

Seabuckthorn oil for vision

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Abstract

Seabuckthorn oil is rich in compounds important for normal vision. Two clinical studies have shown beneficial effects of CO₂-extracted seabuckthorn oil on dry eye. Accumulating evidence indicates seabuckthorn oil has anti-inflammatory and antioxidative effects and it can promote healthy blood lipid and lipoprotein profile. Seabuckthorn oil is also a natural source of macular carotenoids. This suggests potential for enhancing retinal health by intake of seabuckthorn oil and encourages further studies on the subject.

Introduction

Seabuckthorn seed oil is rich in the essential linoleic (18:2n-6) and α -linolenic (18:3n-3) fatty acids, which are present in a nutritionally favourable ratio of <2:1. The characteristic fatty acid to seabuckthorn pulp oil is palmitoleic acid (16:1n-7), found in similar amounts only in few food sources. Seabuckthorn pulp oil in particular is rich in carotenoids, which give the berry its orange to red color. In addition, oils from both the soft parts of seabuckthorn and the seeds contain high amount of tocopherols, tocotrienols, and phytosterols (1-4).

Inflammation and oxidative damage contribute to several eye diseases, including dry eye, age-related macular degeneration and cataract (5-8). The bioactive compounds found in seabuckthorn are important for the maintenance of eye health. Essential fatty acids regulate inflammation via their effect on eicosanoid production. Carotenoids, tocopherols, tocotrienols and phytosterols have anti-inflammatory and anti-oxidative potential. Of the main carotenoids reported in seabuckthorn oils, β -carotene and β -cryptoxanthin can be converted to vitamin A in the body. This is of importance, as vitamin A is needed for the formation of retinal pigments and normal function of vision. Vitamin A is also important due to its regulatory function on differentiation of epithelial cells. In lack of vitamin A, mucus production by the goblet cells of the eye conjunctival membrane is reduced and the cornea becomes dry (9).

Seabuckthorn oil has traditionally been used for the treatment of mucous membranes (10, 11). Particularly in Russia, it has been known as a treatment for eye disorders (12). In the English language scientific literature only few studies concerning the effects of seabuckthorn oil on vision have been published. Here, two studies on the effects on dry eye are reviewed. Also the potential of seabuckthorn oil in enhancing other aspects of eye health and vision are discussed.

Clinical studies – dry eye

Dry eye is defined as a disease of tears and ocular surface, which causes symptoms of visual disturbance and discomfort. Dry eye is characterized by increased osmolarity of the tear film that covers and protects the ocular surface, and inflammation which worsens the symptoms. Typically, dry eye causes sensations of grittiness, dryness, burning and redness of eyes and blurring of vision. There are two main types of dry eye: the aqueous deficient type, which is caused by inadequate secretion of the watery layer of the tear film, and the evaporative dry eye, which is caused by excessive evaporation of the aqueous tear film. The evaporative dry eye is associated with an instable lipid layer of the tear film. Normally the outermost lipid layer, produced by the meibomian glands, provides a smooth optical surface and prevents excess evaporation of water (5, 13, 14).

The prevalence of dry eye increases with age. It is more common among women compared to men. Other risk factors include contact lens wear, laser surgery of eyes, certain medications, and dry and windy conditions (5, 13, 14). The aqueous deficient dry eye in particular, may also be a symptom of Sjogren's syndrome, a systemic autoimmune disease, where lymphocytic infiltration damages the exocrine glands. This leads to dryness of mucous membranes in general, including the dryness of eyes due to damage to lacrimal glands (15).

The effects of seabuckthorn oil on dry eye have been investigated in two clinical studies. Twenty-five women with Sjogren's syndrome participated in a randomized double-blind cross-over study by Yang & Erkkola (16). The participants took daily 3 g (6 capsules) of seabuckthorn oil or 3 g (6 capsules) of fractionated coconut oil for three months. Seabuckthorn oil used in the study was a standardized combination of seed and pulp oils produced with supercritical CO₂-extraction (Aromtech Ltd, Tornio, Finland). The effect of oils on the symptoms of Sjogren's syndrome were evaluated using a visual analogical scale (VAS) by the participants at the beginning and end of the intervention periods. The main interest was on the symptoms of the genital mucous membranes. During the first phase of the study, a significantly ($P<0.01$) greater proportion of participants in the seabuckthorn oil group compared to the placebo reported improvement of the overall symptoms of Sjogren's syndrome, including dryness of eyes. Of the participants in the seabuckthorn oil group, 91% reported improvement in dryness of eyes, versus the 67% in the placebo group during the first phase.

Based on the study by Yang & Erkkola (16) a larger study focused on the effects of seabuckthorn oil on dry eye was carried out at the University of Turku, Finland (17). A total of 100 women and men experiencing dry eye symptoms were included in this randomized, double-blind, placebo-controlled parallel group study. During the study period of three months, the participants took daily 2 g of seabuckthorn oil or placebo oil as 4 capsules. The seabuckthorn oil was the same standardized composition by Aromtech Ltd (Tornio, Finland) that was used in the study by Yang & Erkkola (16). The placebo oil was medium-chain triacylglycerols from palm and coconut oils. At the beginning, after one month, and at the end of the intervention of three months, clinical dry eye tests were performed by an ophthalmologist. In addition, severity of dry eye symptoms was measured by questionnaires at study visits and by a symptom logbook kept by the participants each day during the intervention. Compared to the placebo, intake of seabuckthorn oil had significant ($P<0.05$) beneficial effects on tear film osmolarity, the "gold standard" clinical measure of dry eye, and on the severity of symptoms of burning and redness of eyes.

The effects of seabuckthorn oil on dry eye most likely were mediated by a joint effect of the bioactive compounds on the inflammation and oxidative damage central to the dry eye syndrome. Also the effects of seabuckthorn carotenoids and fatty acids on the regulation of cells of the lacrimal and meibomian glands and goblet cells may have contributed to the effect (9, 18).

Seabuckthorn oil and retinal health

Diabetes, metabolic syndrome, dyslipidemia, obesity, impaired glucose metabolism and hypertension are associated with detrimental changes to the retinal microvascular system. These include narrowing the retinal arteries and dilatation of the retinal venules. The effects are likely mediated by endothelial dysfunction and inflammation (19-21).

Seabuckthorn oil has in clinical studies shown beneficial effects on the markers associated with the risk of retinal vascular changes. In a randomized, open, cross-over study of 80 overweight women, intake of 4 g of combined seabuckthorn seed and pulp oil for 1 month induced a beneficial trend on serum lipids (22). In the same study setting a significant ($P<0.05$) reduction in serum vascular cell adhesion molecule (VCAM), a marker of endothelial dysfunction and inflammation was observed (23). In a randomized, double-blind, placebo-controlled study of 78 women with atopic dermatitis, an increase in the plasma HDL cholesterol occurred during intake of seabuckthorn pulp oil (24).

The intervention with 5 g oil per day lasted for four months (24). These results suggest the effects of seabuckthorn oil on retinal circulation merit investigation.

Age-related macular degeneration (AMD) is a disease of the retina, affecting specifically macula, the cone-rich region that is responsible for the highest visual activity (25-27). AMD is the leading cause of incurable blindness and visual impairment in industrialized countries. It is characterized by formation of drusens, yellow deposits under the retinal pigment epithelium. There are two types of AMD: atropic and neovascular type. In the neovascular or wet AMD, new blood vessels grow from the choriocapillaris underlying the retinal pigment epithelium. This leads to detachment of the retinal pigment epithelium and periretinal scarring in the macular area. In the atropic or dry AMD well-defined areas of atrophy exist in the retinal pigment epithelium and in the underlying choriocapillaris. Risk factors of AMD include older age, genetic factors, smoking, atherosclerosis, and low intake of antioxidant nutrients (27). Chronic oxidative stress and inflammation are considered central in the pathogenesis of the disease (6).

Seabuckthorn oil contains lutein and zeaxanthin, the xanthophyll carotenoids found in the macula and lens of the eye. The amount of these carotenoids vary depending on the source of the berries (4, 28, 29). Lutein and zeaxanthin are referred to as macular pigment, and their amount in the retina can be measured as macular pigment optical density. Lutein and zeaxanthin quench free radicals, filter the blue light and act as protective antioxidants in the eye (30). Dietary intake of lutein and zeaxanthin has been associated with a reduced risk of AMD (26). In addition to the results from epidemiological studies, several controlled, randomized interventions support the observation of beneficial effects of lutein and zeaxanthin on macular health (25, 31). Based on the high content of lutein and zeaxanthin in certain seabuckthorn sources, also the effects of seabuckthorn oil on this aspect of eye health is of interest in future studies.

Conclusions

The beneficial effects of seabuckthorn oil on dry eye have been observed in two clinical studies. Based on the effects of seabuckthorn oil on risk factors and markers of metabolic syndrome, cardiovascular disease and inflammation and the content of macular pigment carotenoids in the oil, also the effects on retinal health merit investigation.

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