Ex Vivo Therapeutic Assessment of Cardiospermum halicacabum Extract: A Dual Investigation on Cataract and Helminthic Infections

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***Abstract*—This research examines the therapeutic power of ethanolic Cardiospermum halicacabum extract on cataractogenesis and helminthic infections in ex vivo conditions. The plant underwent an authentication process before shade-drying for cold maceration extraction. A preliminary phytochemical examination showed that the extract contained alkaloids, together with flavonoids and carbohydrates and proteins and amino acids and glycosides and saponins and phenols, and tannins. Anthelmintic activity was evaluated using Indian adult earthworms, where the extract demonstrated significant, dose-dependent paralytic and lethal effects, comparable to the standard drug albendazole. The extract showed strong antioxidant and protective properties by reducing lens opacification in glucose-induced cataract goat lens models. The therapeutic effects of C. halicacabum validate its traditional use in medicine and demonstrate its potential as a natural treatment option. Additional studies using living organisms together with detailed mechanism analysis need to identify the active components while proving safety for clinical practice validation.**

***Index Terms*—Cardiospermum halicacabum, ethanolic extract, phytochemical screening, ex vivo evaluation, herbal therapeutics, anthelmintic activity, cataractogenesis, antioxidant activity.**

I. INTRODUCTION

HERBAL PLANTS

People have used medicinal plants as a source of cures and treatments for many illnesses. Many cultures worldwide have recognized and utilized these plants' therapeutic qualities. Because of their potential efficacy and few adverse effects, medicinal plants have attracted increased attention as natural substitutes for synthetic medications in recent years [1][2][3].

HELMINTHES

Helminthes infections are a cause of serious concern to human health as well as cattle. Helminthes larvae mostly reside in the intestinal tract, which causes malnutrition, pneumonia, eosinophilia, and anaemia. Other clinical signs and symptoms are dysentery, skin diseases, loss of appetite, and weight loss. Instances of occurrence of eggs or larvae in other body tissues have also been found [4][5]. Parasitic diseases, particularly helminthiasis, occur more frequently in tropical nations such as Asian nations and are endemic in origin. Unregulated and continuous usage of chemical anthelmintic drugs over significant years has led to resistance among helminthes against drugs. Consequently, novel anthelmintic drug candidates' discovery is of utmost significance in order to reduce the havoc helminthes create. Due to the common observations, drug candidates derived from nature possess fewer side effects compared to the chemically synthesized ones. This has given impetus to pharmacognostic research on the anthelmintic potential of plant-based products during the last few years [6][7].

CATARACT

The decrease in transparency in the lens due to opacification is known as a cataract. Reduces the quantity of light that reaches the eye. The lens is a derivation of the epidermis and, like hair, it tends to get dark and gray with age [8][9]. Cataracts affect about 90% of people by the age of 70; however, the condition usually causes very little vision loss and progresses very slowly. Additionally, it may appear at birth in very rare cases or develop following trauma or surgery [10][11].

PLANT PROFILE

The name Cardiospermum refers to the white heart-shaped pattern on the seed and is derived from the Latin words "cardio," which means heart, and "sperma," which means seed. The Latin word "halicacabus" refers to a plant with puffed fruits, and this is where halicacabum gets its name [12][13][14].

Biological sources: whole plant of "Cardiospermum halicacabum"

Family: Sapindaceae

Common name: Balloon Vein, Heart's Pea, Mudakattan, Ekkudutige, Buddakakara

Uses: C. halicacabum is used to treat chronic bronchitis, limb stiffness, and snakebite. In Unani medicine, seeds are offered as a cancer-curing tonic, for neurological disorders, rheumatism, and lumbago, and as a demulcent for dropsy and orchitis. It helps dry, itchy skin and scalp, and is sold as herbal preparations in cream, gel, shampoo, spray, and other forms. [15][16][17].

Figure 1: Cardiospermum halicacabum

AIM

To assess the ethanolic extract of Cardiospermum halicacabum's anti-helminthic and anti-cataract properties for their potential as an ex vivo treatment.

OBJECTIVE

- To prepare the ethanolic extract
- To identify the presence of bioactive constituents
- To evaluate the anti-cataract and anti-helminthic activity.

II. METHODS AND MATERIALS

PLANT COLLECTION

The fresh leaves, stems, fruits, and flowers of the plant Cardiospermum halicacabum were collected from the neighborhood farm. The taxonomy of the plant was authenticated by Dr. K.N. Sunil Kumar, Research Officer/Sci-II and HOD of Pharmacognosy, Siddha Central Research Institute, Chennai-600106.

PROCESSING

The collected samples were carefully washed with tap and distilled water to remove dust and dirt. To preserve the integrity of the phytochemicals, they were then shade-dried for seven to ten days at room temperature [18]. Once they had completely dried, a mechanical blender was used to grind the plant materials into a coarse powder. The powder was kept in a sealed container until it was extracted [19].

COLLECTION OF EARTHWORMS

Indian adult earthworms were obtained from neighborhood soil, and it was washed with normal saline to remove the fecal matter. As per the literature review, earthworms of 8-10cm in length and 0.3-0.4cm in width were used for the study [23].

Figure 2: Earthworms

COLLECTION OF EYE BALL

As soon as the goats were killed, fresh eyeballs were collected from the nearby slaughterhouse and brought to the lab, where they were kept between 0 and 4°C.

PROCEDURE

EXTRACTION PREPARATION

In a beaker, about 50g of the coarse powder had been soaked in 500ml of ethanol. For 72 hours, the mixture was maintained at room temperature with occasional shaking. Three days later, Whatman No. 1 filter paper was used to filter the mixture. The filtrate was utilized for further pharmacological activity and phytochemical investigation The filtrate was utilized for further pharmacological activity and phytochemical investigation [19, 20].

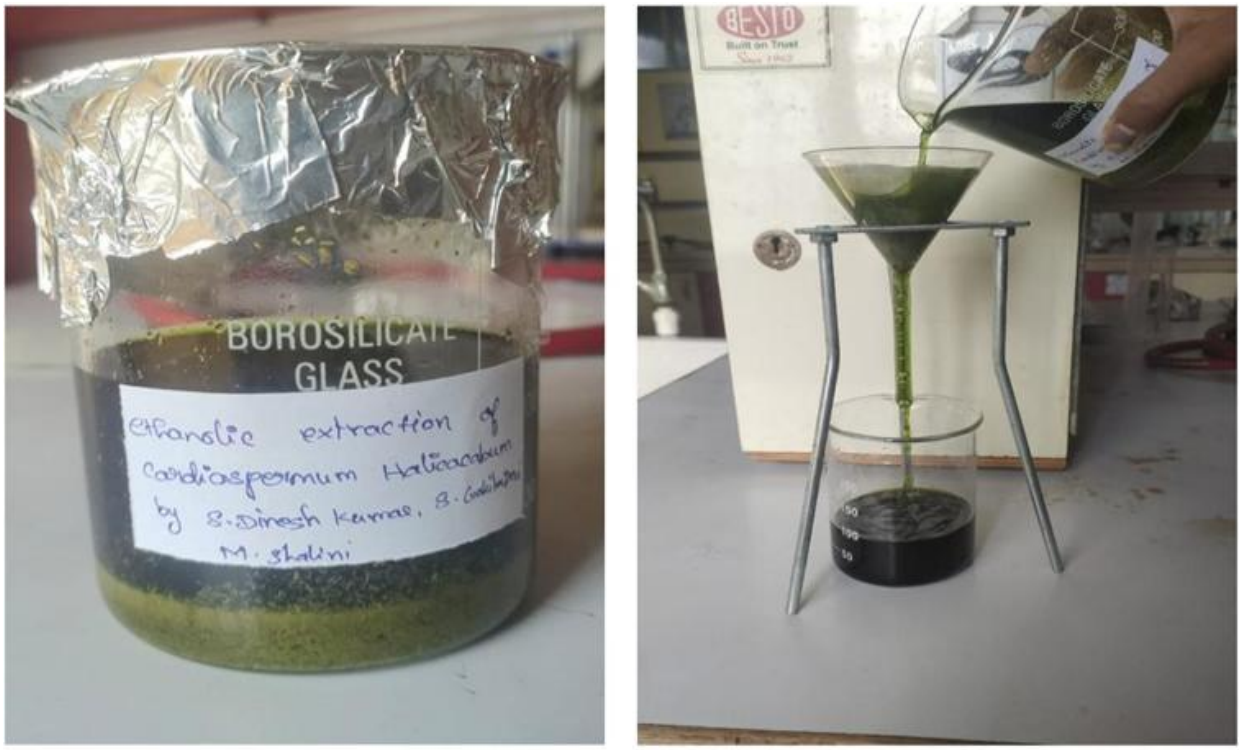

Figure 3: Extraction process of the sample

III. PROCEDURE FOR ANTI HELMENTIC ACTIVITY [24,25]

Anthelmintic activity of the aerial part of plant extracts of Cardiospermum halicacbum was determined against earthworms. Six groups of earthworms were prepared. Separate earthworms were released in 10 mL of the required control, reference drug, and extract formulation in clean Petri dishes. Group 1 earthworms were released in 10 mL of distilled water in a sterile petri dish. Group 2 earthworms were put in 10 mL of normal saline with the standard drug albendazole (25

mg/mL) present, which is the reference drug in this research work. Group 3, 4, and 5 earthworms were put in all 10 mL ethanolic extract solutions at a concentration of 25 mg/mL, 50 mg/mL, and 100 mg/mL, respectively. Earthworms were sensed; paralysis duration and death duration were recorded and measured in minutes. Paralysis was reported as a function of the response of earthworms with no resurrection body state in the normal saline medium. Death was determined upon finding that the earthworm neither moved when violently shaken nor upon being immersed in warm water (50 °C) with bleached body color.

STUDY DESIGN AND GROUPS [25, 26]

Collected earthworms were divided into five groups

S.NO	GROUPS	VOLUME OF DRUG-INDUCED
1.	GROUP I	DISTILLED WATER
2.	GROUP II	NORMAL SALINE
3.	GROUP III	EXTRACT 25mg/ml
4.	GROUP IV	EXTRACT 50mg/ml
5.	GROUP V	EXTRACT 100mg/ml
6.	GROUP VI	STANDARD ALBENDAZOLE 25mg/ml

Table 1: Study design and groups for anti-helminthic activity

PREPARATION OF LENS

Extra-capsular extraction was used to isolate the lenses and incubated in artificial aqueous humor (NaCl 140 mM, KCl 5 mM, $MgCl_2$ 2 mM, NaHCO3 0.5 mM, $NaH(PO4)_2$ 0.5 mM, $CaCl_2$ 0.4 mM, and glucose 5.5 mM) at room temperature and pH 7.8 for 72 hr. To stop bacterial contamination, culture media were supplemented with 200 mg of streptomycin and 30 mg of penicillin.

INDUCTION OF CATARACT [27,28]

Glucose at a concentration of 55 mM was utilized for the induction of cataract. At high concentrations, glucose in the lens was metabolized via the sorbitol pathway and polyol (sugar alcohol) accumulation, leading to overhydration and oxidative stress. This resulted in cataractogenesis.

STUDY DESIGN AND GROUPS [29,30]

S.NO	GROUPS	VOLUME OF DRUG INDUCE
1.	GROUP I (Normal control)	Glucose 5.5mM
2.	GROUP II (Toxic control)	Glucose 55mM
3.	GROUP III (Test)	Extract 50mg/ml
4.	GROUP IV (TEST)	Extract 100mg/ml
5.	GROUP V (Standard)	Enalapril 10mg/ml

Table 2: Study design and groups for anticataract activity

IV. RESULT

PHYTOCHEMICAL SCREENING [21, 22]

Preliminary phytochemical screening was carried out using the standard procedure for the Identification of Alkaloids, Glycosides, carbohydrates, Saponins, Proteins, Amino acids, Steroids, Triterpenoids, Flavonoids, and Tannins.

S.NO	PHYTOCHEMICAL CONSTITUTION	PRESENT	ABSENT
1.	Carbohydrate	Present	
2.	Alkaloids	Present	
3.	Flavonoids	Present	
4.	Proteins	Present	
5.	Amino acids	Present	
6.	Steroids		Absent
7.	Terpenoids		Absent
8.	Saponins	Present	
9.	Phenols	Present	
10.	Glycosides	Present	
11.	Tannins	Present	

Table 3: Phytochemical screening.

V. ANTI-HELMINTHIC ACTIVITY
EX VIVO EVALUATION

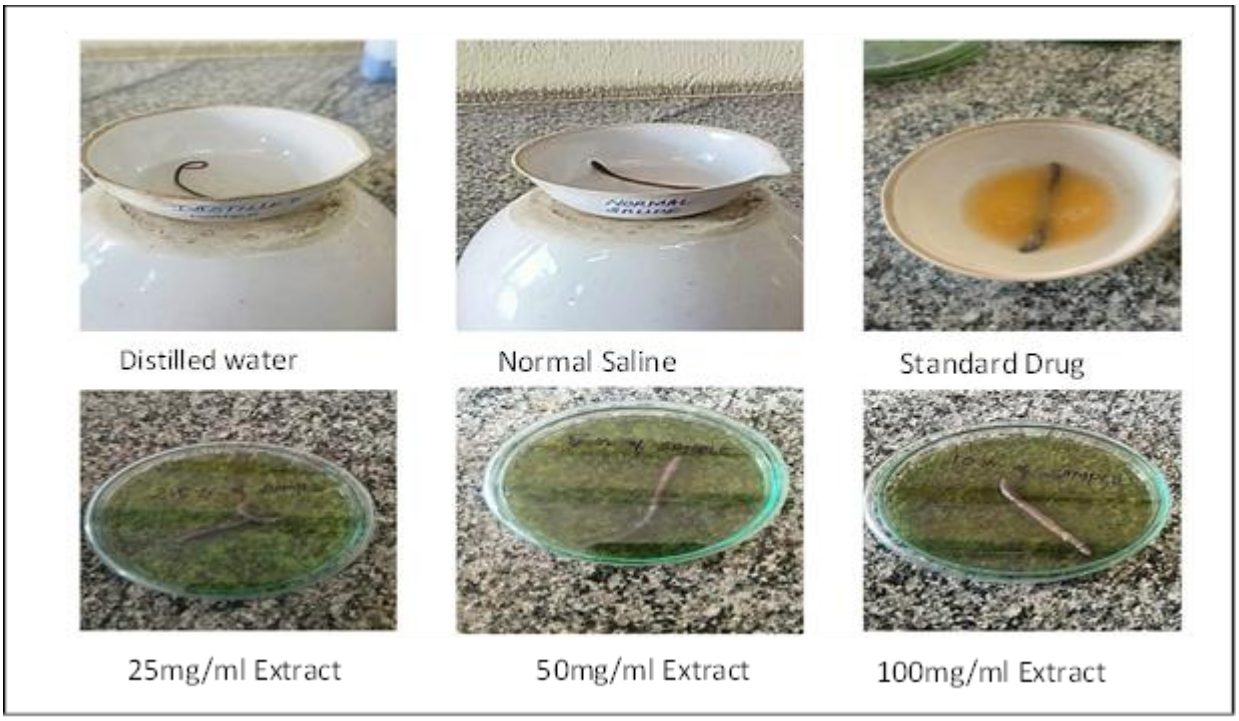

Figure 4: Anti-helminthic activity

TIME IN MINUTES					
PARAMETERS	STANDARD	CONTROL	TEST I (2.5mg/ml)	TEST II (5mg/ml)	TEST III (10mg/ml)
PARALYSE TIME	-	17.22 ± 0.82	17.14 ± 0.80	15.22 ± 0.72	12.11 ± 0.51
DEATH TIME	-	22.55 ± 1.49	22.11 ± 1.32	19.52 ± 1.22	15.23 ± 0.99

Table 4: Anti-helminthic activity result

STATISTICAL DATA:

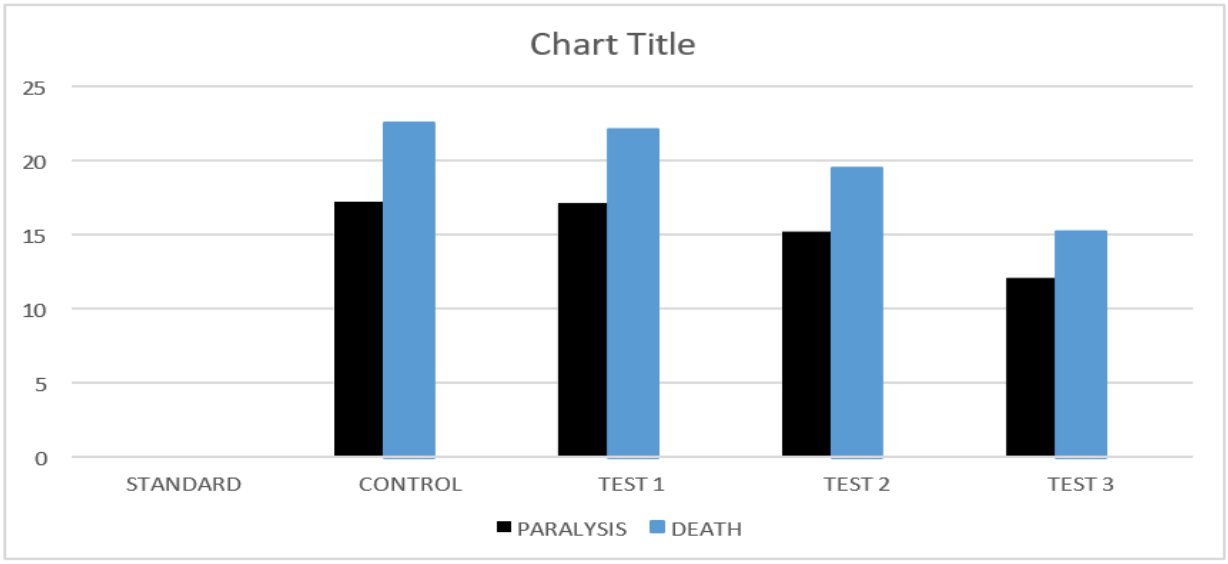

Figure 5: Graph for anti-helminthic activity

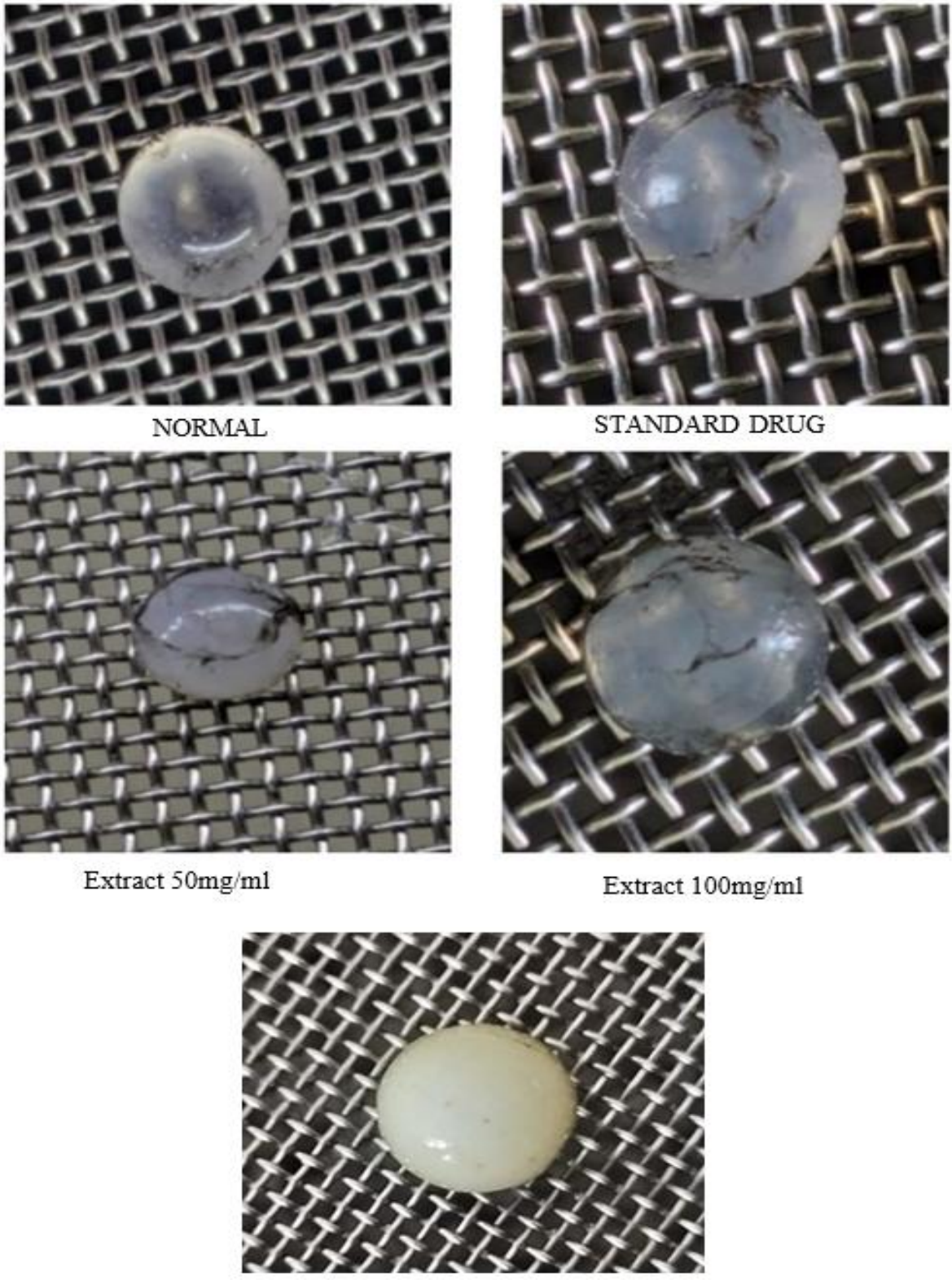

Figure 6: Anti-cataract activity

VI. DISCUSSION

The present study investigated the anthelmintic efficacy of the ethanolic extract derived from Cardiospermum halicacabum, yielding promising outcomes. The extract demonstrated considerable effectiveness, akin to standard anthelmintic medications, suggesting its viability as a natural treatment for helminthic infections. Potential mechanisms may involve interference with the metabolic pathways of the parasites or the inhibition of their reproductive functions. In addition, the extract showed robust antioxidant activity, which may aid in preventing or delaying cataract formation by mitigating oxidative stress in ocular tissues. These dual pharmacological effects emphasize the therapeutic potential of C. halicacabum in managing parasitic infections and supporting eye health while preventing age-related visual decline. However, further research is needed to isolate the active ingredients, clarify the mechanisms at play, and optimize dosage regimens for future applications.

VII. CONCLUSION

The ethanolic extract derived from Cardiospermum halicacabum has exhibited notable ex vivo therapeutic potential in the management of cataractogenesis and helminthic infections. Its capacity to delay the onset of cataracts and induce paralysis and death in helminths highlights its significant pharmacological effects. These outcomes validate the traditional uses of the plant and encourage further exploration into the isolation of active compounds and their mechanisms. With more in vivo studies and toxicity profiling, this extract could be developed into a natural and affordable therapeutic option for preventing cataracts and treating parasitic infections.

VIII. SUMMARY

This study investigated the ex vivo therapeutic efficacy of Cardiospermum halicacabum extract in addressing two significant health issues: cataracts and helminthic infections. The plant was verified and underwent ethanolic extraction through cold maceration. Phytochemical analysis revealed the presence of essential bioactive compounds, including carbohydrates, alkaloids, flavonoids, proteins, amino acids, saponins, phenols, glycosides, and tannins. The anti-helminthic properties were tested using Indian adult earthworms, where the extract demonstrated notable paralytic and lethal effects at various concentrations, showing results comparable to the standard medication, albendazole. For the anti-cataract assessment, goat lenses were treated ex vivo, and the extract-treated group exhibited significant protection against cataract formation induced by glucose, suggesting robust antioxidant and protective capabilities. These results reinforce the traditional medicinal applications of C. halicacabum and underscore its dual role as an anti-parasitic and promoter of eye health.

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