

# A Pharmacological study of *Boerhavia Diffusa* roots in the treatment of eye diseases

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**Abstract - The present research work aims to explore the therapeutic uses of root of *Boerhavia diffusa* in eye ailments particularly to evaluate its suitability as a topical formulation in the form of eye drops. The study utilised both the *in vivo* and *in vitro* techniques in order to assess the effectiveness and safety of the plant extract. Male adult Wistar albino rats were used in inducing cataracts and in the efficacy testing of the formulated eye drops. The study contrasted the outcomes of the *Boerhavia diffusa*-based eye drops against a traditional commercial eye drop known as Itone. Studies revealed that the herbal formulate did not cause any form of ocular irritation and also that there were possibilities of using this formulation to controlled formation of cataract. The lens opacity score analysis using photometry and lens morphology observation for 30 days showed that treatments with *Boerhavia diffusa* eye drops had less increase from the basal level and less fold increase compared to the control group. They hypothesize that this herbal preparation could be an effective Natural treatment option or an adjunct therapy for some eye afflictions especially cataract.**

**Keywords: *Boerhavia Diffusa*, Treatment, Herbal, Healthcare, Eye, Opacity Score.**

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## INTRODUCTION

Various kinds of health care are accessible to people in various societies. Both developed and developing nations face a healthcare scenario that is often seen in industrialized nations; this is called healthcare pluralism. People throughout the globe seek medical assistance in diverse ways, and this diversity in healthcare systems within a single nation is a reflection of that. In developed nations like the United States, Europe, and Australia, there are two distinct healthcare systems that coexist. This phenomenon is known as healthcare pluralism. It is only fair that people have access to public health programs while still being able to seek care from whatever private facility they want. Because of the duality, individuals may choose between different healthcare systems based on things like cost and accessibility. [1]

Another way in which healthcare diversity shows itself is in the hybrid nature of traditional and contemporary medical practices seen in developing nations. Traditional medicines, cultural traditions, and institutionalized healthcare systems often work together to address health concerns in local communities. Societal, economic, and cultural factors, as well as historical and contemporary events, all contribute to the distinctive health seeking behavior. The strength of health plurality is in the variety of

choices it presents, each of which may be adapted to meet the specific requirements and preferences of the person. However, obstacles do exist, such as the need to promote collaboration and dialogue amongst various providers and the difficulty of guaranteeing access to adequate and suitable treatment within health care systems. Improving our knowledge of system interactions and resolving to provide health care that puts people and communities first are essential for directing the expansion of health services. In order to guarantee that everyone has access to good health care in an ever-changing society, dynamic health plurality emphasizes the need for inclusive reform initiatives.[2]

As part of their contemporary profession, medical teams in nations like China and India provide occupational health care that combines Western scientific medicine with local traditions, which benefits society as a whole. This encompasses not only medical physicians but also other medically-recognized professionals, such as midwives, dentists, optometrists, and physical therapists. [3] There is also a folk sector that operates in tandem with the professional one; its practitioners focus on therapeutic techniques that have their origins in either religious or secular traditions, or both. This folk sector maintains a diverse array of healing practices that have long been practiced in communities across

the world. From osteopaths, midwives, tooth extractors, herbalists, and bone-setters to clairvoyants and spiritual healers, folk healers include a wide spectrum of professionals. With a combination of prevailing traditional knowledge and behaviors, the folk sector reflects the cultural and historical subtleties of different communities. [4]

People here have access to a wide range of medications since both Western science and traditional healing practices coexist. The integration of professional and community-based sectors highlights the need of adaptable healthcare systems that can embrace diverse practices while ensuring the overall well-being of the community. [5] In underdeveloped nations where modern medical treatment is scarce, traditional healers play a crucial role. According to the research, 70–90% of health care practitioners in certain regions of the nation are folk healers, especially in areas where the health system has not been adequately developed by professionals. Even though Western medicine has advanced, there are still civilizations that use these ways. As a result, traditional therapeutic practices that are based on cultural and community traditions, in addition to modern medicine, continue to have merit. [6]

Methods that people use outside of formal therapy settings, such as self-treatment, consulting with relatives and friends, and consulting with more seasoned individuals, are all part of the popular sector. The cultural heritage, standing in for the social intelligence, has a powerful influence in making such judgments. The diversity of approaches that make up the public sector is indicative of the adaptability and variety of healthcare problems that may be found in many contexts. The majority of people still rely on traditional healing methods, even though many believe in the benefits of contemporary Western scientific treatment. Traditional attitudes, lack of resources, and an absence of modern healthcare options are common causes of dependence. It shows how cultural factors, in addition to traditional medicine and other old therapeutic approaches, must be considered for world health. [7]

To guarantee access to primary health care based on western standards, the World Health Organization launched "health for all by year 2000" in the 1990s. In addition to promoting illness prevention and community engagement in the healthcare system, the initiative sought to address the problem of disease inequality. Despite the unfulfilled goal, the proclamation set in motion worldwide initiatives to improve public health systems and provide equitable access to treatment, which in turn influenced the present push for high-quality healthcare for everyone. [8]

As a precondition for a high-quality existence, health is ranked first in the ancient books of wisdom. Disease prevention and treatment is the only field that even somewhat resembles the good aspects of wellness. The use of traditional herbal medicines for the treatment and prevention of illness is one of the long-

standing traditions that have persisted throughout history. Traditional Indian medicine (Ayurveda, Unani, Siddha, and Homeopathy) relies on herbal remedies and other plant-based substances for patient treatment. Dietary plant sources of key macromolecules crucial to treating a wide range of human diseases are abundant. Natural resource-based traditional medicine systems, such as Ayurveda, now provide for 70% of India's healthcare requirements. Some estimate that there are 250,000 species of exceptional plants in the globe, with India supplying 50,000 of them to different organizations. The "Botanical Garden of the World" designation is justifiably bestowed to India for its prominence as a provider of therapeutic herbs. There are several pharmacological, nutritional, and cosmetic uses for plant materials, which is why they are attracting more and more interest. Some of these substances have many uses; they include agrochemicals, tastes, perfumes, pigments, food additives, and, more recently, nutraceuticals. [9] They are derived from certain medicinal plants. The natural model with synergistic effects for combination therapy is provided by phytopharmaceuticals, which are herbal medications produced from plants. These medicines provide a more comprehensive approach to treatment than those that rely on single synthetic chemicals since they comprise mixtures of bioactive components. This synergy between natural ingredients not only makes the product more effective, but it also makes it safer to use. Figure shows that there is hope for establishing successful therapeutic techniques based on the synergy of natural substances thanks to the intricate interactions within phytopharmaceuticals, which are part of combinatorial therapy. [10]

## MATERIAL AND METHODS

An attempt was made in this research to assess the effectiveness of eye drops derived from a water distillate of *Boerhaavia diffusa*. Preclinical investigations will be guided by these research. Following the procedures outlined in the sections dealing with pharmacognostic and phytochemical research as well as formulation development, the plant material was gathered, authenticated, and then transformed into an aqueous distillate (arka) or eye drop. [11]

- **Assessments And Experiments**

### *In-Vivo* Studies

**Ocular irritation test:** We observed for redness, inflammation, or an increase in tear production to assess the ocular irritancy effects of the formulations. In order to estimate the human ocular reaction to the investigated items, a local irritation test was conducted. male Wister rats were used to test various formulations, including eye drops. [12] The animals in the eye drop groups were given either plain gel or distilled water as a control. Up to 10 hours after instillation, no abnormalities were

detected when both eyes of the test animals were inspected for signs of irritation. [13]

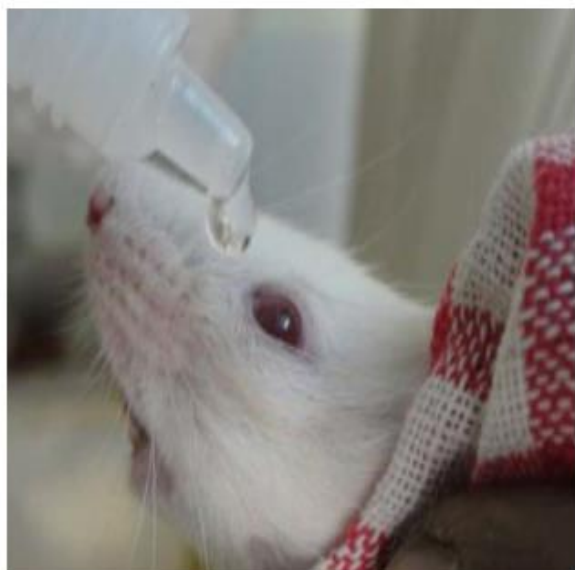


Figure 1: Applying eye drops



Figure 2: The eye returns to normal after three days of using eye drops.

### In-Vivo Study

There were a total of six male Wister rats used in this study; rats in group I served as controls, while rats in group II received an ophthalmic drop (eye drop) to evaluate the formulations' effectiveness. Two drops of distilled water into each eye, twice day, was all that the control group got. [14] In group II, the identical animal had test samples of eye drops and the conventional medicine Itone (Eye drop) injected into both of its eyes. The drug was made by Deys Pharmaceutical Pvt. Ltd. of Calcutta.[15]

### The Cataract Induction

Subcutaneous injections of 0.1 ml of sodium selenite (0.01% w/v) were administered to all groups of rats. From 12 to 48 hours, opacity was created. [16] The degree of lens opacity, or cataract maturity, was assessed using grading standards developed for use with an ophthalmoscope. The test was conducted with the use of tropicamide (0.5%) and phenylephrine (10%) to achieve the maximal dilation of the pupils.[17]

### Design of the study and groups

**Animals:** Wistar male albino rats (Weight 108-129gm)

Animals were divided in to three groups, each group containing 6-animals.

**Group I :** Control

**Group II :** Treated with preparation (Eye Drop)

**Standard drug :** *Itone* (Deys Pharmaceuticals Calcutta)

**Dosing** Treated group : Left eye

**Standard :** Right eye of same animals

**Cataract development :** 0.1 ml of Sodiumselenite (0.01% w/v), Subcutaneously.

**Development of cataract :** 24- 48 hrs

**Dosing :** From first day of cataract induction.

**Assessment based on morphology and photography:**

In order to determine lens opacity, the lenses could be seen clearly via the eyes.

Here are the grades for the degree of opacity:

- |             |                                                            |
|-------------|------------------------------------------------------------|
| <b>0</b>    | <b>: Absence</b>                                           |
| <b>+</b>    | <b>: Slight degree</b>                                     |
| <b>++</b>   | <b>: Dispersed opacity is present</b>                      |
| <b>+++</b>  | <b>: There is a significant amount of diffuse opacity.</b> |
| <b>++++</b> | <b>: Identification of a large area of dense opacity</b>   |

### RESULTS

#### Visual Irritation Evaluation

There was no evidence of redness, irritation, or increased tear formation in any of the improved formulations.

### Photometric Assessment and Lens Morphology

Rats had their opacities measured using photometric analysis for 30 days after cataract induction.

Cataracts developed throughout the whole retina in group I (control) subjects given sterile distilled water, and this condition persisted even after 30 days. [18] Additionally, all six lenses in group II (eye drop) originally had a modest degree of opacity. Near the middle, the opacity rose gradually, reaching full opacity after 48 hours. Beginning on the first day after cataract induction, treatment was initiated. Reduce the formation of opacity using eye drops. [19] The onset of opacity was subjectively delayed by Group II (eye drop). There were three levels of opacity:+++,+ and +. In comparison to the standard, the study also demonstrated an equivalent delay in the formation of cataracts.[20]

Imaging the development of cataracts and the impact of experimental eye drops and a reference medication was captured using a digital camera with a SONY 25 mm wide angle lens and an optical zoom of 10X in macro mode. [21]



**Figure 3: Image of cataract induction (adult cataract)**



**Figure 4: After using eye drop therapy, take a photo.**



**Figure 5: Images taken after normal (Itone) therapy**

### CONCLUSION

Analysis of the ethanolic extract of Boerhavia diffusa roots used in treating eye related diseases including cataracts has shown beneficial effects. With reference to safety, no signs of ocular irritation were observed from test subjects applying the formulated eye drops. Most significantly, the reinvented treatment demonstrated the capacity of preventing and reversing incipient cataracts and reducing lens opacity in induced cataract models involving Wister rats. The herbal eye drop formulation was also as effective as the commercial eye drop formulation, the Itone in arresting cataract in the rabbits. This implies that eye drop made from Boerhavia diffusa could complement or act as a doze eye treatment for particular eye ailments. Nonetheless, it is clear that more research needs to be done, although the above given results can be seen as promising. However, further studies need to be conducted involving large-scale human clinical trials, long term assessment of safety profile and detailed research on the elucidation of specific working of this polyherbal formulation in clinical ophthalmology. This study opens the gates for other independent researchers to integrate traditional herbal medicines and modern pharmaceutical drugs. It also calls for further research on phytopharmaceuticals that may help solve major health challenges and offers an opportunity to discover the health benefits of using natural products for ocular health.

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