



REVIEW ARTICLE

Exploring the therapeutic potential of natural ingredients for eye health: A comprehensive review

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ABSTRACT

The pursuit of optimal eye health and the management of common eye conditions have led to a growing interest in exploring alternative therapeutic approaches. Natural ingredients derived from plants, herbs, and other natural sources have a long history of use in traditional medicine systems and are known to possess bioactive compounds with potential health benefits. This comprehensive review aims to explore the therapeutic potential of natural ingredients for promoting eye health and managing various eye conditions. It offers a thorough overview of the possible advantages of using natural substances by analyzing the scientific evidence supporting their usage, including their mechanisms of action and clinical efficacy. We have discussed various ingredients in detail with their function on the eye, such as turmeric, honey, neem, and rose water for their anti-inflammatory activity and anti-irritation activity of red sandalwood, phitkari, and bibhitaki. Other than these, there is a lot of ingredients that reduce redness and dryness of the eye, act as antibacterial agent, and so on, which includes pudina, white sandalwood, tulsi patra, amla, yamana, elaichi, and bhringraj. The results of this review add to the body of currently available knowledge, direct clinical practice, stimulate additional study, and offer insights into the creation of natural-based therapies for preserving and increasing eye health.

KEY WORDS: Anti-inflammatory, Eye, Natural ingredient, Neem, Traditional medicine, Turmeric

INTRODUCTION

The eye is a wonderful and intricate organ that is essential to our capacity to view and understand the outside world. It is made up of a number of interrelated structures and processes that function in unison to gather, concentrate, and send visual information to the brain. The cornea, a clean and transparent dome-shaped structure, is located at the front of the eye. The cornea acts as the eye's outermost layer of defense and is essential for bending or refractively altering light as it enters the eye. The iris, the colored portion of the eye, is located just beneath the cornea. The muscles in the iris regulate the pupil's size, which is the iris's dark, circular opening in the middle. The pupil controls how much light enters the eye by changing its size in reaction to the amount of light in the surrounding area. The lens, a transparent and malleable component situated behind the iris, receives light

after it has passed through the pupil. The retina, which is found in the rear of the eye, is focused and further refracted by the lens. Millions of specialized photoreceptor cells called rods and cones make up the thin layer of tissue known as the retina. Cones are in charge of color vision and function best in bright light, whereas rods are in charge of seeing in low-light situations and mainly contribute to black-and-white vision. Light activates the rods and cones in the retina, causing them to produce electrical signals. The optic nerve, a group of nerve fibers, then carries the electrical signals generated by the rods and cones to the brain. These impulses are sent from the optic nerve to the visual cortex, a region of the brain in the occipital lobe. Electrical signals

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Access this article online

Website:

<http://isfcpsharmaspire.com>

DOI:

10.56933/Pharmaspire.2023.15125

Date of Submission: 23 June 2023

Date of Revision: 05 July 2023

Date of Acceptance: 07 July 2023

are processed and interpreted by the visual cortex, which enables us to see and comprehend visual information. The physiology of the eye is influenced by several elements in addition to these important ones. We can concentrate on things at various distances because of a process known as accommodation, which causes the lens to change its shape. The aqueous humor and vitreous humor, among other fluids found in the eye, support the maintenance of the eye's form, nourish the surrounding tissues, and aid in light transmission. Overall, the eye's physiology is a magnificent and complex mechanism that gives us the ability to view the world in all of its visual splendor. It is evidence of how

sophisticated and intricately designed the human body is.^[1] They play an integral role in our daily lives, enabling us to engage in activities such as reading, appreciating art, and navigating our surroundings. Our ocular health, vital for daily functioning, necessitates an understanding of the basic eye structure, the impact of lifestyle choices, and the potential concerns arising from neglecting its well-being. Visualize the eye as a camera, wherein several components harmoniously collaborate. The cornea, a transparent convex layer at the anterior, facilitates light focusing. Adjacent lies the iris, regulating light admission. Behind the iris resides the lens, which further refracts light, while the retina, positioned at the posterior, converts light into electrical signals, which the brain interprets. These signals are then transmitted through the optic nerve, enabling visual perception. Having comprehended the eye's structure, it is imperative to grasp the visual process. As light enters the eye, it traverses the cornea and lens, which meticulously focuses it onto the retina. Within the retina, specialized photoreceptor cells convert light into electrical signals. These signals are subsequently relayed through the optic nerve to the brain, where they undergo processing, culminating in our ability to perceive and comprehend the visual world.^[2,3]

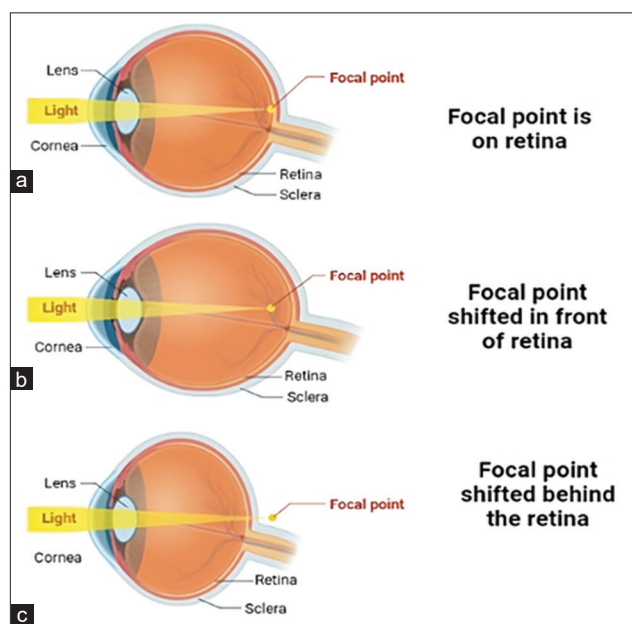


Figure 1: Common eye conditions (a) Normal Vision (Eyeball is regular in length), (b) Myopia (Eyeball increased in length), (c) Hyperopia (Eyeball is decreased in length)

COMMON EYE CONDITIONS

While the eye is a remarkable organ, it is not immune to certain conditions. Nearsightedness, farsightedness, astigmatism, and presbyopia are some of the most common eye conditions. Nearsightedness, or myopia, causes distant objects to appear blurry, while farsightedness, or hyperopia, leads to difficulties in focusing on nearby objects.

Astigmatism results in distorted or blurry vision at all distances. Presbyopia, often associated with aging,

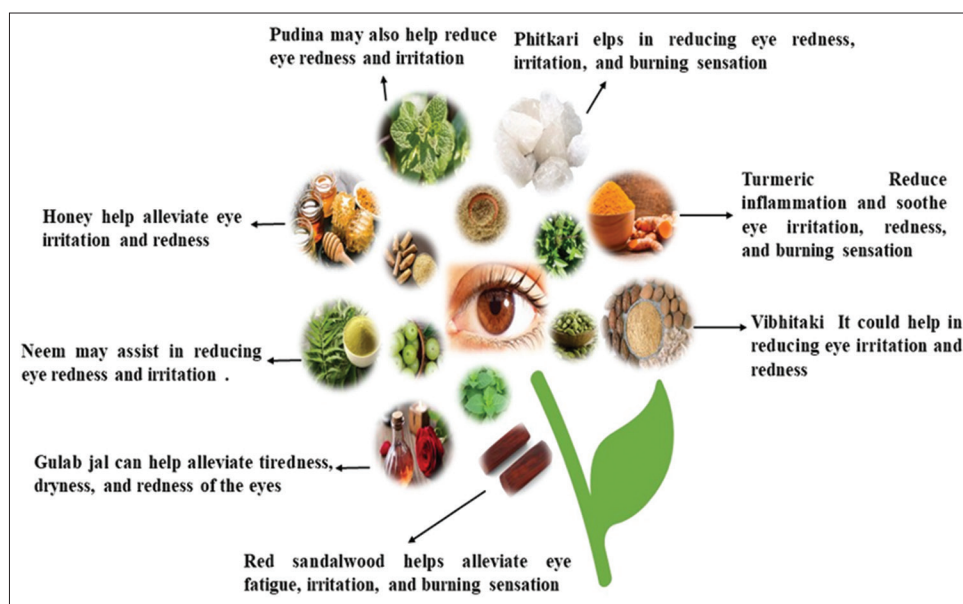


Figure 2: Benefit of various herbs in maintaining eye health

affects the eye's ability to focus on close objects. These conditions can be corrected with glasses or contact lenses, emphasizing the importance of regular eye examinations to ensure optimal vision [Figure 1].^[4]

LIFESTYLE FACTORS AFFECTING OCULAR HEALTH

Screen usage

Prolonged screen usage, particularly with digital devices, may contribute to digital eye strain, characterized by symptoms such as ocular fatigue, dryness, and blurred vision.

Inadequate nutrition and Ultraviolet (UV) rays

Inadequate nutrition, deficient in essential vitamins and minerals, can predispose individuals to ocular maladies such as cataracts and age-related macular degeneration (AMD). Furthermore, insufficient safeguarding of the eyes against harmful UV rays may entail long-term ocular damage.^[5]

CONCERNS RELATED TO LIFESTYLE AND EYE HEALTH

Neglecting eye health can have significant consequences. Digital eye strain, caused by excessive screen time, can impact productivity and overall well-being. Dry eye syndrome, often associated with prolonged screen use, can cause discomfort, redness, and blurry vision. The pernicious habit of smoking, in addition to its systemic repercussions, heightens the risk of ocular diseases, including cataracts and glaucoma. Cataracts, characterized by clouding of the eye's lens, can lead to vision impairment or even blindness if left untreated. AMD, a leading cause of vision loss in older adults, can result in a loss of central vision. Glaucoma, a condition associated with increased eye pressure, can lead to irreversible damage to the optic nerve if undetected and untreated.^[6]

LIST OF INGREDIENTS

Turmeric

“Trikaṭūvālāṅgulyāḍhyaṁ tridoṣaghnaṁ cha chakṣuṣi, śuṣkaṁ timiraṇāśanaṁ cha nāmnā haridrā tathā śrutā.”

-Turmeric is known as Trikatuvalanguliyadhya, which means it helps to alleviate the three doshas (Vata, Pitta, Kapha) and is beneficial for the eyes. It also helps to relieve dryness and eliminate darkness.

Turmeric (*Curcuma longa*) is known for its anti-inflammatory and antioxidant properties. It may help

reduce inflammation and soothe eye irritation, redness, and burning sensation. The most investigated active compound is curcumin. A preliminary study suggests that curcumin may help treat uveitis, an inflammation of the eye's iris. Preliminary research suggests that curcumin may be as effective as corticosteroids, the type of medication usually prescribed for this condition.^[7]

Gulab jal (Rose Water)

“Sarvarogaharaṁ toyam gulābam tṛṣṇāpahaṁ smṛtam, netradaurgandhyaharaṁ śubhaṁ gandhavartikaṁ svarūpataḥ.”

-“Gulab” (Rose) water is considered a panacea for all diseases. It helps quench thirst, removes eye tiredness, and provides a pleasant fragrance, which is auspicious and beneficial for the eyes.

Gulab jal, or rose water (*Rosa rubiginosa*), has a calming and cooling effect on the eyes. It can help alleviate tiredness, dryness, and redness of the eyes. Rose water also possesses mild antibacterial properties. Rose water is scented water made by steeping rose petals in boiling water. It has anti-inflammatory and anti-infective properties.

Rose water has been shown to have excellent benefits for people with eye problems. Conditions it can help treat include conjunctivitis, conjunctival xerosis or dry eye, and acute dacryocystitis. A 2011 review trusted source reports on the effectiveness of rose water in treating conditions affecting the eyes.^[8]

Vibhitaki

“Ayam paripakvaphalo vibhītakī tridoṣaghnaḥ, pittadāhaviṣaharo chakṣurrogavināśanaḥ.”

-Vibhitaki, when consumed in its ripe fruit form, helps balance the three doshas, alleviates pitta dosha, relieves burning sensation, and promotes eye health.

Vibhitaki, also known as *Terminalia bellirica*, is an Ayurvedic herb that may have astringent and anti-inflammatory properties. It could help in reducing eye irritation and redness.

A study published in the journal *Inflammopharmacology* in 2011 investigated the anti-inflammatory activity of various Ayurvedic herbs, including *T. bellirica*. The study found that extracts of *T. bellirica* exhibited significant anti-inflammatory effects, potentially attributed to its inhibitory action on pro-inflammatory mediators.^[9]

Neem

Neem, also known as *Azadirachta indica*, has been used in traditional medicine for its wide range of

medicinal properties, including its antimicrobial and anti-inflammatory effects [Figure 2].

It may assist in reducing eye redness and irritation caused by bacterial or fungal infections. Neem contains several bioactive phytochemicals, such as quercetin, an antibacterial compound. A study suggests that neem showed antibacterial activity against the bacterial pathogen *Vibrio vulnificus* by disrupting the integrity of the bacterial cell membrane.^[10]

Red sandalwood

Red sandalwood, also known as *Pterocarpus santalinus*, is a tree native to India and has been used in traditional medicine. It is known for its soothing properties and may help alleviate eye fatigue, irritation, and burning sensation. It is believed to have anti-inflammatory effects. A study found that the methanolic wood extract of *P. santalinus* exhibited anti-inflammatory, analgesic, and antioxidant activities.^[11]

Pudina (Mint)

“Śiraśchedakaraṁ vyomnaṁ tīkṣṇagrāhiviśodhanam, śukradoṣavināśanaṁ pudīnaṁ śrutimucyate.”

“Pudina” (Mint) has a cooling effect, refreshes the mind, purifies the senses, alleviates eye irritation, soothes the eyes, and removes imbalances related to the seminal fluid.

Pudina or mint has a cooling effect and can provide relief from tiredness and burning sensation in the eyes. It may also help reduce eye redness and irritation. Pudina, or mint, is known for its cooling effect and has been used in traditional medicine for various purposes, including supporting digestive health and skin health. Mint contains menthol, which has a natural cooling effect and can help soothe irritated eye.^[12]

Phitkari (Alum)

Phitkari, or alum, has astringent properties and may help in reducing eye redness, irritation, and burning sensation. It has been traditionally used for its soothing effects on the eyes. Phitkari, or alum, is a mineral salt that has been used in traditional medicine for various purposes, including its astringent properties. Alum has a strong astringent quality, which means it can shrink or constrict body tissues.^[13]

Honey

Honey is known for its antibacterial and anti-inflammatory properties. In eye drops, it may help alleviate eye irritation and redness caused by allergies or environmental factors. Honey has been shown to have antibacterial and anti-inflammatory properties in several studies.

Honey contains hydrogen peroxide, which gives it its antibacterial properties. Honey also contains other bioactive components, such as flavonoids and phenolic acids, which have been shown to have anti-inflammatory effects. A review of recent clinical research on honey found that it has broad-spectrum antimicrobial properties, including antibacterial, antifungal, antiviral, and antimycobacterial properties.^[14]

White sandalwood

White sandalwood has cooling and soothing properties. It may help reduce eye fatigue, irritation, and burning sensation. White sandalwood oil has been shown to have anti-inflammatory and antioxidant properties.^[15]

Amla (Indian Gooseberry)

Amla (*Phyllanthus emblica*) is rich in vitamin C and possesses antioxidant properties. It may contribute to the overall health of the eyes and help reduce eye fatigue and dryness. According to a study published in the Journal of Agricultural and Food Chemistry, vitamin C, tannins, and flavonoids present in amla have very powerful immunomodulatory, antioxidant, and anticancer activities.

Another study published in the Journal of Medicinal Food found that amla phytochemicals can exert antioxidant activity by limiting the formation of oxidation products, increasing antioxidant status, and also inducing the endogenous antioxidant defense system.^[16,17]

Tulsi patra (Holy Basil)

Tulsi Patra (Holy Basil) has antimicrobial and anti-inflammatory properties. It may help in reducing eye redness, irritation, and burning sensation caused by infections or allergies. Tulsi extract shows inhibitory effects against pathogens such as *Escherichia coli*, *Salmonella typhimurium*, *Bacillus pumilus*, *Aspergillus* spp., and *Candida albican*.

Essential oil and extract of Tulsi leaves have antiviral properties that's why it is used extensively in medical practices. There are two clinical trials that studied the effect of daily administration of 10 g of an aqueous extract of fresh tulsi leaves in patients with acute viral infections. One study on patients with acute viral encephalitis reported increased survival after 4 weeks in the tulsi group compared to a group given dexamethasone and a study on viral hepatitis reported symptomatic improvement after 2 weeks.^[18,19]

Yamani

Yamani is commonly known as Ajwain (*Trachyspermum ammi*). Yamani is an herb known for its cooling and

soothing effects. It may help alleviate eye fatigue and provide relief from tired and dry eyes. An *in vivo* study on hexachlorocyclohexane-induced oxidative stress and toxicity of ajwain extract revealed that it reduces the toxicity resulting from hepatic free radical stress.^[20]

Elaichi

Elaichi, or green cardamom, is rich in antioxidants and may have anti-inflammatory properties. It could contribute to reducing eye inflammation and discomfort. A study by Alam *et al.* evaluated the *in vitro* antioxidant and anti-inflammatory activities of green cardamom essential oil. They found that the oil had significant antioxidant and anti-inflammatory activities compared with standard drugs and that the bioactive compounds had considerable binding potential with the receptors. They also performed *in silico* molecular docking of the major bioactive compounds of the oil, namely α -terpinyl acetate and 1,8-cineole, with some receptors involved in oxidative stress and inflammation.^[21]

Bhringaraj

Bhringaraj, an Ayurvedic herb, is believed to have cooling and rejuvenating effects on the eyes. It may help in reducing eye fatigue and soothing eye irritation. Bhringaraj is an Ayurvedic herb that is believed to have cooling and rejuvenating effects on the eyes. It is also known as false daisy, and its scientific name is *Eclipta alba* or *Eclipta prostrata*. It contains various phytochemicals that may have pharmacological activities, such as alkaloids, coumestans, flavonoids, polyacetylenes, thiopenes, and triterpene saponins. A study by Nelson *et al.* evaluated the *in vitro* antioxidant activity of bhringaraj whole plant extract. They found that the extract had significant free radical scavenging activity. The anti-inflammatory activity exhibited by methanolic extract of whole plants of *E. prostrata* has shown similar effects as that of the standard drugs such as indomethacin and cyproheptadine.^[22]

CONCLUSION

The eye is a crucial sensory organ that enables us to take in our environment. By enabling us to view and understand visual information, it plays a key part in our daily lives. Its significance cannot be stressed because it gives us the gift of vision and raises our standard of living as a whole. Our current way of living, which includes a lot of screen time, prolonged close work, and pollution has a big impact on how well our eye's function. Digital eye strain, dry eye syndrome, myopia, and other visual discomforts are becoming more common due to these lifestyle factors. In this review, we have discussed about different natural ingredients with their activity on the eye and came to know that although there are a wide range of chemical compounds in treating and maintaining eye health, phytochemicals are

examples of natural compounds that can equally contribute and essential for sustaining eye health. They have qualities that can help shield the eyes from oxidative stress, inflammation, and age-related damage. These components can promote eye health and lower the risk of common eye disorders by supporting the health of the retina, lens, and other ocular structures. To maintain and improve general eye health, natural components can be added to the diet or used in eye care products.

ACKNOWLEDGMENT

The authors are grateful to the Director of the ISF College of Pharmacy for providing the necessary infrastructure to complete this review on time.

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