PHARMACOLOGICAL SCREENING OF CATARACT USING MEDICINAL PLANT EXTRACT

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ABSTRACT
It is the biggest cause of blindness in the world since it is characterised by the presence of any lens opacity or loss of transparency. Cataract Impaired vision, diminished contrast sensitivity, colour disharmonies, and glare are some of the most prevalent symptoms of cataracts Oxidative stress is a major factor in the development of cataracts as we get older. An intraocular lens implant and phacoemulsification procedure, which is the most effective way to cure cataracts, may cause major problems and perhaps permanent blindness. Secondary metabolites that are antioxidants or anti-inflammatory natural chemicals may be used as a starting point for the development of anti-cataract drugs. Using ethnopharmacological/ethnobotanical data, we documented medicinal plants and plant-based natural products used for cataract therapy across the globe in this study.

KEYWORDS: medicinal plants, natural products, cataract, antioxidant, aldose reductase, lens opacity, MAPK

INTRODUCTION
The dynamic component of the eye's optical system, the crystalline lens, is located behind the iris and is responsible for focusing the picture onto the retina. Lens opacity or lack of transparency is a sign of cataract. Impaired vision, diminished contrast sensitivity, colour disharmonies, and glare are some of the most prevalent symptoms of cataracts Modifications to one's lens may also be indicative of one's general health and ageing as a whole (Song et al., 2014). Cataracts may be divided into three categories based on the kind of lens opacity they have: nuclear, posterior sub capsular, and cortical. If left untreated, these conditions may lead to complete lens opacification, which can be life-threatening. Adults with diabetes, steroid usage, a family history of cataracts or trauma are among the most prevalent causes of cataract. The frequency of congenital cataracts is likewise high.

In spite of recent technical advances in eye surgery, cataract remains the leading cause of global blindness, despite these advances. Around 32 million individuals were blind in 2010 and 191 million had impaired eyesight. As many as one in three persons who are blind have cataracts (Khairallah et al., 2015). 90 million people worldwide will be blind by 2020, according to the World Health Organization (WHO) (Khairallah et al., 2015; Taylor, 2016). It will be expensive to combat this problem by investing in human capital, building up infrastructure, and implementing effective disease control.
measures. The latter is determined by the individual disease's features. In Europe, the prevalence of cataracts rises from 5% for individuals aged 52–62 to 64% for those aged 70 and above (Prokofyeva et al., 2013). The ageing of the population is a worrying problem since age is a non-modifiable risk factor in the pathogenesis of cataracts. It is critical to identify cataract-related risk factors that may be changed in order to develop effective preventative interventions.

LITERATURE REVIEW

C Nirmala (2021) There are several local varieties of the shrub, which may be found in tropical and subtropical climates. Raw and refined components from the entire plant and its sections revealed diverse pharmacological effects including antioxidants, analgesics and sedatives as well as antibacterial and anti-fungal/parasitic capabilities. Plants with a strong phytochemical profile and a long history of medicinal use are particularly useful in treating infections, inflammation, and other degenerative disorders. Although more research is needed to validate its traditional usage against various ailments, it must be confirmed. Research into the mechanisms that prevent cataracts and diabetes as well as anaemia and cancer has to be done in greater depth. Despite the large number of published studies on the suggested plant, there is growing interest in its medicinal properties, particularly the alkaloids and flavonoids, for the purpose of developing new drugs.

Murugan Prasathkumar (2021) Many acute and chronic illnesses may be treated using traditional herbal remedies, which have few or no harmful effects and are widely utilised in health systems across the world. To treat a wide range of ailments, including TB, cancer, diabetes and heart disease as well as wound healing and respiratory issues including asthma and pneumonia, herbal plants are often employed. Alkaloids, flavonoids, tannins, and polyphenols, among other bioactive phytomedicine chemicals found in plants, have long been utilised in traditional medicine to treat disease. Herbal medicine is regarded as a "living tradition" in India because of the country's extensive collection of medicinal herbs.

Feriyani Feriyani (2021) It is one of the leading causes of vision loss in the globe. A condition like cataracts may be caused by oxidative stress. Malondialdehyde (MDA) is a biomarker for this oxidative stress ability. Many ailments, including cataracts, are treated using Indonesian natural plant Anredera cordifolia (Tenore) Steenis, often known as binahong leaf Flavonoids and antioxidants in Binahong leaf (Anredera cordifolia (Tenore) Steenis) may be utilised to cure cataracts. Objective. MDA levels in a goat's lens containing cataract-inducing substance were examined in this investigation using the binahong leaf extract. Method. There were a total of 40 goat eye lenses, which were divided into four groups: a control group with glucose 5.5 mM, a cataract-inducing group with glucose concentration of 55 mM, and an experimental group with glucose 55 mM + binahong leaf extract (100 g/ml) and binahong leaf extract (200 g/ml) (positive control).

Devesh Tewari (2019) It is the biggest cause of blindness in the globe because of the existence of any lens opacity or loss of transparency. Impaired vision, diminished contrast sensitivity, colour disharmonies, and glare are some of the most prevalent symptoms of cataracts As we age, our eyes become more susceptible to the effects of oxidative stress. Phacoemulsification and intraocular lens implantation is the most efficient approach for cataract therapy, however problems and permanent vision loss might occur as a side consequence. Antioxidant and anti-inflammatory secondary metabolites found in natural chemicals may function as potential anticataract therapies. In this research, we sought to compile a list of
ethnopharmacological/ethnobotanical data on medicinal plants and plant-based natural products used to cure cataracts across the globe.

**Pasumarthy N.V. Gopal (2016)** As one of the most sensitive organs in the body, the eye is constantly exposed to a wide range of environmental irritants and pollutants. Conjunctivitis, cataracts, ocular allergies, glaucoma, and inflammation are just a few of the common eye diseases. In light of the negative effects of allopathic pharmaceuticals, herbal medicines have become the primary therapy for eye illnesses in recent years. Even in both rich and developing nations, cataracts account for half of all occurrences of blindness in the globe. Surgery is the most common treatment for cataracts, which are an eye condition. Using this research, I was able to provide a concise summary of the literature on several plant materials that may be used to cure cataracts naturally rather than surgically.

**METHODOLOGY**

It was our goal to acquire and compile data from diverse preclinical studies and ethnopharmacological reports into a single database. The databases we used were Scifinder, ScienceDirect, Pubmed, Scopus, and Google Scholar, to mention just a few of the many. The "AND" operator was used to search for "cataract" and other terms, such as "cataract," "traditional medicine," "ethnobotany," "sodium selenite," and "ethnopharmacology," in the same way as in prior systematic reviews (Tewari et al., 2017 and 2018).

Are folk and traditional medicine's medicinal plants and natural products important in the treatment of cataract? That's the overarching question we set out to answer in this work. In vitro/in vivo models utilised worldwide for the study of cataracts, as well as Preclinical research on several cataract models suggest that plants used in ethnomedicine might lead to the creation of new medication candidates in the future, as well. This is a great opportunity for scientists and researchers working in this field, as well as for patients, to advance preclinically successful plants into clinical trials.

**ANALYSIS**

The activation of MAPKs is mediated by xidative stress. Apoptosis-inducing compounds derived from MAPK activation have been investigated. An in vitro study found that hydrogen peroxide activates p38 MAPK, which causes cell death in lens epithelial cells, and that antioxidants may minimise its effects. ROS and apoptosis were decreased when p38 MAPK inhibitors were used (Bai et al., 2015).

Table 6 provides a comprehensive overview of ethnopharmacological surveys' reports on medicinal plants used to treat cataracts. Singh et al. (2012) had also included the medicinal plants used in the treatment of cataract, however the mechanistic insight was not done and plants utilised in the therapy of cataract till 2011 were included (Singh et al., 2012).

**Table 1 | “Medicinal plants/natural products used against cataract on hydrogen peroxide- and naphthalene induced cataract and other miscellaneous models and possible mechanisms of action”**

<table>
<thead>
<tr>
<th>Plant (with part used)/natural product</th>
<th>Doses, concentrations and characteristics of</th>
<th>Suggested/possible mechanism of action</th>
<th>References</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Extract Type</th>
<th>Activity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abies pindrow (Royle ex D.Don) Royle (Leaves)</td>
<td>Aqueous extract (5–20 mg/mL)</td>
<td>Inhibition of free radical generation.</td>
<td>Dubey et al., 2015b</td>
</tr>
<tr>
<td>Cistanche deserticola Y.C.Ma and SkQ1 (Stolons)</td>
<td>Fraction</td>
<td>Increase of the lens protein solubility and destroying of large protein aggregates, antioxidant action leads to elevation of tryptophan and kynurenine levels in the lens.</td>
<td>Snytnikova et al., 2012</td>
</tr>
<tr>
<td>Elaeagnus rhamnoides (L.) A.Nelson (Syn. Hippophae rhamnoides L.) (Leaves)</td>
<td>Aqueous extract, 100–1,000 mg/mL</td>
<td>Regulation of oxidative stress and promotion of antioxidant systems.</td>
<td>Dubey et al., 2016</td>
</tr>
<tr>
<td>Erythrina stricta Roxb. (Leaves)</td>
<td>Hydromethanolic extract (fractions), 200 mg/kg</td>
<td>Antioxidant activity, prevented the peroxidative damage caused by naphthalene.</td>
<td>Umamaheswari et al., 2010</td>
</tr>
<tr>
<td>Foeniculum vulgare Mill. (Fruits)</td>
<td>Petroleum ether fraction, 10 mg/kg, twice daily</td>
<td>AR reduction and antioxidant action.</td>
<td>Dongare et al., 2012</td>
</tr>
<tr>
<td>L-arginine</td>
<td>L-arginine</td>
<td>Blocking of carbonyl stress in the lens.</td>
<td>Fan et al., 2011</td>
</tr>
<tr>
<td>Luffa cylindrica (L.) M.Roem. (Fruits)</td>
<td>Standardized extract, 5–30 mg/mL</td>
<td>Protection of lens proteins from oxidative damage.</td>
<td>Dubey et al., 2015a</td>
</tr>
<tr>
<td>Nigella sativa L. (Seeds)</td>
<td>Oil</td>
<td>Inhibiting of RNS generation, antioxidant action, and FRSA.</td>
<td>Taysi et al., 2015;</td>
</tr>
<tr>
<td>Ocimum tenuiflorum L. (Leaves)</td>
<td>Aqueous extract, 150 mg/mL</td>
<td>FRSA</td>
<td>Demir et al., 2016</td>
</tr>
<tr>
<td>Pueraria montana var. lobata(Will) Sanjappa &amp;</td>
<td>Puerariafuran isolated from metabolic extract</td>
<td>Inhibition of AR, xylems-induced lens opacity, and</td>
<td>Kim et al., 2010</td>
</tr>
</tbody>
</table>
Pradeep[Syn. Pueraria lobata (Willd.) Ohwi] (Roots)  the oxidation in lenses.

Vitis vinifera L. (Seed)  Extract constituting of 95% proanthocyanidins  Attenuates cell signaling, cell migration and inflammation.  Jia et al., 2011

![FIGURE 1 Percentage of different models used for evaluation of anticataract activity of plants/natural products](image)

An 11-year-old atopic dermatitis patient's cataract or the development of cataract was worsened by therapy with an unknown herbal drug (Kang et al., 2008). Natural products used to treat cataracts are most commonly studied using models that include selenite/sodium selenite-induced cataracts, sugar-induced lens opacity/diabetes-induced cataract models, AGE-BSA cross-linking inhibition assay, lens aldose reductase activity models, and hydrogen peroxide-induced cataracts. Cataracts may be treated using a wide range of phytochemicals found in a wide variety of plants. Antataract action is mediated in part by antioxidant action (inhibitory effect on ROS formation). Antioxidant enzyme activity is also boosted by a number of plants. Additionally, calpain inhibitory, lipid peroxide inhibition, amelioration of calcium-induced proteolysis, alteration of protein profiles and insolubilization of soluble proteins, attenuation of inducible nitric oxide synthase expression, and AR inhibition are all important mechanisms in this process.

Various variables affecting the bioavailability of ocular medications should be taken into account while developing ocular drug delivery. It's important to keep in mind that the drug's salt form and osmolality are also elements to consider (Goodman, 1996). Scientific evidence is mounting that natural compounds may cure cataract on several levels, but they must also be subjected to rigorous testing for their safety and toxicity. Even while there is some evidence that natural items may reduce the risk of developing cataracts, scientific studies are still missing.

**CONCLUSION**

For the development of natural product treatments against cataract, ethno pharmacological study of medicinal plants used for cataract therapy might be an advantageous strategy. In this study, we examined over 120 publications and

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discovered that 44 medicinal plants and natural items are employed in various traditional and folk medicine systems for the treatment of cataracts. It is also explored the possible processes of roughly 118 plants/natural products (repeated in several models). Of note is that many ethnobotanical survey studies have come from developing nations like Bangladesh and Chile and have reported findings from ethnobotanical research conducted in Nepal and Tanzania. Traditional medical systems such as Ayurveda, Chinese traditional medicine, and Korean tradition medicine all reference medicinal plants for cataract care, in addition to the folk medicine that relies on them. In order to confirm the usage of these plants, extensive preclinical and clinical investigations are still necessary. Documentation of traditional medicine plants is still of paramount relevance.

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