicological profile of the drug make its use in glaucoma patients unjustifiable. Specific dosage for the treatment of glaucoma was not found in the literature as it is not a widely accepted treatment.

**Gingko biloba**, often called “the living fossil,” is the world’s oldest tree species dating back over 200 million years. This popular herbal supplement has been used medicinally for thousands of years. In the context of CAM, gingko refers to the leaf extract. This is different from the ginkgo seed or fruit, which are toxic if consumed directly. Gingko exerts a variety of effects in the body, including vasodilation, antiplatelet activity, membrane-stabilizing effects, and antioxidant properties.

*Gingko biloba* is the most widely recommended and supported herbal supplement for the treatment of glaucoma. Chung et al found that as a vasodilator, gingko improves blood flow to the ophthalmic artery. This property addresses the vascular theory of glaucomatous damage, which postulates a lack of proper circulation to the optic nerve causing nerve fiber loss. Gingko has also been found to have a positive effect on improving visual field damage in patients with normal tension glaucoma.

Gingko is also thought to possibly provide neuroprotective activity and addresses the apoptosis theory of glaucomatous damage. Glutamate is a neurotoxic compound and its release is indirectly inhibited by gingko. The herb thins blood by inhibiting platelet-activating factor (PAF). PAF has been shown to enhance glutamate release from the
retina. Therefore, inhibition of PAF provides neuroprotection of the retina by decreasing the release of glutamate.

The recommended dosage for glaucoma patients is 40-80mg three times a day, of an extract containing 24-27% flavonglycosides.\textsuperscript{23,31,43} Due to its mild blood thinning properties, caution is advised when used with other anti-coagulant medications such as warfarin and aspirin.\textsuperscript{16}

- **Magnesium** is a mineral necessary for many aspects of human metabolism acting as a cofactor of over 300 enzymatic reactions.\textsuperscript{43} It is the most recommended mineral supplement in the prevention and treatment of glaucoma.\textsuperscript{23,31,37,38,41,44} According to the naturopathic community, it has been found that patients with high IOP are also more likely to have increased blood pressure.\textsuperscript{37} As a natural calcium channel blocker, magnesium decreases blood pressure by dilating and relaxing blood vessels. By treating high blood pressure and vasospasms with magnesium, it is thought to contribute to a lower IOP. One study reported decreased vasospasm which improved peripheral circulation and visual field results in glaucoma patients.\textsuperscript{37,57} In this study, visual field improvement was shown in 80% of patients after one month of treatment with 121.5mg magnesium twice daily. Additionally, it appeared to work best on patients with less severe optic nerve damage.\textsuperscript{57} The recommended dosage for glaucoma patients is 200-600mg daily.\textsuperscript{23,31,37,38,43} The RDA for magnesium is 420mg daily for adult males and 320mg daily for adult females.\textsuperscript{24}

- **Omega-3 oil** is a supplement to aid in the prevention and treatment of vision loss in glaucoma patients by addressing the vascular theory of glaucomatous damage.\textsuperscript{23,31,37,38} This oil is reported to prevent blood vessel leakage by maintaining healthy cell
membranes. It also improves circulation by smoothing blood vessel lining and thinning the blood.\textsuperscript{37}

Omega-3 oils are components of various supplements and each have their own recommendations. For glaucoma, it was most often recommended that 1-2 tablespoons of flaxseed be taken daily.\textsuperscript{23,31,43} If fish oil supplementation is preferred, 500mg daily is the recommended dose.\textsuperscript{37} Due to possible anti-platelet activity, caution is advised for patients taking anti-coagulants or who have active bleeding conditions.\textsuperscript{16,37,43} Flaxseed can also lower blood glucose levels and might increase the risk of hypoglycemia when used with antidiabetes medications.\textsuperscript{16}

- **Vitamin C** has a wide variety of beneficial uses such as boosting immune function, promoting wound healing, and decreasing allergic reactions.\textsuperscript{16,43} It is a useful complimentary supplement for the prevention and treatment of glaucoma mainly due to its pressure-reducing osmotic effect.\textsuperscript{23,31,37,38,41,44,58} One small, uncontrolled, unblind study by Boyd, addressed this property of ascorbic acid, showing a mean IOP decrease of 10.0 mmHg in 30 patients using an average dose of 10g daily.\textsuperscript{59}

Oxidative stress may be a factor in glaucoma due to a demonstrated decline in natural antioxidants within the human trabecular meshwork with increasing age.\textsuperscript{60} Therefore, maintaining appropriate levels of ascorbic acid is thought to aid in achieving optimal collagen integrity.\textsuperscript{23,31} There is debate as to how much vitamin C is actually useful to our bodies. Sources have reported intake from 500mg to over 5,000mg per day up to bowel tolerance.\textsuperscript{23,31,37,38,41} The RDA for vitamin C is 90mg daily for adult males and 75mg daily for adult females.\textsuperscript{24}
AGE-RELATED MACULAR DEGENERATION (ARMD) –

ARMD is a chronic degenerative disease affecting the retinal pigment epithelium (RPE) and Bruch’s membrane, resulting in damage to photoreceptor cells of the macula. Non-exudative (dry) ARMD is characterized by the formation of drusen, followed by mottled pigment surrounding the drusen as the disease progresses. Exudative (wet) ARMD occurs when leakage of fluid causes an RPE or neurosensory retinal detachment, or when there is leakage of fluid and blood from choroidal neovascularization. The wet form occurs in about 10% of all ARMD cases. Both forms can eventually progress to severe loss of central vision. ARMD is the leading cause of blindness in the Western World among those aged 65 years and older. The total number of individuals with ARMD is 1.75 million in the U.S. alone, and is projected to increase to 2.95 million by the year 2020.

Prevention and Treatment: Macular degeneration is thought to be primarily caused by oxidative damage to the RPE. Therefore, antioxidant supplementation is one of the targeted areas of prevention and treatment of ARMD. Because of the elevated prevalence of ARMD, and the popularity of CAM, there have been multiple large, randomized controlled trials to investigate the effect of nutritional supplements on ARMD progression. The study which upholds the standard of care for ARMD today is the Age-Related Eye Disease Study (AREDS). The most commonly recommended supplements for ARMD are bilberry, gingko biloba, lutein, vitamins A, C and E, and zinc. Some common pre-formulated combinations of these supplements include, Ocuvite PreserVision and Ocuvite Lutein (Bausch & Lomb), ICaps (Alcon), Eyebright (Rosemary’s, Solgar, Nutricia, and more), Macuvite (Springfield), Ocuguard Plus (Twinlab), and Visi Vite (Vitamin Science).
• **Bilberry** is a popular herb in the bioflavonoid group with beneficial effects for the treatment and prevention of ARMD.\textsuperscript{16,23,31,37,38,41,42,43} The active pharmacological benefit is said to be related to its anthocyanoside content.\textsuperscript{23,31} Anthocyanosides are potent antioxidant and free radical scavengers, which are thought to be bilberry’s primary mechanism against damage in ARMD.\textsuperscript{17,23,31} Anthocyanosides are also believed to promote circulation to the retina.\textsuperscript{37} There have been no large-scale studies on humans to confirm the treatment effect of bilberry on ARMD. A study on rats with early macular degeneration found that bilberry supplementation completely prevented further macular damage.\textsuperscript{17} For prevention and treatment of ARMD, it is recommended to use an extract of 25% acanthosides at a dose of 40-160mg two to three times daily. If fresh berries are preferred, the recommended dose is 55-115g three times daily.\textsuperscript{16,23,31,38,43}

• **Gingko biloba** exerts a variety of effects in the body, including vasodilation, anti-platelet activity, membrane-stabilizing effects, and antioxidant properties.\textsuperscript{23} The positive effects for ARMD are thought to be due primarily to its antioxidant properties as well as increased blood flow and oxygenation to the macula.\textsuperscript{69-71} A small trial study compared the use of 80mg gingko twice daily versus a placebo over a six-month period.\textsuperscript{72} Results indicated a statistically significant improvement in vision for ARMD patients. The recommended dosage of *ginkgo biloba* for ARMD is 40-80mg two to three times daily.\textsuperscript{23,54,43,72} The most standard extract form is EGb 761 which contains approximately 24% ginkgo flavonglycosides.

• **Lutein/Zeaxanthin** are dietary carotenoids which compose the macular pigment.\textsuperscript{73} Because macular pigment is entirely dietary in origin, its density can be changed by supplementing with different amounts of lutein and zeaxanthin.\textsuperscript{74-76} These carotenoids
have been shown to reduce blue light incident on photoreceptors in the fovea by approximately 40%, which is thought to limit oxidative damage.73,77,78 One study found that declining macular pigment with age may be associated with an increased risk for ARMD.79

The Lutein Antioxidant Supplementation Trial (LAST) included ninety, mostly male veterans, with atrophic ARMD.80 The study found a statistically significant treatment effect in those that took 10mg lutein and 10mg lutein with additional antioxidants. The latter group demonstrated added improvement with contrast sensitivity. The Eye Disease Case Control Study (EDCC) found that high dietary intake of carotenoids provided a 43% risk reduction for ARMD progression after adjusting for other risk-factors.81 Lutein and zeaxanthin were found to be the most beneficial carotenoids. The recommended dosage of lutein for ARMD patients is 10mg daily. If preferred, five servings of dark green leafy vegetables daily are recommended to reduce the risk of advancing ARMD.38,80,81

- Vitamin A, also called retinol, was the first fat-soluble vitamin to be isolated.43 It is derived either from animal foods and byproducts or from beta-carotene. Beta-carotene is a pigment that occurs in leafy green vegetables and in yellow fruits and vegetables. Vitamin A is essential to vision because it is required for the photochemical processes that regenerate rhodopsin. It has also been found to work closely with vitamin E and helps to prevent vitamin E deficiency.82 Vitamin A has also been reported to assist in the repair of cells that have been damaged by oxidation.83 Although vitamin A itself is not widely recognized as an antioxidant, its precursor beta-carotene is.46,84,85
The Beaver Dam Eye Study (BDES) showed a weak inverse relationship between past consumption of pro-vitamin A carotenoids and early ARMD. The study also found a significant inverse relationship between pro-vitamin A carotenoids and the presence of large drusen, which could not be attributed specifically to vitamin A. All other studies that found benefit with the use of beta-carotene incorporated it into a group of antioxidants being tested. This implies that it should not be used alone, but would be most beneficial when used with other antioxidants and supplements. AREDS advised the use of 15mg vitamin A, as beta-carotene, for non-smokers with high-risk ARMD. High doses of beta-carotene is contraindicated for smokers, especially female smokers, as it has been found to increase their risk for developing lung cancer. Ex-smokers were not shown to have less risk than current smokers. The RDA for vitamin A is 900mcg daily for adult males and 700mcg daily for adult females.

- **Vitamin C** is well known for its antioxidant properties. It is the most successful aqueous-phase antioxidant in the blood plasma of humans, suggesting that it is important for protection against degenerative disease processes related to oxidative damage. This characteristic of vitamin C is one which undoubtedly brought about abundant research on its effectiveness in the treatment of ARMD.

Prior to the AREDS study, there were a few noteworthy studies related to ascorbic acid and ARMD. The EDCC and BDES both report protective effects associated with high dosage supplementation of vitamin C. However, the findings were not statistically significant. The BMES found no reduced risk of early age-related maculopathy (ARM) with regular dietary intake of antioxidants and zinc. An increased risk of early ARMD with increased baseline vitamin C intake was also found. The EDCC
also used plasma analysis to show that low plasma levels of vitamin C were associated with increased risk for ARMD, but that high levels did not necessarily protect against it.\textsuperscript{93} These variable findings do not support the use of vitamin C alone for prevention of ARMD. When used in combination with other antioxidants and zinc in doses well above the RDA, AREDS found a significant risk reduction of developing advanced ARMD for high-risk individuals.\textsuperscript{68} The AREDS recommended dosage for high-risk individuals is 500mg daily, in combination with other antioxidants and zinc. The RDA is 90mg daily for adult males and 75mg daily for adult females.\textsuperscript{24}

- **Vitamin E** is a well documented antioxidant.\textsuperscript{43,94} It is speculated that oxidative stress increases with age leading to a higher demand for free radical scavengers.\textsuperscript{95-97} It has also been shown that vitamin E deficiency results in retinal degeneration and excessive lipofuscin (waste product) presence in the RPE.\textsuperscript{82,98}

  Major clinical trials have tested the use of vitamin E by itself or in combination with other antioxidants. The EDCC, Vitamin E, Cataract, and Age-Related Maculopathy Trial (VECAT), and BMES found no significant association between dietary and/or supplemental intake of vitamin E alone and progression of ARMD.\textsuperscript{81,99,100} However, the BMES tested a serum antioxidant index, including alpha-tocopherol, the most common form of vitamin E, which had a significant protective effect for ARMD.\textsuperscript{100} The BDES found a correlation between patients with high dietary vitamin E intake and decreased risk of large macular drusen.\textsuperscript{86} This correlation was not strengthened by including vitamin E supplementation.

  The Pathologies Oculaires Liees a l'Age (POLA) study was a large-scale investigation of 2584 subjects on the relationship between alpha-tocopherol and
This study found a significant inverse relationship between plasma alpha-tocopherol and both early and late ARMD in 82% of subjects.

The AREDS was the largest and most recent investigation. The study trialed a dosage of 400IU of vitamin E in conjunction with vitamin C, beta-carotene, and zinc. In subjects with intermediate or monocular advanced ARMD there was a significant reduction in developing an advanced course of the disease. Another study concluded that a high dietary intake of vitamins E and C, beta carotene, and zinc substantially reduces the risk of ARMD. The AREDS recommends a dosage of 400mg daily for high-risk individuals in combination with other antioxidants and zinc. The RDA for vitamin E is 30 IU daily.

• Zinc is the second most abundant essential trace element in the human body. It is a cofactor in many biological processes including DNA, RNA, and protein synthesis. Zinc is vital to the functioning of over 300 enzymes, nearly 100 of which depend on it as a catalyst. Zinc is present in relatively high concentrations in the human RPE, and is the most abundant trace element in the human eye. It acts as a cofactor in antioxidant defenses and stabilizes lipid membranes from oxidation. Zinc deficiency results in lipid peroxidation, causing damage to lipid membranes.

There are very few studies that have found a significant reduction in the risk of ARMD progression with the use of zinc alone. The EDCC, BMES, BDES, and Stur et al. did not find a significant relationship between zinc intake and the advancement of ARMD. The retrospective arm of the BDES found a weak protective effect for the highest level of dietary zinc. Another study found that there was less visual acuity loss, and less drusen progression in the zinc treated group compared to the placebo.
AREDS found a reduction in the progression to advanced ARMD in the intermediate to monocular advanced groups with the use of zinc alone. AREDS and other studies found the benefit was statistically significant only when zinc was used with other antioxidants. AREDS recommends 80mg (with 2mg copper) in conjunction with other supplements in high-risk ARMD patients. It is recommended to be taken with copper as there is some concern that doses higher than the upper intake level (UL) of 40 mg/day might decrease copper absorption and result in anemia. The RDA for zinc is 40mg daily.

**DIABETIC RETINOPATHY (DR)**

Diabetes mellitus (DM) is the leading cause of new blindness in the U.S. in adults aged 20-74 years. According to the American Diabetes Association, diabetic retinopathy causes 12,000-24,000 new cases of blindness each year. In 2005, the National Diabetes Information Clearinghouse (NDIC) estimated that 7% of the U.S. population has diabetes.

Diabetic retinopathy (DR) is a condition directly related to the duration and severity of one’s diabetes. It is characterized by focal development of microaneurysms, dilated capillaries and vessel leakage secondary to changes in capillary basement membrane structure. DR is classified as either non-proliferative or proliferative based on findings of new vessel formation (neovascularization). Non-proliferative DR, comprising 90-95% of all DR cases, is less likely to progress if diabetic control is good.

**Prevention and Treatment:** Conventional medical approach for diabetes management involves recommendations for a healthy diet, a physically active lifestyle, weight control, regular blood
glucose testing, and prescription medications\textsuperscript{114}. In CAM, nutritional supplementation, rather than prescription medication, is emphasized in addition to healthy lifestyle changes. A research report issued by the National Center for Complementary and Alternative Medicine lists the following as dietary supplements patients use for diabetic control: alpha-lipoic acid (ALA), chromium, coenzyme Q10, magnesium, omega-3 fatty acids, and garlic\textsuperscript{114}. Additional supplements commonly sited in the literature for use in diabetic management are bilberry, ginkgo biloba, vitamins C and E, and zinc.

- **Alpha-lipoic acid (ALA)** is a water and fat soluble antioxidant made by the body\textsuperscript{16,22}. In addition to its own ability to prevent oxidative stress, it enhances the antioxidant functions of vitamins C and E, and glutathione\textsuperscript{22}. It is often used by diabetics to prevent oxidative stress caused by high blood glucose levels\textsuperscript{114}. In experimental diabetes models, it has proven to provide neuronal protective properties\textsuperscript{16}. ALA supplementation has also demonstrated significant improvements in symptoms associated with diabetic neuropathy including pain, burning, paresthesia, and numbness\textsuperscript{22}. Additional studies have indicated that ALA supplemented orally (600-1800mg daily) or intravenously (500-1000mg daily) is associated with improved insulin sensitivity and glucose disposal in type 2 diabetics (DM 2) after four weeks of treatment\textsuperscript{16}. Although ALA can affect blood glucose, it has not been proven to lower glycosylated hemoglobin (HbA1c) levels in DM 2 patients. ALA manufacturers suggest between 50mg-100mg daily as a dietary supplement\textsuperscript{22}. For DM, doses of 600-1200mg daily have been used\textsuperscript{16}.

- **Bilberry** is a popular bioflavonoid herbal remedy. It contains anthocyanosides which have been shown to increase intracellular vitamin C levels and decrease leakiness and breakage of small blood vessels\textsuperscript{16,23}. They also prevent easy bruising and demonstrate
antioxidant effects valuable to the microvascular abnormalities of DM. Clinical studies have demonstrated an affinity between the anthocyanosides and improved circulation to the retina.²³

It has been suggested that bilberry leaf extract may have blood glucose, triglyceride, and cholesterol lowering effects.¹⁶ Leaves from the bilberry plant have been shown to contain polyphenols, tannins, flavonoids, and chromium. Chromium is theorized to have a role in lowering blood glucose, and the flavonoids may be useful for diabetic circulatory disorders. It is believed that bilberry might have additive effects with herbs that decrease blood glucose levels, and may require dosing adjustments of anti-diabetes medications if administered concomitantly.

Bilberry extracts have been prescribed for diabetic retinopathy since 1945.²³ Although not proven, bilberry leaf supplements may lower blood glucose and serum triglyceride levels. A review article discussed an open trial of bilberry extract on patients with retinal pathologies.¹¹⁵,¹¹⁶ Findings indicated a tendency toward reduced vascular permeability and hemorrhage in all patients. The recommended dosage for bilberry extract for DM patients is 160mg daily. If dried ripe berries are preferred, 20-60g daily is recommended.¹⁶

- **Chromium** is a trace mineral that has been used for years with diabetic patients.¹⁶ It plays a major role in the sensitivity of cells to insulin.¹⁶,²³ In a diet without chromium, insulin’s action is blocked and glucose levels become elevated.²³ Although chromium deficiency is not a direct causative factor of diabetes, it is associated with several features of the disease, including impaired glucose tolerance, hyperglycemia, glycosuria, decreased number of insulin receptors, poor insulin binding, and neuropathies.¹⁶,²³
Chromium supplements have proven to decrease fasting glucose, cholesterol, and triglyceride levels as well as increased HDL-cholesterol levels.\textsuperscript{23,21,31}

Although diabetics with chromium deficiencies have attained better glucose control through chromium supplementation, not enough evidence exists to recommend it for all DM patients.\textsuperscript{16} The American Diabetes Association recommends chromium supplementation only for those patients with a documented chromium deficiency. One study found significant improvements in the glucose/insulin system in subjects receiving 500mcg of chromium picolinate twice daily.\textsuperscript{23,116,117} However, in an evidence based review conducted by the United States Food and Drug Administration (FDA), no relationship was found between chromium and reduced risk of insulin resistance.\textsuperscript{118}

For DM 2 patients, it is advised to take at least 100-500 mcg twice daily.\textsuperscript{16,31,38} Although the lower dosages seem just as effective, higher dosages may result in more rapid improvement.\textsuperscript{16} It is advised to avoid chromium supplements in diabetic patients with renal problems, as excessive chromium may damage the kidneys and worsen renal disease. The RDA for chromium is 30-35mg daily for adult males and 20-35mg daily for adult females.\textsuperscript{24}

- **Coenzyme Q10 (CoQ10)** Few studies have been performed on CoQ10 and DM 2. Insufficient evidence exists as to its effectiveness as a CAM therapy in diabetes.\textsuperscript{114} Some research indicates a reduction in hemoglobin A1c in DM2 patients taking 200 mg daily.\textsuperscript{119,120} However, other studies have found no effect in DM1 and DM2 patients.\textsuperscript{121-123}

- **Garlic** has been used as a food, spice, and medicine by most cultures for thousands of years.\textsuperscript{124} One of the most famous usages of garlic was against the plague during the Middle Ages.\textsuperscript{125} Active components found within the garlic bulb include the amino acid,
allicin, and the enzyme, allinase. The medicinal properties of garlic manifest as allicin break down into other sulfur compounds which have overlapping healing properties.\textsuperscript{43,125}

Extensive scientific investigations of garlic's properties continue as it is one of the best-researched and best-selling herbal remedies currently available.\textsuperscript{124} Garlic's ability to lower blood pressure, cholesterol and blood glucose levels has attracted its use by diabetics. It lowers blood glucose levels by increasing the amount of insulin available in the bloodstream. A number of animal and human studies have been performed analyzing the effectiveness of garlic in reducing blood glucose levels.\textsuperscript{126-133} No definite conclusions have been made as the findings have lead to mixed results.

- **Ginkgo biloba** has been used in China for centuries, and is currently the most frequently prescribed medicinal herb in Europe.\textsuperscript{22} Although both the gingko leaf and seed were used in Chinese herbal medicine, modern research has focused on the standardized Ginkgo biloba extract (GBE), which is produced from the leaves.

  Most uses of gingko center around its ability to improve regional and peripheral blood flow and oxygen delivery throughout the body.\textsuperscript{22} Use of the herb in preventing or treating diabetic retinopathy has limited, but convincing evidence. A study found that gingko biloba extract was proven to effectively improve the retinal capillary blood flow rate in DM 2 patients with retinopathy.\textsuperscript{134} A different study demonstrated that ginkgo biloba extract may have a protective effect on the retina from ischemia.\textsuperscript{135} The recommended dose for individuals with diabetic retinopathy is 40-120mg of ginkgo extract daily.

- **Magnesium** is a mineral involved in many important body functions, including several areas of glucose metabolism.\textsuperscript{31,114} Magnesium deficiency is found in 25-38\% of diabetics
due to enhanced osmotic diuresis and increased urinary loss of magnesium.\textsuperscript{16} The lowest levels are often present in those with severe retinopathy.\textsuperscript{21,31,114} The Atherosclerosis Risk in Communities Study, low serum magnesium levels were strong, independent predictors of DM 2.\textsuperscript{136} Other studies have demonstrated a direct association between magnesium deficiency and insulin resistance in various populations.\textsuperscript{137,138} A study conducted in 2006 suggested a direct association with magnesium intake and insulin sensitivity.\textsuperscript{16}

A small observational study indicated that progression of retinopathy was related to plasma magnesium concentration.\textsuperscript{116} Researchers from this study concluded that magnesium supplementation may aid in reducing the development or progression of retinopathy, but whether or not plasma magnesium concentration is a causative factor remains to be determined. For diabetic patients, at least 50mg of vitamin B6 daily is also recommended in addition to magnesium, as intracellular vitamin B6 affects cellular magnesium content.\textsuperscript{21,23} Also, for treatment of hypomagnesemia in patients with DM 2, a 50ml magnesium chloride solution (containing 50g magnesium chloride per 1000ml solution) daily for 16 weeks has been used. Insulin has been found to enhance the renal excretion of magnesium.\textsuperscript{16} For that reason, diabetics may require twice the recommended amount due to reduced renal reabsorption of the mineral. The RDA for magnesium is 420mg daily for adult males and 320mg daily for adult females.\textsuperscript{24}

- \textbf{Omega-3-fatty acids} are commonly supplemented in one’s diet to decrease the rate of heart disease, inflammation, and triglyceride levels.\textsuperscript{114} Since diabetics are at higher risk for developing heart disease and stroke, omega-3 fatty acid supplementation has gained popularity with this patient base. To decrease triglyceride levels, sources suggest
increased cold-water fish and use of flaxseed oil in the DM diet. One ounce of fish and one tablespoon (approx. 10 g) of flaxseed oil daily is recommended.\textsuperscript{21,23,31}

- **Vitamin C** transport into cells is enabled by insulin.\textsuperscript{23,31} Many diabetics do not have adequate intracellular levels of vitamin C. As a result, a relative vitamin C deficiency often exists in diabetics, even in the presence of adequate dietary intake. A longstanding latent vitamin C deficiency can lead to elevated cholesterol levels, depressed immunity, poor wound healing, microvascular disease, and an increased tendency to bleed (i.e. increased capillary permeability).\textsuperscript{37} Some studies have found no significant associated between vitamin C intake and diabetic retinopathy.\textsuperscript{139-142} However, other sources state that a high dose of 2,000mg daily has been shown to reduce ocular complications of diabetes.\textsuperscript{21,23,31,37,139} The RDA for vitamin C is 90mg daily for adult males and 75mg daily for adult females daily.\textsuperscript{24}

- **Vitamin E** protects cell membranes from oxidants, thus improving insulin’s ability to cross cell membranes in glucose transport.\textsuperscript{21} Researchers have found that diabetics tend to have lower levels of vitamin E, especially in those with retinopathy.\textsuperscript{116} A high dose of 900IU has been demonstrated not only to improve insulin function, but also to aid in preventing the long-term complications of diabetes.\textsuperscript{23}

  Although vitamin E is recommended for diabetics, its effectiveness remains inconclusive. Clinical research in people with poorly controlled diabetes suggests no effect on serum glucose, HbA1c, or fructosamine levels.\textsuperscript{16} A review article discussed the role of vitamin E in preventing diabetic retinopathy. According to the authors, increased activity of enzyme, diacylglycerol protein kinase C, (DAG-PKC), in diabetic animals was found to interfere with normal retinal circulation.\textsuperscript{115,116} Vitamin E was found to inhibit
the activity of DAG-PKC, which improved retinal blood flow. Because diabetics require more vitamin E than the average healthy adult, the recommended dose is 800-1200IU daily. The RDA for vitamin E is 30IU daily.

- **Zinc** is involved in nearly all aspects of insulin metabolism. It also displays a protective effect against pancreatic beta-cell destruction. Diabetics require zinc supplementation as they tend to excrete excessive amounts in urine. In the few studies conducted, zinc supplementation has been shown to increase insulin levels in both type DM 1 and DM 2, as well as to improve wound healing. A supplementation of at least 30mg zinc daily is recommended for diabetics. The RDA for zinc is 40mg daily.

**“RED EYE” CONDITIONS**

The following six sections of this review will cover common inflammatory ocular conditions. It should be noted that unless a specific mechanism of the CAM therapy is described, that no such description could be found in the literature.

**DRY EYE SYNDROME (DES)**

DES is a chronic condition in which a person cannot generate an acceptable quantity of tears and/or they produce poor quality tears that quickly evaporate. This causes the eye to loose moisture and lubrication which are necessary to sustain healthy conjunctival and corneal structures. DES is widely considered to be one of the most common ocular disorders seen by eye care practitioners. The Beaver Dam Wisconsin Eye Study estimated that 14.4% of the general U.S. population suffer from DES. The study also showed a variance of prevalence based on
age with only 8.4% of subjects under 60 years old being affected compared to 19% of subjects over the age of 80.

**Prevention and Treatment:** DES can occur for a variety of reasons, and it is thought that a localized vitamin A deficiency is one cause for developing the condition.\(^{145,146}\) Therefore, the use of vitamin A eye drops or dietary supplementation can halt the development of DES. Vitamins C and E and zinc are essential for the conversion of pro-vitamin A to vitamin A.\(^{145}\) Therefore a deficiency in any of these can result in DES and should be supplemented in the diet. Other theories about the development of DES involve its link with systemic diseases. Inflammatory conditions including connective tissue disease processes such as rheumatoid arthritis, Sjogrens, and lupus can destroy the tear ducts and lead to dry eye complications.\(^{146}\) Diabetics can produce a more “syrupy” tear film during times of uncontrolled high glucose levels also leading to symptoms of dryness.

Regardless of the presence of a systemic risk factor, all patients need to drink plenty of water and maintain a well balanced diet that includes the consumption of fresh fruits and vegetables to prevent onset of DES.\(^{147}\) Increased quantities of Omega-3 fatty acids and avoidance of transfatty acidic foods and artificial sweeteners are also key elements in preventing the condition. In a double blind controlled study, increased antioxidant supplementation was shown to increase the quality of tear film in DES sufferers while patients on a placebo showed no detectable change. The following recommended supplements are all dosed for the management of DES patients.

- **Calcium** is the most abundant trace mineral element of the human body.\(^{16,148}\) It is important in enzymatic processes and for controlling the movement of fluid and nutrients through cell walls. The recommended dosage is 750mg daily.\(^{146,147}\) Calcium should be
taken separately from magnesium to avoid calcium depletion.\textsuperscript{16,146} The RDA for calcium is 1000-1200mg daily.\textsuperscript{24}

- **Copper** is a mineral that is found in both animal and plant tissue.\textsuperscript{16,148} It is essential for the formation of hemoglobin and is important for protein and enzyme formation. Copper also helps to oxidize vitamin C and works with it to form elastin. The recommended dosage is 2mg daily while taking zinc due to possible copper depletion.\textsuperscript{146} The RDA for copper is 900mcg daily.\textsuperscript{24}

- **Fish Oil**, such as cod liver oil, is an anti-inflammatory that is recommended at a dose of 1000-2000mg daily.\textsuperscript{38}

- **Flax Oil** is an essential fatty acids (EFA) essential for survival.\textsuperscript{38,146,147} It contains linoleic acid, an EFA, and alpha linoleic acid, an Omega-3 oil, which are converted into beneficial prostaglandins. EFAs also provide lubrication of the ocular tissues.\textsuperscript{148} Two tablespoons daily is recommended for its anti-inflammatory properties.\textsuperscript{38}

- **Folic Acid** is required for many functions including the production and growth of all body cells and is advised to be supplemented.\textsuperscript{38,148} No specific recommendation could be found in the literature for DES patients. The RDA for folic acid is 1000mcg daily.\textsuperscript{24}

- **Magnesium** is a vasodilator and is thought to assist in increasing blood flow to the tear glands.\textsuperscript{146} This is essential for healthy tear production. Recommended dose is 500mg every night at bedtime. The RDA for adult males is 420mg daily and 320mg daily for adult females.\textsuperscript{24}

- **Omega-3** oils are recommended for their anti-inflammatory and immune supportive properties.\textsuperscript{24} It is recommended at a dose of 500mg twice daily and should be taken with meals.
• **Para-Aminobenzoic Acid (PABA)** is part of the folic acid molecule, which is required for the production and growth of all body cells as stated previously.\(^{16,148}\) Extra intake of foods rich in PABA such as eggs, meat and milk is recommended.\(^{38}\)

• **Selenium** is recommended for its antioxidant properties.\(^{147}\) There was no specific recommended dosage found in the literature. The RDA for selenium is 400mcg daily.\(^{24}\)

• **Vitamin A** enhances immune support and is recommended at a dose of 10,000-20,000IU daily.\(^{38,145-147}\) The RDA of vitamin A is 3000mcg daily.\(^{24}\)

• **Vitamin B-Complex** enhances immune support and is recommended at a dose of 50-100mg daily.\(^{146,147}\) The RDA varies for each component of the vitamin B complex.\(^{24}\)

• **Vitamin C** enhances immune support and is recommended at a dose of 1,000mg three times daily.\(^{146}\) The RDA for vitamin C is 90mg daily for adult males and 75mg daily for adult females daily.\(^{24}\)

• **Vitamin E** enhances immune support and is recommended at a dose of 400-800 IU daily taken with meals.\(^{38,146,147}\) The RDA for vitamin E is 30IU daily.\(^{24}\)

• **Zinc** is fundamental for healing structures that may have been damaged as a result of dry eye.\(^{146,147}\) It should be taken at a dose of 30mg daily for several months.\(^{146}\) Since zinc can lead to copper depletion, the two minerals should be taken in conjunction. The RDA for zinc is 40mg daily.\(^{24}\)

**CONJUNCTIVITIS**

Conjunctivitis is inflammation of the conjunctiva due to either infectious or noninfectious agents, and is classified as either acute (≤4 week duration) or chronic (>4 week duration).\(^{149}\) The causative agent may be allergic, bacterial, or viral in nature. The condition is characterized by
redness and irritation, and may be accompanied with discharge of the affected eye. According to a U.S. National Survey, prevalence was estimated at 13 per 1,000 people aged 1-74 years.\textsuperscript{150} However, there are no reliable figures that estimate the true and accurate rate of occurrence for this condition.\textsuperscript{143,150} Even though there are no solid statistics, it is generally accepted that conjunctivitis is one of the most common ocular conditions in the general population.\textsuperscript{149}

**Prevention and Treatment:** To prevent conjunctivitis, daily supplementation of substances that provide immune support and antioxidant activity are recommended.\textsuperscript{147} These include vitamins A, B, C and E, selenium and zinc. Healthy diet, immune support, avoidance of possible allergens, treatment of underlying conditions that can make the tissues more vulnerable to infection, and attention to hygiene are all recommended to prevent conjunctivitis. Once the condition is present, immune support is still important to resolve the inflammation and fight infection. If a patient is experiencing symptoms, various other remedies are recommended.

- **Apis** also known as bee venom, is recommended to treat the neuralgia associated with conjunctivitis.\textsuperscript{38,151} Resources did not specify a dosage, but generally this medication is administered as an injection and should only be used under direct physician supervision.\textsuperscript{16}

- **Chamomile** contains many active components including the flavonoid compound, apigenin, which has sedative, anti-anxiety, anti-inflammatory and antispasmotic effects.\textsuperscript{16,38,148} This compound has provided therapeutic application of the herb dating back to the times of the early Romans.\textsuperscript{148} A warm compress consisting of 10-15 drops chamomile extract diluted into 100mL of water can be applied three times a day.\textsuperscript{16}
• EFA enhance immune support in inflammation, and provides lubrication of the ocular tissues.\textsuperscript{16,147} Clinical observation by Kaitaeff showed successful treatment of over 1000 blepharitis patients.\textsuperscript{147} Patients were treated using a combination of EFA 100mg three times daily and 2-5g vitamin C, 150mg vitamin B6, and 200mcg of selenium daily. No specific recommended dosage could be found in the literature.

• Euphrasia is a flower also known as Eyebright that actually resembles a blood shot eye.\textsuperscript{148} This similarity is thought to be why ancient people utilized the plant for eye conditions such as conjunctivitis. The herb decreases mucous discharge and acts as an anti-inflammatory and vasoconstrictor.\textsuperscript{16,148} An experimental study showed that treatment with 1 drop single-dose Euphrasia eye drops three times daily for 14 days yielded complete recovery in 81.5\% and improvement in 17\% of patients.\textsuperscript{147} Orally, 30x three times daily is recommended and the condition should respond within 24 hours of treatment initiation.\textsuperscript{38,147}

• Magnesium in the form of Epson salts applied topically will reduce watery discharge.\textsuperscript{16,147,151} It is recommended that warm compresses of Epson salt water are to be applied for 20 minutes four times daily.\textsuperscript{147}

• Pulsatilla is a flower that is part of the buttercup family often found to grow in areas with calcium rich soil.\textsuperscript{27} The plant is used for conditions with “thick yellow or white discharge.”\textsuperscript{148} This remedy is utilized in conjunctivitis for its analgesic and antibacterial activity.\textsuperscript{38,147,151} The recommended dosage is 30x three times daily. Patients should respond within 24 hours of treatment initiation.\textsuperscript{16,147} This herb should not be used on any patient that is or could become pregnant as it has the ability to cause spontaneous abortion and has potential to have teratogenic effects.\textsuperscript{16}
• **Selenium** enhances immune support and is recommended at a dose of 200mcg daily.\textsuperscript{38,147} The RDA for selenium is 400mcg daily.\textsuperscript{24}

• **Thuja** is an extract from a genus of trees in the cypress family.\textsuperscript{27} The extract is an antiviral remedy that can be applied topically to the eyelids.\textsuperscript{147,151} No specific dosage could be found in the literature.

• **Vitamin A** enhances immune support and can be used topically, orally or in combination for this condition.\textsuperscript{145,147,151} Topically, eye drops at a concentration of 200 IU/ml used four times daily is recommended. Oral supplementation is recommended at a dose of 10,000-25,000IU daily for 10 days. The RDA for vitamin A is 3000mcg daily.\textsuperscript{24}

• **Vitamin B Complex** can be increased for immune support.\textsuperscript{145,147} No specific dosages for conjunctivitis could be found in the literature. The RDA varies for each component of vitamin B complex.\textsuperscript{24}

• **Vitamin C** enhances immune support and can be used topically or orally.\textsuperscript{38,147} The recommended oral dosage is 2g every two hours or to bowel tolerance.\textsuperscript{38} There was no recommended topical dosage of vitamin C found in the literature. A clinical observation by Wright reports that dosage of 1-2 drops (125-250mg/mL) 3-5 times a day adjusted the pH of the eye in a way which assisted in resolving allergic and viral infections.\textsuperscript{147} The RDA for vitamin C is 90mg daily for adult males and 75mg daily for adult females.\textsuperscript{24}

• **Vitamin E** enhances immune support and provides anti-inflammatory action.\textsuperscript{38,147,151} No specific dosage for conjunctivitis could be found in the literature. The RDA for vitamin E 30IU daily.\textsuperscript{24}

• **Zinc** enhances immune support and is recommended at a dose of 30mg three times a day.\textsuperscript{38,147} The RDA for zinc is 40mg daily.\textsuperscript{24}
CORNEAL ULCERS

Corneal ulcers are the destruction of corneal epithelium and stroma due to an inflammatory process brought on by an infectious organism. Corneal ulcers are the leading cause of monocular blindness in developed countries. Common risk factors for developing ulcers include contact lens wear, trauma, and dry eye. It is estimated that 10-30 per 100,000 contact lens wearers will develop bacterial ulcers. There are 30,000 cases of bacterial ulcers and 1,500 cases of fungal ulcers reported annually.

Prevention and treatment: Corneal ulcers are thought to often occur due to a vitamin-A deficiency which can lead to a delayed healing process. Underlying bacterial (i.e. chronic blepharitis), fungal (i.e. Candida), and viral (i.e. herpes zoster) infections, foreign bodies and trauma are also contributing factors to the development of corneal ulcers. Daily intake of vitamin-A in conjunction with antioxidant and immune supporting supplements such as vitamins B, C and E, zinc and selenium can aid in the prevention of developing corneal ulcers. Decreased contact lens wear time was noted in CAM literature as a general rule for prevention of ulcers. Most of the treatments for ulcers are identical to the preventative measures. The remedies used for treatment help with the healing process and improve immune responses.

- Berberis, commonly called the “Oregon Grape,” is derived from a small evergreen that grows in the Pacific Northwest mountains. Berberis is an antibacterial, antifungal and anti-inflammatory agent. It can be prescribed orally or topically. Typical oral dosage is up to 2g of the dried parts ingested daily for up to eight weeks. No specific topical dosage could be found in the literature.
- **Euphrasia** drops or tea can be taken to decrease inflammation.\textsuperscript{16,38,147} Typical oral dosing of 2-4g three times daily should be taken as needed.

- **Pulsatilla** can be added for its antibacterial effects in a dosage of 120-300mg three times daily.\textsuperscript{16,38,147} This herb should not be used on any patient that is or could become pregnant as it has the ability to cause spontaneous abortion and has potential to have teratogenic effects.\textsuperscript{16} Pulsatilla herb should only be used in dry form.\textsuperscript{148}

- **Vitamin A** enhances immune support and provides antioxidant activity.\textsuperscript{38,147} Orally, a dosage of 10,000-50,000IU daily, tapered after 2-3 weeks is recommended. Topical vitamin A eye drops can be used with the oral supplement at a dose of 2,000 IU/oz three times a day. Antioxidants should be taken in combination with vitamin A to provide a stronger effect than if used individually.\textsuperscript{148} These include vitamins B, C and E as well as selenium, and zinc.\textsuperscript{16,38,147}

- It should be noted that CAM literature clearly states that corneal ulcers need to be treated aggressively with antibiotics and should be referred immediately to an eye care practitioner.\textsuperscript{38,146,147}

**UVEITIS**

Uveitis is the inflammation of the iris, ciliary body and/or choroid which are collectively known as the uveal tract.\textsuperscript{38,145} Most commonly, inflammation involves the iris and ciliary body making anterior uveitis four times more common than posterior uveitis. Forty percent of cases are related to an associated systemic disease process including but not limited to syphilis, tuberculosis, rheumatic arthritis, sarcoidosis, irritable bowel disease, Crohn’s disease, and Lyme disease.\textsuperscript{38,147}
Prevalence of this condition is varied statistically in the literature. Estimations range from as few as 14 to as many as 110 cases per 100,000 people.\textsuperscript{143}

**Prevention and Treatment:** Prevention of uveitis requires a strong immune system.\textsuperscript{38,147} Supplements that provide immune support and antioxidant properties are recommended. These include Vitamins A, B, C, and E as well as zinc and selenium. Once a patient develops uveitis, it is important to treat the inflammation and possible underlying infection. Patients will often report variable symptoms which need to be treated on an individual basis. Immune support at the time of active inflammation is beneficial for promotion of healing.

- **Arsenicum** is derived from the metallic element arsenic, and is poisonous in crude form.\textsuperscript{152} It is useful for patients who have periodic burning pains.\textsuperscript{151,153} No specific dosage could be found in the literature.

- **Belladonna** is a shrub related to tobacco and jimsonweed that is cultivated as a source of atropine.\textsuperscript{27} It is useful in uveitis with conjunctival congestion, throbbing pain, neuralgia, swollen/protruding feeling of the eyes, foreign body sensation, and photophobia.\textsuperscript{27,147,151,153} No specific dosage could be found in the literature.

- **Bromelain** is a collection of enzymes and other compounds found in pineapple juice.\textsuperscript{27} It is an anticholinergic agent that acts like an anti-inflammatory similar to NSAIDs.\textsuperscript{16,148} Its anticholinergic activity is due mainly to the alkaloid 1-hyoscyamine which becomes atropine on extraction. A dose of 250-750mg three times daily is recommended to reduce inflammation and scar tissue formation.\textsuperscript{147}

- **Cinnabar** is the common ore from which liquid mercury is developed.\textsuperscript{27} It is useful in uveitis patients who have symptoms of shooting pains across the brow and through the
eye into the head. The herb acts as an antiseptic, analgesic and tranquilizer. Recommended oral dosage is 0.3-1.0g ground into powder.

- **Clematis** is a climbing flower with 297 recognized species. It is useful in uveitis patients with symptoms of heat and dryness of the eye. The herb provides fungicidal activity, treatment for purulent conditions, and is an analgesic. No specific dosage could be found in the literature.

- **Curcumin**, the major component of curry powder, is an essential oil that acts as a scavenger for free radicals. With help from the adrenal glands, curcumin provides anti-inflammatory activity by inhibiting platelet aggregation and enzyme activity which trigger prostaglandin formation. For its antioxidant and anti-inflammatory properties, curcumin is recommended at a dose of 400mg three times daily.

- **Euphrasia** is useful in uveitis patients with symptoms of aching pain, ciliary injection, photophobia, and signs of cloudy aqueous humor. The recommended dosage is 1-2 teaspoons of dried herb seeped into one cup of water used as an eyewash two to three times daily.

- **Hepar-S**, also known as calcium sulfide, was created by the “father of homeopathy,” Samuel Hahnemann, by combining the inner calcium layer of oyster shells with flowers of sulfur. It is useful for uveitis when the ciliary body is involved, and when the patient experiences boring/throbbing pain, heat, and tenderness to the touch. It is also useful if there is evidence of pus formation either in the form of purulent discharge or the development of hypopyon. No specific dosage could be found in the literature.

- **Potassium** is a mineral found in abundance in both plant and animal tissue. It is required in the body to maintain pH levels and fluid balance inside and outside of cells.
Recommended dosages of potassium should not exceed 90mEq per day. The RDA of potassium is "not determinable due to lack of data of adverse effects and concern with regard to lack of ability to handle excess amounts."  

- **Rhus**, commonly known as Poison Ivy, acts very contradictory to common knowledge of the plant. Medicinally, it is used as an anti-inflammatory, analgesic and antipyretic. It is reported to be useful in uveitis patients with tearing and chemosis. The literature recommends oral use, however, no specific dosage could be found.

- **Spigelia** is an herbal plant that is native to the southeastern quadrant of the U.S. It is useful in uveitis patients with ciliary neuralgia, radiating pain, and cold sensation in the eye. Recommended dosage for adults is 2-5g twice daily and 0.5-4g twice daily for children over four years old. This herb should only be used for a short period of time as continuous use may cause depressive effects on the heart and may also paralyze the spinal marrow leading to death by asphyxiation.

- **Vitamin C** enhances immune support and provides anti-inflammatory action. It is recommended at a dose of 500mg daily. The RDA for vitamin C is 90mg daily for adult males and 75mg daily for adult females.

- **Vitamin E** enhances immune support and provides anti-inflammatory action. It is recommended at a dose of 100mg twice daily. The RDA of vitamin E is 30IU daily.

- **Zinc** can be supplemented to enhance immune support. No specific dosage could be found in the literature. The RDA for zinc is 40mg daily.
HERPES –

There are more than 70 different viral strands that compose the herpes viradae. Of those, four strains cause disease in humans including herpes simplex (HSV-1 and HSV-2) and varicella zoster (VZV). HSV-2 and VZV strains are typically responsible for ocular complications related to the herpes virus.

HSV is a dormant inhabitant of sensory and/or somatic ganglia. It is estimated that 20,000 new herpes simplex cases are reported in the U.S. annually. It is estimated that 70% of the population are said to be carriers of the virus by age 25, and 95% are carriers by the age of 60. HSV-2 is usually extragenital in nature and has a recurrence rate of 60% after the primary infection resolves, with men being more susceptible to recurrences than women.

VZV commonly affects the nasociliary branch of the trigeminal nerve. It is reported that as many as 50% of patients with the virus will develop ocular complications.

Prevention and Treatment: Transmission of the virus occurs by direct contact with a herpetic lesion. Enhancement of the immune system plays a key role in prevention from exposure to the virus. Increased intake of antioxidants and immune supporting supplements such as vitamins A, B, C and E, zinc and selenium are recommended. Once the virus has infected the host, the goal of treatment is to shorten the attack and prevent recurrences. Immune supportive supplements are essential in treatment of herpes as well as administering antiviral, anti-inflammatory and neuralgia soothing medications.

- **Echinacea** is a unique herb belonging to the sunflower family. This flower has been used for centuries by Native American populations as an antiseptic and analgesic. It has been studied extensively for its support of the immune system. Echinacea can be
supplemented for immune support against infectious agents. It is recommended that the herb only be used for a few weeks at a time because the body becomes adjusted to it with continuous use. The medication loses its effectiveness after approximately two weeks and will regain its effectiveness in the body after discontinued use of one or two weeks. No specific dosage could be found in the literature.

- Licorice has been used by the Chinese for thousands of years for a variety of applications. It is widely used and revered for its anti-inflammatory properties in which it stimulates the production of the body's natural steroids, cortisone and aldosterone. For herpetic skin lesions, topical application of licorice root tincture should be applied twice daily.

- Lysine is an essential amino acid that cannot be provided by the human body. It inhibits arginine metabolism which is essential for HSV survival. Arginine rich foods such as chocolate, nuts and gelatin should be avoided to increase the positive effects of lysine supplementation as well as reduce recurrence of herpetic outbreaks. A recommended dose of 500-2,000 mg three times daily for 2-7 weeks should be taken by the patient to provide antiviral activity.

  - A combination of 500mg vitamin C and 500mg lysine is available in capsule form and should be dosed at 1-4 capsules three times daily for 2-7 weeks.

- St John's Wort is an extremely useful plant that dates all the way back to medieval times, and is once again gaining popularity for its many medicinal properties. In relation to herpes, this herb is utilized in tincture preparation for its antiviral effects and to treat associated neuralgias. It is recommended at a dosage of one teaspoon, orally,
three times daily. The medicine needs to be exposed to visible light in order for it to be activated.

- **Vitamin C** enhances immune support and supplementation is recommended. It can be administered orally or topically to increase the rate of herpetic ulcer healing and can prevent vesicular membrane disruption. Orally, it is recommended at a dosage of 2,000mg daily or to bowel tolerance. Topically, it can be used as a 0.25% topical eye drops dosed at 1-2 drops applied five times daily. The RDA for oral vitamin C is 90mg daily for adult males and 75mg daily for adult females.

- **Zinc** enhances immune support and is recommended at a dosage of 25-200 mg three times daily. One study shows that 0.025%-0.05% topical zinc solution in mucous membrane infections used daily during acute phase, then weekly for a month, and then twice a month for maintenance, prevented relapses in all patients for a period of 16-23 months. The RDA for oral zinc is 40mg daily.

**EPISCLERITIS**

Episcleritis is a condition usually idiopathic in nature and is characterized by the engorgement and inflammation of the episcleral blood vessels. Although most episodes of episcleritis are considered to be idiopathic, sometimes they are associated with an underlying disease process. Typically, the underlying causes fall into the two categories of autoimmune disorders and collagen vascular diseases. Some examples include rheumatoid arthritis, tuberculosis, lupus, herpes zoster, sarcoidosis, and syphilis. The most common underlying problem related to episcleritis is irritable bowel disease.
**Prevention and Treatment:** In order to prevent occurrences of episcleritis, any underlying systemic conditions should be carefully monitored and controlled.\textsuperscript{38,145} Supplements that aid in immune support such as vitamins A, B, C and E as well as zinc and selenium can be increased to enhance the immune system and promote health. The therapies used to prevent occurrences are the same therapies used to treat active flare-ups.

- **Euphrasia** is recommended for its vasoconstrictive and anti-inflammatory properties during these episodes.\textsuperscript{38,145} The typical oral dosage used is 2-4g three times daily.\textsuperscript{16}
- **Vitamin A** is thought to have protective properties for the eye during inflammatory processes and is recommended as a nutritional supplement at times of episcleritis flare-ups.\textsuperscript{16,38,147} The recommended dosage of vitamin A is 10,000-25,000IU daily for seven days and then tapered to 5,000IU daily for men and 2,500IU daily for women. Vitamin A eye drops can be used in conjunction at a dosage of 2000 IU/mL three to four times daily. The RDA of vitamin A is 900mcg daily for adult males and 700mcg daily for adult females.\textsuperscript{24}
- **Vitamin B Complex** enhances immune support and acts as an antioxidant.\textsuperscript{38,147} It should be taken in conjunction with other antioxidants to increase efficacy and support during the inflammatory process. No specific recommended dosage could be found in the literature. The RDA varies for each component of vitamin B complex.\textsuperscript{24}
- **Vitamin C** enhances immune support and acts as an antioxidant.\textsuperscript{38,147} One study suggests that high concentrations of ascorbic acid in the aqueous humor provide extracellular protection for the ocular tissues against oxygen radicals and metabolites released during inflammation.\textsuperscript{147} No specific recommended dosage could be found in the literature. The RDA for vitamin C is 90mg daily for adult males and 75mg daily for adult females.\textsuperscript{24}
Conclusion

Complementary and alternative medicine (CAM) is a multi-billion dollar industry that has increased over the last two decades in the U.S. There is evidence that the majority of all health-related symptoms are self-diagnosed and self-treated, with a large portion of this population using CAM therapy. For this reason, it is imperative that eye care providers question their patients on use of non-conventional therapies.

Both conventional scientific literature, as well as standard naturopathic references were reviewed to compile the information included in this article. Although there are some well designed large, randomized, controlled studies of certain alternative treatments, especially in the realm of ARMD, reports of beneficial effects for other diseases and treatments are variable. Instead, many claims are supported by historical use, clinical observations, or small uncontrolled studies. Limitations of the larger studies include variations between study populations, dependence on self-reporting dietary intake, inexact measurement of antioxidant nutrients, and dose/formulation variations between studies.

There is no “gold standard” routine CAM treatment for most ocular diseases described in this paper. Recommendations in this review were made from compiling ranges of recommended dosages found throughout the scientific and naturopathic literature. It is the aim of this review to equip eye care providers with essential knowledge of the common vitamins, minerals, and herbs used for eye disease to properly counsel patients in making appropriate and safe choices. We are in no way supporting or refuting the use of CAM supplementation for the treatment of ocular disease.
Bibliography


151. Luftig, W. *The natural treatment of eye diseases in simple, advanced and so-called incurable cases.* London: Health For All, 1947.


## Appendix #1: Ocular Complications Treatment Table

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Appendix #2: Supplement Reference Guide

**Alpha-Lipoic Acid** – AKA: A-Linoic Acid, Lipoicin  
Usage: Diabetic Retinopathy  
Administration: Intravenous injection or increased dietary intake (broccoli, beef, spinach, kidney and yeast).  
Dosage: Orally; 600-800mg daily. IV; 500-1000mg daily.  
Property: Antioxidant.  
Adverse Reactions: Orally; rash. IV; local allergic reactions, paresthesia, nausea, vomiting, headache. Patients taking high doses are at risk of thiamine deficiency and supplementation may be necessary.  
Drug Interactions: Herbs with hyperglycemic properties including ephedra, ginger, and gotu kola, herbs with hypoglycemic properties including garlic, guar gum, ginseng, devil’s claw, fenugreek, and horse chestnut, antidiabetes drugs, and chemotherapy.  
Contraindications: Thiamine deficiency, thyroid disorders. May decrease blood glucose levels in diabetics. Avoid using if pregnant or nursing.

**Apis** - AKA: Bee Venom  
Usage: Conjunctivitis  
Administration: Subcutaneous injections.  
Dosage: 0.05-1ml sub-q injection of 2mg/ml apitoxin; under direct physician supervision.  
Property: To treat neuralgias.  
Adverse Reaction: local erythema, swelling and tenderness at injection site are common. Itching, urticaria, edema, malaise, flu-like symptoms and anxiety to anaphylaxis occur in 20% of patients.  
Drug Interactions: None known.  
Contraindications: High doses should not be used when pregnant or nursing.

**Arsenicum** - AKA: Arsenic (in crude form)  
Usage: Uveitis  
Administration: Oral. Supplemental pills and tinctures.  
Dosage: Various potencies. Do not exceed recommended dosage on package.  
Property: Antipyretic, analgesic.  
Adverse Reactions: GI disturbances, nausea, vomiting, diarrhea, dehydration, coma, shock, convulsions, paralysis and death.  
Drug Interactions: Peppermint, coffee and alcohol.  
Contraindications: Unknown.

**Belladonna** -  
Usage: Uveitis  
Administration: Oral standardized extract.  
Dosage: 50-100mg single dose. Not to exceed 200mg leaf powder.  
Property: Anesthetic, anticholinergic, sedative, mydriatic, cycloplegic and anti-
ulcer.

Adverse Reactions: Dry mouth, decreased perspiration, pupil dilation, blurred vision, mydriasis, palpitation, red dry skin, hyperthermia, hypotension, mucous membrane irritation, tachycardia, difficulty urinating, hallucinations, spasms, acute psychosis, convulsions, and coma.

Drug Interactions: Anticholinesterase drugs.

Contraindications: Glaucoma/glaucoma suspects, congestive heart failure, constipation, Down syndrome, esophageal reflux, fever, gastric ulcer, GI infections, hiatal hernia, narrow-angle glaucoma, obstructive GI tract disease, tachyarrhythmia, toxic megacolon, ulcerative colitis, urinary retention. Do not use with children under 6 years. Do not use if pregnant or lactating. Do not use without direct medical professional supervision.

**Berberis** – AKA: Barberry, Oregon Grape.

Usage: Corneal Ulcers

Administration: Oral herbal supplement or topical eye drop.

Property: Antibacterial, antifungal, antioxidant and anti-inflammatory.

Preliminary research suggests that it may inhibit the protein responsible for anchoring gram-positive bacteria to cell membranes.

Adverse Reactions: Topical; itching, burning, skin irritation, and allergic reactions. There are no known herbal or supplement interactions.

Drug interactions: Cyclosporin and cytochrome P450 substrates. Reduces metabolism and increases serum levels. No known herbal or supplemental interactions.

Contraindications: Not to be used for children. Avoid using if pregnant or nursing.

**Bilberry** – AKA: Huckleberry, Whortleberry, Wineberry, Dyeberry

Usage: ARMD, Cataracts, Diabetic Retinopathy, Glaucoma

Administration: Oral or topical. Supplemental pills, extracts and teas.

Dosage: Orally; 20-60 grams daily. Topically, applied as 10% decoction.


Adverse Reactions: Death may occur at chronic use of 1.5g/kg/day.

Drug Interactions: Antidiabetic drugs.

Contraindications: May decrease blood glucose levels in diabetics. Avoid using if pregnant or nursing.

**Bromelain** – AKA: Pineapple Enzyme

Usage: Uveitis

Administration: Oral. Supplemental pill or increased dietary intake (pineapple).

Dosage: 50-300mg tid.

Property: anti-inflammatory, interferes with growth of malignant cells, platelet aggregation inhibition, fibrinolytic, and skin debridement.
Adverse Reactions: GI disturbances, diarrhea, IgE mediated immune reactions.

Drug Interactions: Anticoagulant/antiplatelet drugs.

Contraindications: Allergy to pineapple. Cross-allergy may occur from allergies to wheat flour, celery, papain, carrot, fennel, cypress pollen, grass pollen and members of the Asteraceae/Compositae plant family (ragweed, chrysanthemums, marigolds, daisies, echinacea and many others). Avoid using if pregnant or lactating.

**Calcium**

Usage: Dry Eye
Administration: Oral. Supplemental pill or increased dietary intake (milk, dairy, sunflower seeds, dried apricots, dark green vegetables, cottage cheese, turnip greens, almonds, sardines, cheese, kale, broccoli, calcium enriched citrus juice, mineral water, Brazil nuts, scallops, yogurt, tofu, canned fish with bones, soy products processed with calcium, okra oranges, peas, radishes, rosehips and edible kelp).

Dosage: Not to exceed tolerable upper intake level (UL) of 2.5 grams.

Property: Neurological, muscular and blood clotting abilities, proper bone formation and maintenance.

Adverse Reactions: Belching and flatulence. High able UL may cause hypercalcemia, milk-alkali syndrome, nephrocalcinosis and renal insufficiency.

Drug Interactions: Bisphosphonates, calcipotriene, digoxin, diltiazem, levothyroxine, quinolones, sotalol, tetracycline antibiotics, thiazide diuretics, and verapamil.

Contraindication: Hypercalciuria, hyperparathyroidism, hypophosphatemia, hypothyroidism, renal insufficiency, sarcoidosis and smoking.

**Cannabis** – AKA: Marijuana, Grass, Bud, Weed, Pot, Hemp, Hash, Ganga, Mary Jane

Usage: Glaucoma
Administration: Oral/inhalation

Dosage: Oral (Marinol) 2.5-15mg dose varying in frequency based on use.

Inhalation typically consists of 65-195mg per dose.

Property: Cannabinoid; euphoriant. Schedule I controlled substance.

Adverse Reactions: Dry mouth, nausea, vomiting, red eyes, tachycardia, hypotension, hypertension, syncope, palpitations, vasodilation, impaired reaction time, impaired motor coordination, impaired visual perception, panic reactions, hallucinations, flashbacks, depression, emotional disturbances, and cognitive impairment. Long term use may cause laryngitis, cognitive impairment lasting longer than intoxication, apathy, psychic decline, sexual dysfunction, abnormal menstruation, bronchitis and bolus emphysema. Regular smoking of 3-4 marijuana cigarettes a day is comparable in effects to smoking 20-22 tobacco cigarettes a day.

Drug Interactions: Barbituates, CNS depressants, antabuse, fluoxetine, Theophylline, alcohol and medications with sedative properties.

Contraindications: Cardiovascular disease, compromised immune system,
respiratory disease, and seizure disorders. Avoid using if pregnant or nursing.

**Chamomile**
- **Usage:** Conjunctivitis
- **Administration:** Oral or topical. Supplemental pills and extracts and tea.
- **Dosage:** Orally; 1 ml tid. Topically; 10-15 drops of German Chamomile liquid extract in 100ml warm water applied tid.
- **Property:** Anti-inflammatory, sedative, antipruritic.
- **Adverse Reactions:** Orally; allergic reactions. Topically; allergic dermatitis and eczema. Ocular application may cause irritation.
- **Drug Interactions:** Herbs with sedative properties, benzodiazepines, CNS depressants, CPY1A2 substrates, CYP3A4 substrates, and warfarin.
- **Contraindications:** Hormone sensitive cancers/conditions. Possible cross-allergy with members of the Asteraceae/Compositae plant family (ragweed, chrysanthemums, marigolds, daisies and many other herbs). Avoid using if pregnant or lactating.

**Chromium** — AKA: Chromium Chloride, Chromium Acetate
- **Usage:** Diabetic Retinopathy
- **Administration:** Oral. Supplemental pills or increased dietary intake (canned foods due to leaching of chromium into food from can, meat, animal fat, fish, brown sugar, coffee, tea, spices, calf liver, whole wheat bread, rye bread, and brewer’s yeast).
- **Dosage:** 200-1000mcg daily.
- **Property:** Trace element; component of glucose tolerance factor molecule complex
- **Adverse Reactions:** cognitive, perceptual and motor dysfunction, weight gain, headache, insomnia, sleep disturbance, irritability, mood changes, vomiting, diarrhea, hemorrhage and blood loss into the GI tract causing cardiogenic shock. High doses may also cause anemia, thrombocytopenia, hemolysis, hepatic dysfunction, and renal failure.
- **Drug Interactions:** Chromium containing herbs (i.e. horsetail and cascara), iron, vitamin C, zinc, insulin, and NSAIDs,
- **Contraindications:** Behavioral/psychiatric disorders, chromeate/leather allergy, liver disease and renal disease. May decrease blood glucose levels in diabetics.

**Cineraria Maritima** — AKA: Dusty Miller, Silver Ragwort
- **Usage:** Cataract
- **Administration:** Combination topical eye drop.
- **Dosage:** See package insert for Similasan Cataract Care™ eye drops.
- **Property:** Pyrrolizidine alkaloid (PA); improvement of eyesight.
- **Adverse Reactions:** Orally is considered hepatotoxic. Topically, may cause allergic reaction in patients with allergy to Asteraceae/Compositae family (ragweed, chrysanthemums, marigolds, daisies and others).
Drug Interactions: hepatotoxic PA containing herbs, and CYP3A4 drugs (phenytoin, Phenobarbital, carbamazepine, rifampin rifabutin and others). Contraindications: Cross-sensitivity to Asteraceae/Compositae family, and liver disease. Avoid using if pregnant or nursing.

**Cinnabar** - AKA: Cinnabar, Zhu Sha
Usage: Uveitis
Administration: Oral or topical.
Dosage: Orally or topically; 0.3 - 1.0 gram ground into powder.
Property: Sedative, antipyretic.
Adverse Reactions: Intoxication with long term use.
Drug Interactions: Unknown.
Contraindications: Unknown.

**Clematis**
Usage: Uveitis
Administration: Oral or topical. Available in teas, drops and extracts.
Dosage: Unknown.
Property: Analgesic.
Adverse Reactions: Orally; cholic, diarrhea, and severe irritation to GI and urinary tracts. Topically; slow-healing blisters and burns.
Drug Interactions: None known.
Contraindications: Avoid using orally. Do not use if pregnant or lactating.

**Coenzyme Q-10** – AKA: CoQ10
Usage: Diabetic Retinopathy
Administration: Oral or topical.
Dosage: Varied dosage up to 1200 mg daily based on condition treated. It is recommended that daily dosage exceeding 100mg be divided into multiple dosages throughout the day.
Property: Antioxidant, membrane stabilizer, and cofactor of metabolic pathways.
Adverse Reactions: Generally well tolerated but may cause nausea, vomiting, diarrhea, appetite suppression, heartburn, and epigastric discomfort.
Drug Interactions: Red yeast, antihypertensive drugs, chemotherapy, and warfarin.
Contraindications: Hypotension, hypertension and smoking. Avoid using if pregnant or nursing.

**Conium Maculatum** – AKA: Hemlock, Carrot Weed
Usage: Cataract
Administration: Topical eye drop
Dosage: See package insert for Similasan Cataract Care TM eye drops
Property: Sedative, antispasmodic, paralyzer.
Adverse Reactions: Death by respiratory failure may occur when used orally. Oral administration also causes salivation, drowsiness, mydriasis, muscle pain, rapid swelling and stiffening of muscles, tachycardia, bradycardia, loss of speech, paralysis, rhabdomyolysis, unconsciousness,
cardiovascular collapse, and burning of the mouth, throat, and abdomen.

Drug Interactions: None known.
Contraindications: Unsafe when used orally. Avoid using if pregnant or nursing.

**Copper**
Usage: Dry Eye
Administration: Oral. Supplemental pill or increased dietary intake (seafood, currants, legumes, nuts, mushrooms, raisins, organ meats, wheat bran, cereals, grain products, and cocoa products).
Dosage: Not to exceed the tolerable upper intake level (UL) of 10mg per day. Separate UL dosages for children have been determined by age. 1-3 yrs; 1mg, 4-8 yrs; 3mg, 9-13 yrs; 5mg, 13-18; 8mg.
Property: Enzyme catalyst and antioxidant.
Adverse Reactions: Abdominal pain, cramps, nausea, diarrhea, and vomiting. Doses above UL may cause renal failure and death. Symptoms of copper poisoning include nausea, vomiting, bloody diarrhea, hypotension, hemolytic anemia, uremia, and cardiovascular collapse.
Drug Interactions: Penicillamine.

**Curcumin** - AKA: Tumeric, Indian Saffron
Usage: Uveitis
Administration: Oral or topical. Orally; supplemental pill or increased dietary intake (major ingredient in curry powder and commonly found in foods such as mustards, butters, and cheeses for flavor and color).
Dosage: Unknown.
Property: Anti-inflammatory, antithrombotic, antioxidant, immune support, angiogenesis inhibition.
Adverse Reactions: Orally; GI disturbances, nausea, and vomiting. Topically; allergic dermatitis.
Drug Interactions: Anticoagulant/antiplatelet drugs and herbs.
Contraindications: Bile duct obstruction and gallstones. Do not use if pregnant or nursing.

**Echinacea** - AKA: Black Susan, Snakeroot, Red Sunflower
Usage: Herpes
Administration: Oral. Supplemental pill, extract, or tea.
Dosage: Tablets containing 6.78 mg crude extract based on 95% herb and 5% root dosed as two tablets tid. Freeze dried juice extract capsules 100mg tid. Herb juice 6 - 9 ml daily. 5 - 6 cups tea initially followed by 1 cup per day (tea prepared by pouring 8 oz of boiling water over one tea bag and steeping, covered, 10 - 15 minutes).
Adverse Reactions: GI disturbances, nausea, vomiting, allergic reactions, fever,
heartburn, constipation, unpleasant taste, dry mouth, sore throat, mouth ulcers, tingling/hunbness of tongue, myalgia, arthralgia, headache, dizziness, insomnia, and disorientation.

Drug Interactions: Caffeine, CYP1A2 substrates, CYP3A4 substrates, and immunosuppressants. Contraindications: atopy, and pemphigus vulgaris. Possible cross-allergy with members of the Asteraceae/Compositae plant family (ragweed, chrysanthemums, marigolds, daisies, and many other herbs). Avoid using if nursing.

**Essential Fatty Acids (EFA)** - AKA: Omega-3 Fatty Acids / Omega-6 Fatty Acids, Unsaturated Fats

Usage: Conjunctivitis, Dry Eye

Administration: Oral. Supplemental pill/liquid or increased dietary intake (vegetable oils, corn, safflower, soybeans, dark green leafy vegetables, canola oil, soybeans, peanut oil, primrose oil, hemp seeds, black currant seeds, sunflower, pumpkin seeds, whole grains, wheat germ, walnuts, olive, almond, flaxseed oil, borage oil, sesame, animal products, salmon, trout, sardines, mackerel, cod and other cold water fish).

Dosage: Two tablespoons (13 - 26 capsules) taken with meals.

Property: Anti-inflammatory, immune support. Important for formation of hormones, cell membrane function, and general tissue lubrication.

Adverse Reactions: Cod liver oil and fish oil supplements may cause vitamin A and D toxicity when taken in excess. EFAs are well tolerated otherwise and converted to energy when taken in excess.

Drug Interactions: saturated fat in diet should be reduced when taking EFAs.

Contraindications: Fish products should be avoided when pregnant as they may contain mercury.

**Euphrasia officinalis** - AKA: Eye Bright

Usage: Conjunctivitis, Episcleritis, Corneal Ulcers, Uveitis

Administration: Oral. Supplemental pill or tea.

Dosage: 2-4gm, tid pill form or one cup tea, tid (2-4gm dried above ground parts steeped in 150mL boiling water for 5-10 minutes, strained.)

Property: Anti-inflammatory, astringent and vasoconstrictor.

Adverse Reactions: mental confusion, headache, increased eye pressure with lacrimation, itching, redness, swelling, dim vision, photophobia, weakness, sneezing, nausea, toothache, constipation, cough, dyspnea, insomnia, polyuria and sweating.

Drug Interactions: None known.

Contraindications: Avoid using if pregnant or nursing.

**Fish Oil** - AKA: Cod Liver Oil, Omega-3

Usage: Dry Eye

Administration: Oral. Supplemental pill/liquid or increased dietary intake (herring, mackerel, menhaden, pilchard, salmon, sardine, trout, tuna, whale blubber, seal blubber, shellfish, oysters, shrimp, and scallops).
Dosage: Not to exceed 3 grams per day.
Property: Anti-inflammatory, antithrombotic.
Adverse Reactions: fishy aftertaste, "fishy burp", nausea, halitosis, heartburn, loose stool, and rash. Doses greater than 3 grams may cause hemorrhagic stroke and suppress immune function.
Drug Interactions: Vitamin E, anticoagulant/antiplatelet drugs and herbs, antihypertensive drugs, and contraceptive drugs.
Contraindications: Hypertension, immunodeficiency, implantable defibrillators, and seafood allergies.

Flaxseed Oil - AKA: Linoleic Acid, Linseed Oil
Usage: Dry Eye
Administration: Oral and topical. Orally; supplemental pill/liquid or increased dietary intake (cooking oils and margarines).
Dosage: Orally; 15-30 ml daily.
Property: Anti-inflammatory, beneficial cardiovascular effects, platelet aggregation inhibition, protection against ischemic and lacunar infarction.
Adverse Reactions: Loose stools and diarrhea in large doses. Allergic reactions and anaphylaxis may occur.
Drug Interactions: Anticoagulation/antiplatelet drugs.
Contraindications: Bleeding disorders. Use caution if pregnant or breast feeding.
Amounts found in foods are likely safe, but medicinal amounts should be avoided if pregnant or nursing.

Folic Acid - AKA: Folate, Vitamin B9
Usage: Dry Eye
Administration: Oral or Topical. Supplemental pills or increased dietary intake (cold cereals, baking flour, breads, pastas, cookies, crackers, green leafy vegetables, spinach, broccoli, lettuce, okra, asparagus, fruits, bananas, melons, lemons, legumes, yeast, mushrooms, beef liver, kidneys, orange juice, tomato juice, bean sprouts, whole grain baked goods, and milk.)
Dosage: Not to exceed 1000 mcg per day.
Property: Intracellular metabolism, rate-limiting step in DNA synthesis, and reduction in damage to DNA and prevention of replication errors. Required for the formation and growth of all body cells
Adverse Reactions: Abdominal cramps, diarrhea, rash, altered sleep, irritability, excitability, overactivity, confusion, impaired judgment, exacerbation of seizure frequency, psychotic behavior, abdominal distention, flatulence, bitter taste, allergic skin reactions, and zinc depletion. May also precipitate or exacerbate neuropathy in those with vitamin B12 deficiencies.
Drug Interactions: Fosphenytoin, methotrexate, Phenobarbital, phenytoin, primidone, and pyrimethamine.
Contraindications: Angioplasty, cancer (avoid using doses higher than RDA), cardiovascular disease, pernicious anemia, and seizure disorders.
Garlic – AKA: Stinking Rose, Ajo
Usage: Diabetic Retinopathy
Administration: Oral. Supplemental pills and extracts or increased dietary intake.
Dosage: 1.2 -4 g fresh garlic daily or 800-1200 mg tablet/capsule form daily (3) 600-900 mg or standardized extract (1.3% alliin content) daily divided in doses
Property: antibacterial, antiviral, antifungal, antihypertensive, blood glucose lowering, antithrombotic, antimutagenic, antiplatelet, support of immune system.
Adverse Reactions: Breath and body odor, mouth and gastrointestinal burning or irritation, heartburn, flatulence, nausea, vomiting, diarrhea, increased risk of bleeding, allergic reactions including rhinitis, conjunctivitis, urticaria, anaphylaxis, angioedema. Topical exposure may cause dermatitis, eczema, blisters, and scarring.
Drug Interactions: Warfarin, aspirin, aspirin-containing products, cytochrome P450 3A4 substrates, and warfarin (Coumadin); decrease effects of contraceptive drugs, cyclosporine, cytochrome P450 2E1 substrates, and non-nucleoside reverse transcriptase inhibitors NSAIDs, and antiplatelet drugs.
Contraindications: Peptic ulcers, intracranial bleeding, allergies to Liliaceae family. Use with caution in individuals with history of bleeding, hemostatic disorders, or drug-related hemostatic problems. Avoid using if pregnant or nursing.

Ginkgo Biloba – AKA: Yinhsing
Usage: ARMD, Diabetic Retinopathy, Glaucoma
Administration: Oral. Supplemental pills, teas and extracts made from dried leaves.
Dosage: Not to exceed 5 ppm daily.
Property: Protects tissue from oxidative damage. Antioxidant, neuroprotection, anti-inflammatory, improvement of circulation, inhibition of platelet activating factor.
Adverse Reactions: GI disturbances, headache, dizziness, palpitations, constipation, restlessness, diarrhea, nausea, vomiting, lack of muscle tone, weakness, spontaneous bleeding, and allergic reaction. Oral use of fresh ginkgo seeds may cause death.
Drug Interactions: Anticoagulant/antiplatelet drugs, seizure threshold lowering drugs, St. John’s Wort, alprazolam, anticonvulsants, antidiabetic drugs, buspirone, cytochrome P450 substrates, fluoxetine, ibuprofen, omeprazole, trazadone, and warfarin.
Contraindications: Bleeding disorders, diabetes, and infertility. Use of ginkgo should be discontinued at least 2 weeks prior to undergoing surgical procedures. Considered unsafe for use in children and should avoid using if pregnant or nursing.
**Hepar Sulphuris** - AKA: Hepar-S, Calcium Sulfide

Usage: Uveitis

Administration: Oral. Supplemental pills and tinctures.

Dosage: Do not exceed recommended package dosing.

Property: Anti-inflammatory, immune support.

Adverse Reactions: Unknown.

Drug Interactions: Peppermint, coffee, and alcohol.

Contraindications: Unknown.

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**Licorice** - AKA: Glycyrrhiza, Sweet Root

Usage: Herpes

Administration: Oral. Supplemental pill or increased dietary intake. Note that most manufactured products don't actually contain licorice but instead use anise oil for the characteristic flavor and aroma.

Dosage: Unknown.

Property: Antispasmodic, anti-inflammatory, laxative, soothing, anti-estrogenic and estrogenic.

Adverse Reactions: Hypertension, sodium and water retention, edema, lethargy, headache, hypokalemia, hypokalemic myopathy, rhabdomyolysis, myoglobinuria, severe CHF, pulmonary edema, lower extremity weakness and hypermineralocorticidism.

Drug Interactions: Herbs with cardiac activity, stimulant laxatives, CYP2B6 substrates, CYP3A4 substrates, digoxin, diuretic drugs, estrogens, and furosemide.

Contraindications: Heart disease, hormone sensitive cancers/conditions, hypertension, hypokalemia, kidney disease, and sexual dysfunction.

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**Lutein** – AKA: Xanthophyll, Zeaxanthin

Usage: ARMD, Cataract

Administration: Oral. Supplemental pills or increased dietary intake (kale, spinach, kiwi, grapes, orange juice, zucchini, squash, corn, orange bell pepper, broccoli, and dark leafy greens).

Dosage: 6-20 mg daily.

Property: Carotenoid; antioxidant

Adverse Reactions: None known.

Drug Interactions: Beta-carotene and olestra

Contraindications: None known

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**Lysine** – AKA: L-Lysine, Lys

Usage: Herpes

Administration: Oral or topical. Supplemental pills.

Dosage: Orally; 100mg daily for 12 months. Topically; various potencies applied every two hours.

Property: Required for collagen synthesis and bone health. Antagonizes herpes simplex virus.
Adverse Reactions: Diarrhea, and GI disturbances.
Drug Interactions: Calcium supplements.
Contraindications: Kidney disease and osteoporosis. Do not use if pregnant or breast feeding.

**Magnesium** – AKA: Epsom salts, Magnesia, Milk of Magnesia
Usage: Conjunctivitis, Diabetic Retinopathy, Dry Eye, Glaucoma
Administration: Oral. Supplemental pills and suspensions or increased dietary intake (high fiber foods, legumes, whole grains, broccoli, squash, soy, avocado, dried apricots, dark green vegetables, leafy greens, seeds, nuts, dairy, meats, chocolate, coffee, and “hard” water).
Dosage: Not to exceed the tolerable upper intake level (UL) of 350mg per day. Separate UL dosages for children have been determined by age. 1-3 yrs; 65 mg daily, 4-8 yrs; 110 mg daily, 8+ yrs; 350mg daily.
Property: Coenzyme essential in numerous cellular reactions. Necessary extracellularly to maintain nerve and muscle electric potentials and transmitting impulses across neuromuscular junctions. Required for the formation of cAMP and ion movement across cell membranes. Necessary for normal bone structure. Antacid and laxative. Involvement in protein synthesis and carbohydrate metabolism. Possible bronchodilation effects.
Adverse Reactions: GI disturbances, nausea, vomiting, diarrhea. Excessive dosages may cause hypermagnesemia. Signs and symptoms include thirst, confusion, hypotension, drowsiness, loss of tendon reflexes, muscle weakness, respiratory depression, cardiac arrhythmias, coma, cardiac arrest and death.
Drug Interactions: Aminoglycosides, bisphosphates, calcium channel blockers, potassium sparing diuretics, quinolones, skeletal muscle relaxants, and tetracyclines.
Contraindications: Heart block, malabsorption syndromes, renal disease, and restless leg syndrome.

**Omega-3 Fatty Acids** – AKA: EPA
Usage: Diabetic Retinopathy, Dry Eye, Glaucoma
Administration: Oral. Supplemental pills or increased dietary intake (marine mammals, oily fish, fish liver oil and commercial fish oil products).
Dosage: Not to exceed 3 grams daily.
Adverse Reactions: Fishy taste, belching, nosebleeds, nausea and diarrhea. High dosages may cause a decrease in blood coagulation and increase the risk of bleeding. Possible adverse immunologic effects due to decreased natural killer cell activity and therefore possible increase risk for viral infections and some cancers.
Drug Interactions: Anticoagulant/antiplatelet drugs and antihypertensive drugs.
Contraindications: Aspirin-sensitivity and hypertension. Avoid using if pregnant
PABA (Para-Aminobenzoic Acid) – AKA: Vitamin B10, Vitamin H1
Usage: Dry Eye
Administration: Oral and topical. Supplemental pills or increased dietary intake (whole grains, liver, Brewers yeast, eggs, molasses, milk and meat).
Dosage: Not to exceed 12 grams daily. Children not to exceed 220 mg/kg/day.
Property: Nonessential nutrient. Melanin metabolism, blockage of penetration of UV radiation to the epidermis. PABA is a part of the folic acid molecule.
Adverse Reactions: Orally; nausea, vomiting, and anorexia. Dosages over 12 grams can cause liver toxicity, fetal hepatitis, fever and rash. High doses are also associated with vitiligo, decreased WBC count, rheumatic fever, arthritis, fatty changes of the liver, kidney and myocardium, and death.
Topically; contact dermatitis, and photosensitivity.
Drug Interactions: Cortisone, dapsone, and sulfonamides.
Contraindications: Renal disease. Avoid oral use if pregnant or nursing.

Potassium – AKA: Kalium
Usage: Uveitis
Administration: Oral. Supplemental pill or increased dietary intake (dried fruits, avocado, carrot, cantaloupe, banana, cereals, beans, milk, non-cheese dairy products, poultry, legumes and vegetables).
Dosage: Up to 80-90 mEq per day. Pregnant and nursing women; up to 40-80 mEq per day.
Property: Heart rate and blood pressure regulation, muscle contraction, pH balance, and balance of fluid inside and outside of cells.
Adverse Reaction: GI disturbances, nausea, diarrhea, vomiting, belching, flatulence, and ulcerations. Doses above 90 mEq per day, or blood serum levels above 5mEq/L, can result in hyperkalemia. Signs and symptoms of hyperkalemia include paraesthesia, generalized weakness, flaccid paralysis, listlessness, vertigo, mental confusion, hypotension, blood in stool, cardiac arrhythmias, heart block, and death. Doses that increase blood levels above 7mEq/L are potentially life threatening.
Drug Interactions: Vitamin B12, ACE inhibitors, angiotensin receptor blockers, and potassium-sparing diuretics.
Contraindications: Aspirin or tartrazine sensitivities, and GI motility conditions.

Pulsatilla – AKA: Easter Flower, Pasqueflower
Usage: Conjunctivitis, Corneal Ulcers
Administration: Oral and topical. Supplemental pills, extracts, tinctures, or tea.
Dosage: Orally; 120-300mg dried above ground parts or one cup tea tid. Tea prepared by steeping 120-300mg dried pulsatilla in 150mL water for 5-10 minutes.
Property: Analgesic, antispasmodic, sedative, and antibacterial.
Adverse Reactions: Orally; toxic GI irritant, motor function depression,
arrhythmia, dyspnea, and kidney or urinary tract irritation. Topically; skin irritation, mucous membrane irritation, itching, and pustule formation.

Drug Interactions: None known.
Contraindications: Do not use if pregnant or nursing.

Rhus – AKA: Poison Ivy
Usage: Uveitis
Administration: Oral. Supplemental pills and tinctures.
Dosage: Various potencies. Do not exceed recommended dosage on package.
Property: Anti-inflammatory, antipyretic.
Adverse Reactions: Unknown.
Drug Interactions: peppermint, coffee and alcohol
Contraindications: Unknown

Selenium – AKA: Selenized yeast, Brewer’s Yeast
Usage: Cataract, Conjunctivitis, Dry Eye, Episcleritis, Herpes, Corneal Ulcers
Administration: Oral. Supplemental pill or increased dietary intake (broccoli, garlic, onion, crab, liver, fish, poultry, Brewer’s yeast, wheat germ, whole grains, butter, lamb, many fresh vegetables, shellfish, wheat and selenate salt. Content of selenium in diet is dependent on concentration in soil).
Dosage: Not to exceed the tolerable upper intake level (UL) of 400mcg daily. Separate UL levels for children have been determined by age. Infant to 6mo; 45mcg daily, 7-12 mo; 60mcg daily, 1-3 yrs; 90mcg daily, 4-8yrs; 150mcg daily, 9-13 yrs; 280mcg daily, 14+ yrs; 400mcg daily.
Property: Antioxidant and immune support. Protein synthesis.
Adverse Reactions: Nausea, vomiting, fatigue, irritability, and weight loss. Dosages above the UL can cause hair and nail brittleness or loss, white horizontal streaking on nails, paronychia, hyperreflexia, garlic odor on breath, metallic taste, muscle tenderness, tremor, lightheadedness, and facial flushing. Also may cause thrombocytopenia and moderate hepatorenal dysfunction.
Contraindications: Hemodialysis, hypothyroidism, impaired male fertility, and skin cancer.

Spigelia – AKA: Pinkroot, Wormgrass
Usage: Uveitis
Administration: Oral. Supplemental pill or tincture.
Dosage: Adults; 2-5 grams bid. Children over 4 yrs; 0.5-4 grams bid.
Note: A strong perulative laxative should always be used in conjunction with spigelia.
Property: Anthelmintic.
Adverse Reactions: Can paralyze the spinal marrow and lead to death by asphyxiation. Depressive effects on the heart.
Drug Interactions: None known.
Contraindications: Avoid using if pregnant or nursing.
**St. John’s Wort** - AKA: Hypereikon
Usage: Herpes
Administration: Oral or topical. Supplemental pills and extracts.
Dosage: Orally; 300mg daily.
Adverse Reactions: insomnia, restlessness, anxiety, agitation, GI disturbances, diarrhea, fatigue, dry mouth, dizziness, headache, rash, paresthesia, hypoglycemia, nausea, anorexia, thirst, chills, weight loss, confusion, and neuropathy. Prolonged topical use can cause significant photodermatitis.
Drug Interactions: Digitalis, tryptophan, “triptans,” alprazolam, aminolevulinic acid, amitryptaline, antidepressants, clopidogrel, contraceptive drugs, cyclosporine, cytochrome P450 substrates, dextromethorphan, digoxin, fenfluramine, fexofenadine, imatinib, meperidine, MAOIs, narcotics, nefazodone, NNRTIs, nortriptyline, P-glycoprotein substrates, paroxetine, pentazocine, phenobarbital, phenprocoumon, phencytoin, photosensitizing drugs, protease inhibitors, reserpine, sertraline, simvastatin, tacrolimus, tramadol, and warfarin.
Contraindications: Alzheimer’s, bipolar disorder, depression, infertility, schizophrenia, and anesthesia. Do not use if pregnant or nursing.

**Thuja** – AKA: Arbor Vitae, White Cedar
Usage: Conjunctivitis
Administration: Oral or topical. Supplemental pills and tinctures or increased dietary intake.
Dosage: 2-4mL liquid extract. Topically apply oil to eyelid.
Property: Antiviral, immunostimulation and possible reverse transcriptase activity. Also urinary irritant, uterine stimulant and effects on menstrual cycle.
Adverse Reactions: Orally; nausea, vomiting, painful diarrhea, mucous membrane hemorrhage, asthma, hypotension, GI disturbances, CNS stimulation, seizures and death.
Drug Interactions: Anticonvulsants, and seizure threshold lowering drugs.
Contraindications: Epilepsy. Avoid using if pregnant or nursing.

**Vitamin A** – AKA: Retinol, Retinyl Acetate, Beta Carotene
Usage: ARMD, Conjunctivitis, Dry Eye, Episcleritis, Herpes, Corneal Ulcers
Administration: Oral or topical. Supplemental pill or increases dietary intake (eggs, whole milk, butter, meat, oily salt-water fish, liver, fresh water fish, grains, oils, green and yellow vegetables, especially carrots, sweet potatoes, pumpkins, apricots, mango, cherries, watermelon, green leafy vegetables, and squash).
Dosage: Orally 10,000-50,000 IU daily, taper after 2-3 weeks. (General intake not to exceed 10,000 IU daily for prolonged periods. Children based on age; up to 3yrs 2000 IU, 4-8yrs 3000 IU, 9-13yrs 5700 IU, 14-18yrs 9300
IU.) Topical eye drops 2,000 IU/oz, tid. Note: beta carotene is less absorbed than retinol, so multiplying the dosage by three is roughly equivalent.

Property: Antioxidant, immune support and health of epithelial cells.

Adverse Reactions: Above 50,000 IU can cause nausea and vomiting, headache, increased CSF, vertigo, blurred vision, and muscular incoordination. In children, doses above 25,000 IU can cause bulging fontanelles, swelling of optic disc, bulging eyeballs and visual disturbances as well as irritability, drowsiness, dizziness, delirium, coma, vomiting, headache and increased intracranial pressure. Skin redness and peeling may occur days later and last several weeks.

Drug Interactions: warfarin, tetracyclines, hepatotoxic drugs, and retinoids.

Contraindications: Fat-malabsorption disorders, alcoholism, hyperlipidemia, liver disease, and malnutrition.

**Vitamin B** – AKA: B Complex, Cobalamin, Cyanocobalamin

**Usage:** Cataract, Conjunctivitis, Dry Eye, Episcleritis, Herpes, Corneal Ulcers

**Administration:** Oral. Supplemental pill or increased dietary intake (meat, fish, shellfish, dairy, liver and some sprouts).

**Dosage:** No tolerable upper intake limit (UL) noted. Considered tolerable even in high doses. Generally 300-10,000 mcg daily.

**Property:** Antioxidant and immune support.

**Adverse Reactions:** Rare; diarrhea, peripheral vascular thrombosis, itching, transitory exanthema, urticaria, and feeling of swelling of entire body. Also, can mask polycythemia vera.

**Drug Interactions:** Folic acid, vitamin C, potassium, and chloramphenicol.

**Contraindications:** Angioplasty, cobalamin or cobalt hypersensitivity, Leber’s disease, megaloblastic anemia, and polycythemia vera.

**Vitamin C** – AKA: Ascorbic Acid

**Usage:** ARMD, Cataract, Conjunctivitis, Diabetic Retinopathy, Episcleritis, Glaucoma, Herpes, Corneal Ulcers, Uveitis

**Administration:** Oral. Supplemental pill or increased dietary intake (fresh fruits and vegetables, especially citrus, red and green bell peppers, rose hips, acerola cherries, strawberries, cantaloup, papaya, broccoli, brussel sprouts, tomatoes, asparagus, dark leafy vegetables, cabbage, sauerkraut, and sprouts).

**Dosage:** Not to exceed tolerable upper intake level (UL) of 200mg daily. Separate UL for children have been determined based on age. 1-3yrs 400mg/day, 4-8yrs 650mg/day, 9-13yrs 1200mg/day, 14-18 1800mg/day.

**Property:** Antioxidant and immune support.

**Adverse Reactions:** dose-related; nausea and vomiting, esophagitis, headache, heartburn, abdominal cramps, GI obstruction, fatigue, flushing insomnia, and diarrhea. Doses above UL can increase risk of osmotic diarrhea and GI upset. May also cause precipitation of urate, oxalate or cysteine stones, or drugs in the urinary tract.
Drug Interactions: Acerola, Cherokee rosehip, grape seed polyphenols, rosehip, vitamin B12, aluminum, chemotherapy, omeprazole, estrogens and aspirin.
Contraindications: Angioplasty, cancer, diabetes, glucose-6-phosphate dehydrogenase deficiency, iron overload, hemochromatosis, thalassemia, sideroblastic anemia, kidney stones and sickle cell disease.

**Vitamin E**
Usage: ARMD, Cataract, Conjunctivitis, Diabetic Retinopathy, Episcleritis, Herpes, Corneal Ulcers, Uveitis
Administration: Oral and topical. Supplemental pill or increased dietary intake (fruits, vegetables, vegetable oil, wheat germ oil, cereal grains, animal fats, meat, poultry, eggs, butter, and milk fats). Note: heat destroys vitamin E.
Dosage: Not to exceed tolerable upper intake level (UL) of 1100 IU synthetic vitamin E and 1500 IU natural vitamin E daily.
Property: Orally; antioxidant, anti-inflammatory and immune support. Topically; wound healing.
Adverse Reactions: Rare but can include nausea and vomiting, intestinal cramps, fatigue, weakness, headache, blurred vision, rash, gonadal dysfunction and creatininuria. High doses may increase the risk of bleeding due to antagonism of vitamin K dependent clotting factors and platelet aggregation.
Drug Interactions: Beta-carotene, anticoagulant/antiplatelet medications, vitamin K, iron, chemotherapy, cyclosporine, P450 3A4 substrates, digitalis and warfarin.
Contraindications: Angioplasty, bleeding disorders, retinitis pigmentosa (synthetic only), head and neck cancer (synthetic only), vitamin K deficiency, and rheumatic heart disease.

**Zeaxanthin** – see Lutein

**Zinc** – AKA: Zinc Oxide, Zinc Sulfate
Usage: ARMD, Conjunctivitis, Diabetic Retinopathy, Episcleritis, Herpes, Corneal Ulcers, Uveitis
Administration: Oral or topical. Supplemental pills, tinctures or increased dietary intake (red meat, liver, egg yolk, beans, ginger root, seafood, dairy, nuts, legumes, and whole grains).
Dosage: Orally; not to exceed the tolerable upper intake level (UL) of 40mg daily. Separate UL dosages for children have been determined by age. Birth-6 mo; 4mg daily, 7-12mo; 5mg daily, 1-3yrs; 7mg daily, 4-8yrs; 12mg daily, 9-13yrs; 23mg daily, 14-18yrs; 34mg daily. Topically; various concentrations of lotions, ointments and creams applied 8-10 times daily.
Property: Antioxidant, immune support and wound healing. Essential trace element. DNA, RNA and protein synthesis.
Adverse Reactions: Orally; nausea, vomiting, and metallic taste. Dosages above the UL can cause copper deficiency which can lead to sideroblastic
anemia, neutropenia, impaired immune function, and increased ratio of
LDL/HDL cholesterol. Zinc overdose can cause watery diarrhea, irritation
and corrosion of GI tract, flu-like symptoms/CNS symptoms (fever, cough,
nausea, diarrhea, epigastric pain, lethargy, fatigue, neuropathy,
dehydation severe vomiting) acute renal tubular necrosis and interstitial
nephritis.
Drug Interactions: Bromelain, calcium, chromium, copper, EDTA, folic acid,
phytic acid, iron, magnesium, vitamin B2, vitamin A, vitamin D,
quinolones, tetracyclines, penicillamine, and amiloride.
Contraindications: Alcoholism, hemodialysis, HIV, and malabsorption
syndromes.