

## THE EFFECTIVE NATURAL AND PHARMACOTHERAPY PRODUCTS IN CATARACT TREATMENT: A REVIEW

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### Abstract

Cataracts are a kind of eye illness that cause gradual but steady disruption of vision by clouding and opacifying the eye lens. Cataracts are clouding of the lens and blurred vision, and they are a primary cause of avoidable blindness globally. Cataract prevalence is expected to rise globally as people live longer, particularly in low-income countries where medical care is scarce. Cataract surgery is generally safe, but it does carry the risk of consequences including retinal detachment, hence less expensive pharmaceutical options for treating this eye illness are being sought. Cataracts are a global health issue because they are a leading cause of preventable blindness. Cataracts are linked to diabetes mellitus because hyperglycemia causes polyol pathways, which the aldose reductase enzyme converts to sorbitol. The polyol pathway may be important in the etiology of diabetic cataracts. Diabetic cataracts may be prevented with the use of plant-based anti-cataract medications.

**Keywords:** Cataract, Natural, Pharmacotherapy, Eye disease, Diabetes

### INTRODUCTION

A cataract is a region of cloudiness in the eye's lens, the transparent structure responsible for focusing light. Cataracts are a typical part of the aging process. Cataract sufferers' vision is blurred and distorted, much like seeing through a fogged glass. Cataracts may make it hard to read, drive (particularly at night), or even see the expression on a friend's face. The incidence of cataracts in Asian countries including China, India, Taiwan, and Singapore ranges from 14% to 49%, and the rate of cataract-related blindness is expected to rise in the near future. Blindness, one kind of visual impairment, affects more than one percent of the worldwide population, making it one of the most prevalent disabilities in the world. The lens sits in front of the iris and works in tandem with the cornea to direct rays of light onto the retina deep inside the eye. While in most species the lens only provides a third of the eye's refractive power, in others it may change the focusing range (i.e., accommodate). The human eye loses this capability entirely around the sixth decade of life. Loss of transparency, often known as cataract if untreated, is the second and more devastating alteration that occurs with age. Surgery to remove the cloudy lens and insert an intraocular implant is the standard method of treating cataract nowadays. With an aging population and a consequent increase in the number of people in need of cataract surgery in the industrialized world, access to these procedures is restricted. Perioperative (during the surgery) problems include lens capsular rupture, nuclear material loss into the vitreous, and vitreal loss, while postoperative complications include endophthalmitis.

In this study, we aimed to compile data on the efficacy of natural medicines derived from plants for the treatment of cataracts. This research aims to identify and assess effective natural ingredients for cataract treatment. The approaching National Herb Day inspired us to talk about the long tradition of treating common ailments using herbs and other home

medicines. Herbs, thought to have several advantages. In addition to improving the taste, they provide other benefits for the eyes. Eye diseases are sometimes called "silent killers" because symptoms are typically missed until it is too late. However, many common illnesses may be treatable with the right herb. The following treatments may help maintain healthy eyes:

- **Eyebright:** These symptoms may be alleviated by using this plant. Its usage dates back centuries in Europe.
- **Gingko Biloba:** This herb acts as a cerebro-spinal dilator, lowering the risk of glaucoma and macular degeneration.
- **Fennel:** Watery, irritated eyes may benefit from fennel's anti-inflammatory properties. Fennel is useful for more than just these minor issues; it may also be used to cure glaucoma and cataracts.
- **Saffron:** Saffron, a culinary herb, is also used to cure cataracts, much as fennel. In addition, it may slow the progression of age-related macular degeneration in the elderly.
- **Bilberries:** During World War II, British pilots discovered the health advantages of bilberries. Their night vision improved, they stated. Bilberries improve blood flow even in the tiniest of capillaries. In addition, the anthocyanosides they contain aid the eye in adjusting to different brightness levels.

## LITERATURE REVIEW

**Durgapal, S., Juyal, V. & Verma, A. (2021)** The homeopathic medicine system has a long history of using *Cineraria maritima* for the treatment of cataract and other eye-related diseases. Cataracts form due to the age-related precipitation of natural lens protein, which is exacerbated by high oxidative stress. The antioxidant methods of 1,1-diphenyl-2-picrylhydrazyl, nitric oxide, hydrogen peroxide, and investigations in an *ex vivo* cataract model have all been used to ascertain the anti-cataract efficacy of *C. maritima*. Phytoconstituents such as alkaloids, phenols, flavonoids, etc. were found in the ethanolic extract of *C. maritima*'s aerial parts (leaves and stems) according to the research. Findings of  $6.31 \pm 0.06\%$  w/w phenol and  $2.14 \pm 0.09\%$  w/w flavonoid indicated a high concentration of these components inside the plant and, therefore, high antioxidant activity. In addition, the antioxidant capability of this plant was strongly supported by the IC<sub>50</sub> values reported across all methodologies. Goat eye lenses were also used to study its anti-cataract activity, and the encouraging findings speak volumes for its anti-cataract potential and provide credence to its safe, recommended use. This research provided strong evidence that this plant has powerful antioxidant properties and may prevent cataracts. Furthermore, this plant needs significant research into the creation of appropriate innovative dosage forms for the efficient treatment of cataract.

**Feriyani, et al (2021)** Cataracts are a global health issue because they are a leading cause of preventable blindness. Cataracts are linked to diabetes mellitus because hyperglycemia causes polyol pathways, which the aldose reductase enzyme converts to sorbitol. The polyol pathway may be important in the etiology of diabetic cataracts. Diabetic cataracts may be prevented with the use of plant-based anti-cataract medications. Several plant-based studies have been designed to evaluate the effectiveness of bioactive substances in

the treatment of diabetic cataracts by blocking the enzyme Aldose Reductase. Recent studies from a variety of disciplines show that natural plant products may provide a significant answer for the prevention and treatment of diabetes-related cataracts.

**Veeram, Anjali & K, Thyagaraju (2018)** The purpose of this study was to determine whether or not *Syzygiumcumini* seed powder extracts were effective in preventing glucose-induced cataracts in the lenses of goats and chickens. Biochemical markers, including total proteins, water-soluble proteins, Malondialdehyde, glutathione, and total ATPases and catalase levels, were measured in the goat lenses and chick lenses in this in vitro investigation. Lens opacification was slowed in those treated with *Syzygiumcumini* seed powder, according to photographs of their eyes. In comparison to the placebo, extract-treated lenses exhibit higher levels of total protein, water-soluble protein, and total ATPases activity. Groups given the extract had higher levels of catalase activity than those given the control medication. Glutathione levels in high glucose (55mM) were considerably greater in *Syzygiumcumini*-treated groups, and the MDA levels in these lenses were much lower than in the normal control group. These findings provide further evidence that seed *Syzygiumcumini* extracts in ethanolic, petroleum ether, and aqueous media may mitigate the effects of glucose in causing cataract in an in vitro model.

**Patel, Milap&Bg, Patel (2018)** This research aims to determine whether or not an Aqueous Extract of *Garcinia Indica* (AGI) fruit rinds may prevent cataract formation in rats subjected to naphthalene. The naphthalene model was used to test the effectiveness of AGI in preventing cataracts. Five groups of rats (n=6 each group) were created. To induce cataracts, naphthalene was dissolved in warm maize oil and then given to the animals at a rate of 0.5 g/kg/day orally (p.o.) for the first three days and 1 g/kg/day p.o. afterwards. 5 ml/kg/day of maize oil was given to the usual control group I. The cataract-controlling naphthalene solution was given to Group II. Along with the naphthalene solution, Group III got 50 mg/kg/day p.o. of vitamin E, while Groups IV and V received 200 mg/kg/day p.o. and 400 mg/kg/day p.o. of AGI, respectively. After the treatment was done, the carbonyl and sulfhydryl content of the lens homogenate, as well as the enzymatic and non-enzymatic antioxidants, were determined. A rise in the opacity index and the development of a mature cataract were the results of naphthalene administration. The naphthalene control group had significantly higher levels of LH and protein carbonyl content and lower levels of protein SH content and antioxidant enzymes than the normal control group. Cataract development was slowed when AGI and naphthalene were given at the same time. The current study provides evidence that AGI prevented lens oxidative damage caused by naphthalene, which may explain why cataract development was slowed.

**Wagh, June &Sathaye, Dr & Amin, Purnima&Wagh, Dr. (2022)** Diabetes-induced in both the industrialized and the developing world, cataracts are a significant cause of blindness. Recent fundamental studies have highlighted the polyol pathway's importance in the onset of illness. "Diabetic Cataract" refers to cataracts caused by diabetes. Cataract risk factors have been characterized thanks in large part to demographic research, which have also improved our understanding of the connection between diabetes and cataract development. Complications during phacoemulsification cataract surgery are more common in diabetic individuals than in the general population. Antioxidants and aldose-reductase inhibitors have shown promise in preventing and treating this potentially blinding disease in in vitro experiments. Inhibitors of aldose reductase have a crucial role in the management of diabetes and the avoidance of its consequences. With more therapeutic potential and fewer adverse effects, natural, herbal, and naturopathic drugs are increasingly being used nowadays. This study delves into the creation of an Eyedrop, a

simple, sterile, and safe ocular formulation that can replace phacoemulsification. Diabetic cataract may be prevented and treated with the use of a new eyedrop formulation that has undergone standardization and in vitro testing of an effective herbal extract.

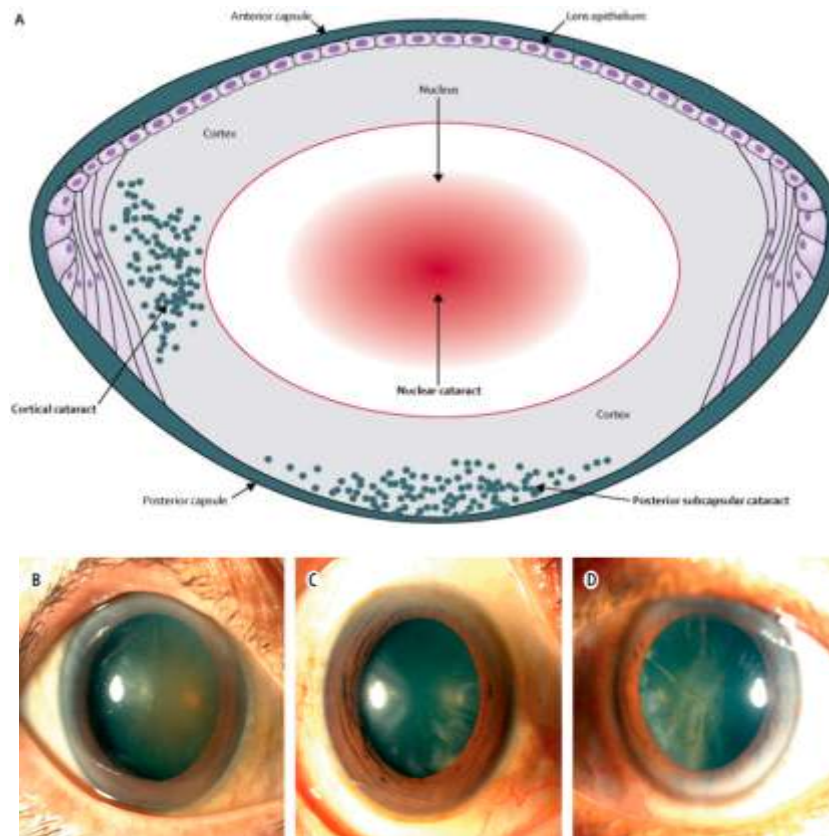
## **CURRENT TRENDS IN CATARACT PHARMACOTHERAPY**

Cataracts are a kind of lens degeneration characterized by clouding, resulting to blurred or hazy vision, and are a primary cause of avoidable blindness worldwide. Evidence suggests that 10.8 million of the 32.4 million blind persons and 35.1 million of the 191 million people with impaired vision worldwide are affected by cataracts. Cataracts become very common beyond age 40, with a rate of 3.9% in those 55–64 years old and a rate of 92.6% in those 80 and over. Cataract cases are expected to quadruple in the United States, from the current estimate of 24.4 million to 50 million by the year 2050. Common risk factors for cataracts have been identified via epidemiological research, and these include advancing age, smoking, exposure to Ultraviolet (UV) radiation, being a woman, using steroids, developing diabetes, and being overweight or obese. The number of people with cataracts is expected to rise globally as life expectancies rise, particularly in low-income nations that lack easy access to cataract surgery, necessitating the search for low-cost, pharmacological alternatives to the management of this disease.

### **Classification, Signs and Symptoms of Cataracts**

Cataracts are categorized according to the underlying disease process and the anatomical site of opacity. Cataracts may form during pregnancy or in young infants as they mature. Cataracts brought on by old age are often caused by oxidative stress. Physical trauma, inflammatory and degenerative eye illness, and metabolic disease are the root causes of traumatic cataracts, complex cataracts, and metabolic cataracts, respectively. On the other hand, exposure to toxicants, electromagnetic waves, and strong electrical currents may cause cataracts. Age-related cataracts are further subdivided into nuclear, cortical, and posterior subcapsular types depending on the anatomical location of opacity inside the lens (Figure 1A-D). Lens hardness (nuclear sclerosis) and discoloration (yellowing or browning) are symptoms of nuclear cataracts, which damage the lens's core.

Nuclear cataracts are prevalent in the elderly and are often linked to myopia. Cortical cataracts, on the other hand, impair the lens's peripheral fibers (near the lens's periphery), giving the lens a wedge shape. Nuclear cataracts significantly impair vision, but cortical cataracts just cause glares. Patients of a younger age group often have posterior subcapsular cataracts, which cloud the lens's posterior cortex. Cataracts of this kind often develop more rapidly than nuclear or cortical cataracts and are linked to hyperopia. Patients with posterior subcapsular cataracts may also feel glare, similar to those with cortical cataracts. Corticosteroid usage has also been linked to posterior subcapsular cataracts. Cloudy or blurred vision (Figure 2), glare, a halo around lights, poor night vision, and the need for new glasses or contacts often are all indications of age-related cataracts.



**Figure 1: Characteristics of lens structures and major types of cataracts for location-based classification**

Figure 1 shown Cataract kinds (A) and lens structures schematically. Images taken with a slit-lamp biomicroscope revealing a nuclear cataract (B), a cortical cataract (C), and a subcapsular posterior cataract (D).



**Figure 2:(A)Scene viewed by normal vision;and (B) a person with cataracts**

## **MEDICAL PLANTS AND NATURAL PRODUCTS USED IN PREVENTING AND TREATING CATARACTS**

The crystalline lens, which sits behind the iris, is the active component of the eye's optical system and is what brings the picture into sharp focus for the retina. Opacities or lack of transparency in the lens characterize cataract. Vision problems, reduced contrast sensitivity, color distortion, and glare are the most typical cataract symptoms. Lens

changes have the potential to act as biomarkers for population-wide indicators of health and age. Nuclear cataract, posterior subcapsular cataract, and cortical cataract are the three traditional categories of cataract based on the location of lens opacities. These forms may coexist and, if left untreated, lead to complete lens opacification. Age, diabetes, steroid usage, family history, and trauma are some of the most prevalent causes of cataract in adults. There is also a high incidence of congenital cataracts. Cataract is the gradual deterioration of the lens's visual quality due to the growth of Crystals (Crystalline Lens).

Free radicals, UV radiation, infrared radiation, malnutrition, smoking, eye chemical damage, certain medications like corticosteroids, penetrating and non-penetrating injuries, intraocular inflammatory diseases, and some congenital diseases are all linked to this condition. The more advanced the cataract, the more severe the visual impairment. Most persons over the age of 50 will develop age-related cataract, which is the most prevalent kind of cataract. Cataracts are rising in incidence in cultures due to inadequate diet, low income, poor social position, and low educational level, according to the World Health Organization (WHO). In underdeveloped nations, cataract is a major health problem since it is responsible for 47.8 percent of all occurrences of blindness. Cataract sufferers may now only regain vision via surgical intervention. Endophthalmitis, posterior capsule rupture, changes in intraocular pressure, and macular cystoid edema are all possible after cataract surgery, despite the fact that the procedure has improved much in recent years.

### **Medicinal Plants and Natural Cataract Treatments**

In most instances, damage to the lens caused by free radicals is responsible for its opacity. Proteins may be modified by free radicals under high oxidative stress, and some plant-based natural compounds might help avoid this insolubilization, which could postpone lens opacity. Since antioxidant effect is among the major mechanisms for preventing cataract in most of the cases, natural compounds comprising antioxidant or anti-inflammatory secondary metabolites could be seen as potentially optimal anticataract agents; however, not all plants possessing antioxidant potential could have anticataract properties. Plant polyphenols' anti-cataractogenic effects are also being researched in depth, both in vitro and in vivo. Although there is a great deal of fundamental and practical research in the area of cataract treatment by natural products, much of it is ethnopharmacological/ethnobotanical research, there are not many review articles accessible regarding the activity analysis of natural products against various cataract models. Forty-one plants were studied for their potential to prevent or treat cataracts, but only one publication was located that specifically addressed antioxidant-rich plants. There is no comprehensive evaluation accessible on the actions of various plant extracts and natural products in cataract models, despite the fact that there are a small number of ethnopharmacological surveys and reviews available.

### **CONCLUSION**

Cataract has been the major cause of avoidable blindness for decades, however effective pharmaceutical interventions to treat, prevent, or even reverse this illness have proven elusive. The anticipated rise in life expectancy is also expected to increase the global prevalence of cataract. In low-income countries where cataract surgery is not widely available or inexpensive, the disease's prognosis is, at best, uncertain. However, good medical treatment may lessen the need for—and the hazards associated with—surgery. The goal of this research is to identify the plants that may effectively cure cataracts with therapeutic properties. Vision problems, reduced contrast sensitivity, color distortion, and

glare are the most typical cataract symptoms. One of the key factors in the onset of age-related cataract is oxidative stress. Traditional systems of medicine such as Ayurveda, Traditional Chinese Medicine, and Korean Traditional Medicine all make use of medicinal plants, and many of these plants are also indicated for cataract care in folk medicine. To confirm the use of such plants, however, robust preclinical and clinical research are necessary. Until then, it is crucial to record the plants used in traditional medicine more thoroughly.

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