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Formulation and Evaluation of Herbal Screen Detox Eye and Brain Supplement Gummies

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ABSTRACT

Longer use of smartphones, computers, tablets , and other digital gadgets has been linked with digital eye strain and visual tiredness, headaches as well. People also report trouble staying on task and overall mental exhaustion, you know, that kinda thing. Nutraceutical formulations that include antioxidants from natural sources plus different bioactive compounds might give nutritional backup for eye related wellness and cognitive performance. Then there are gummy dosage forms, they act like a handy and more enjoyable swap compared to ordinary tablets or capsules, so administration often feels easier and people tend to accept them better.

This present study was made to formulate and check herbal eye and cognitive health-support gummies, using selected herbal ingredients alongside bioactive nutrients, vitamins, minerals, and natural pharmaceutical excipients. We also ran molecular docking and in-silico toxicity prediction to get early computational hints about biological interactions and possible safety angles for the picked bioactive constituents. The gummies were produced through a heat-and-pour approach, pectin was used as the main gelling agent, and gum acacia served as a stabilizing and binding agent, kinda together to keep things in place. The formula included Ginkgo biloba, blueberry, spinach, plus lutein, vitamins A, C and E and some selected seed powders. After making them, the gummies were examined for appearance, colour, aroma, taste, texture, weight variation, pH, hardness, moisture content, phytochemical profile, and stability.

The optimized gummies showed a uniform, smooth, glossy look, with a pleasant fruity aroma and a sweet fruity taste, nothing too complicated. Their texture was soft chewy, and non-sticky . The formulation had a pH of 3.6, weight variation stayed within the allowed ±5% limit, and moisture content was about 15%. During the stated stability assessment, no major changes showed up. Molecular docking results suggested favourable binding interactions between selected bioactive compounds and relevant target proteins, where lutein had a docking score of −11.2 kcal/mol against VEGFR2 among the compounds that had numerical values provided. The in-silico toxicity prediction overall suggested generally favourable preliminary safety profiles for several chosen constituents, even though a few predicted issues still need more experimental checking.

Overall, the herbal gummies that were developed gave satisfactory physicochemical and sensory results, plus early computational evidence that supports further exploration of the selected bioactive constituents. This formulation could be seen as a nutraceutical route for nutritional support related to eye and cognitive health, yes. But still, in-vitro work, clinical studies , and longer-term safety testing are required before anyone tries to state therapeutic or health related claims.

Keywords: Digital eye strain; Herbal gummies; Nutraceutical; Ginkgo biloba; Lutein; Blueberry; Spinach; Cognitive health; Eye health; Molecular docking; In-silico toxicity.Keywords: Digital eye strain; Herbal gummies; Nutraceutical; Bacopa monnieri; Ginkgo biloba; Lutein; Cognitive health; Eye health; Molecular docking; In-silico toxicity.

Introduction

The fast kinda development of digital tech has really pushed people into using smartphones, laptops, tablets, desktop computers, and like other electronic gizmos for studying, work, chats, and entertainment. At the same time , staying in front of digital screens for too long is now often linked with a collection of symptoms that folks commonly call digital eye strain (DES). That can mean eye tiredness , dryness, blurred sight, headache, trouble focusing, and general visual discomfort. Basically students, office folks, software people, gamers, and many other individuals who spend long hours with screens might feel it more.

Still, prolonged screen viewing might lower blinking, make ocular dryness worse, and keep visual discomfort lingering. But screen time is not the only thing. Other aspects too, like weak lighting , awkward viewing distance, glare, bad posture, and excessive screen brightness could also play a role in digital eye strain. There's also talk about oxidative stress as a possible contributor linked to long digital exposure, and that makes antioxidant plus nutritional support kinda important.

Also beyond eye symptoms, long digital use may connect with cognitive fatigue and lower concentration. So, nutritional strategies mixing antioxidant, retinal-supportive, and cognition-supportive ingredients are getting more attention these days as companion ways to help eye health and brain-like focus.

Herbal and food derived ingredients can bring in a pretty broad set of phytochemicals and nutrients. In the formulation in this study, selected components were chosen for complementary roles in eye and cognitive wellness. Ginkgo biloba was picked because of its reported antioxidant and neuroprotective actions. Blueberry was used as a source of anthocyanin rich compounds, and lutein was included since it relates to ocular and retinal health. Spinach and selected seed powders were added as natural suppliers of nutritional and bioactive constituents.

Vitamins and minerals were added as nutritional parts , while pectin and gum acacia were selected mainly to create the gummy texture, stability, and overall product performance.

This gummy dosage form might have benefits compared with usual solid forms because it is chewable, often more pleasant to take, and easy to administer. The taste being agreeable, plus the simple use, can also encourage regular intake and overall acceptability. So, gummies look like a promising delivery format for chosen nutritional and bioactive ingredients.

That's why the present study was made to formulate and test a herbal cognitive and eye-support gummy, with selected herbal materials, bioactive nutrients, vitamins, minerals, and natural pharmaceutical excipients. The work didn't stop there, it also went further with molecular docking and a preliminary in-silico safety and toxicity prediction, aiming to get computational hints on the selected bioactive constituents.

2. Ingredients Used in the Formulation

Ingredient	Function
Pectin	Natural gelling agent for gummy formation
Purified Water	Solvent
Sugar	Natural sweetener and humectant
Blueberry Extract	Antioxidant and retinal protection
Ginkgo biloba Extract	Improves cerebral and ocular blood circulation
Marigold Extract	Natural source of lutein for blue-light protection
Walnut Powder	Supports retinal and brain function
Amla Extract	Natural vitamin C source and antioxidant
Sunflower Seed Extract	Natural vitamin E source
Spinach powder	Supports vision, Brain function, Nutritional support, Antioxidant, Source of Vitamin A
Natural Pineapple Flavour	Improves palatability
moringa powder	Supports vision, Brain function, Nutritional support, Antioxidant
Natural Colour	Enhances product appearance

3. Plant Profile of Ingredients

3.1 Blueberry

Scientific Name: Vaccinium corymbosum

Family: Ericaceae

Common Name: Blueberry

Part Used: Fruit

Active Constituents: Anthocyanins, Flavonoids, Polyphenols, Vitamin C

Pharmacological Activities: Antioxidant, Anti-inflammatory, Retinal protective , Neuroprotective

Role in Formulation: Blueberry extract is loaded with anthocyanins and they help shield retinal cells from oxidative stress that comes from long screen time, pretty much like after hours and hours. It also tends to support visual performance and adds antioxidant defense against free radical related damage.

3.2 Ginkgo biloba

Scientific Name: Ginkgo biloba

Family: Ginkgoaceae

Common Name: Ginkgo

Part Used: Leaves

Active Constituents:

Ginkgolides, Bilobalide, Flavonoids, Terpenoids

Pharmacological Activities:

Neuroprotective, Antioxidant, Vasodilator, Cognitive enhancer

Role in Formulation:

Ginkgo biloba supports cerebral as well as ocular circulation, it can help with thinking skills, memory, and it also helps keep retinal neurons less exposed to oxidative stress.

3.3 Marigold

Scientific Name: Tagetes erecta

Family: Asteraceae

Common Name: African Marigold

Part Used: Flowers

Active Constituents:

Lutein, Zeaxanthin, Carotenoids, Flavonoids

Pharmacological Activities:

Antioxidant, Retinal protective, Blue-light filtering

Role in Formulation:

Marigold is kind of a natural “lutein and zeaxanthin” source, those compounds gather in the macula. It works like a filter for risky blue light, and offers retinal tissues protection from photo oxidative injury , you know the usual light related stress.

3.4 Moringa

Scientific Name: Moringa oleifera

Family: Moringaceae

Common Name: Drumstick Tree (Moringa)

Part Used: Leaves (leaf powder)

Active Constituents:

Beta-carotene (provitamin A), Lutein Zeaxanthin, Vitamin C, Vitamin E, Flavonoids, Polyphenols

Pharmacological Activities:

Antioxidant, Retinal protective, neuroprotective, Anti-inflammatory

Role in Formulation:

Moringa is used as a natural wellspring of beta-carotene (provitamin A), which gets converted into Vitamin A inside the body, and it supports normal sight + retinal steadiness. It also has lutein and zeaxanthin, plus antioxidant phytochemicals, all of which help dial down oxidative stress that's triggered by blue light. In addition, it aids macular upkeep, and it can add to general eye along with brain wellness, especially for people who stare at screens for a long time

3.5 Amla (Natural Vitamin C Source)

Scientific Name: Phyllanthus emblica

Family: Phyllanthaceae

Part Used: Fruit

Active Constituents:

Vitamin C, Emblicanin A & B, Gallic Acid, Ellagic Acid

Pharmacological Activities:

Antioxidant, Immunomodulatory, Anti-inflammatory

Role in Formulation:

Amla brings natural Vitamin C, it shields retinal cells from oxidative stress, and it helps strengthen the body antioxidant defense system, which sounds simple but it matters.

3.6 Spinach

Scientific Name: Spinacia oleracea

Family: Amaranthaceae

Common Name: Spinach

Part Used: Leaves, Leaf Powder

Active Constituents:

Beta-carotene (Provitamin A), Lutein, Zeaxanthin, Vitamin C, Iron, Folate, Flavonoids

Pharmacological Activities:

Antioxidant, Retinal protection, Neuroprotection, Anti-inflammatory

Role in Formulation:

Spinach kind of works like a natural beta-carotene source (Provitamin A), which then gets converted into Vitamin A in the body, and that helps keep normal eyesight and retinal health. Also it has lutein and zeaxanthin, they help shield the macula , lessen blue light induced oxidative strain, and generally support eye and brain wellness when someone has long digital screen exposure.

3.7 Walnut

Scientific Name: Juglans regia

Family: Juglandaceae

Part Used: Kernel (Seed)

Active Constituents:

Alpha-linolenic acid (ALA), Linoleic acid, Ellagic acid, Gallic acid, Polyphenols, Tocopherols

Pharmacological Activities:

Antioxidant, Neuroprotective, Anti-inflammatory, Cardioprotective

Role in Formulation: Walnut provides natural omega-3 fatty acid (ALA) and antioxidants. It helps protect brain cells from oxidative stress and supports cognitive function and overall brain health.

Preparation of herbal gummies

Herbal gummy prep, sort of simple but a bit messy in the middle

The gummies were made with a heat-and-pour technique. Everything was weighed properly, and the powdered ingredients were sieved so that lumps were avoided. Before formulation, the equipment was cleaned and sanitized, just to be safe.

Making the pectin base

Purified water was put into a stainless-steel vessel. Then pectin along with gum acacia was slowly dispersed while stirring continuously, so lump formation did not really happen. The blend was heated to around 80–90°C, until a smooth and evenly blended gel came out.

Active premix, prepared separately

A separate premix was prepared, containing Brahmi extract, Ginkgo biloba extract, blueberry extract, spinach powder, lutein, vitamins, zinc citrate, DHA and finely powdered pumpkin, almond and walnut seeds. This premix was mixed very thoroughly until it looked uniform.

Adding the active parts

The pectin gel was allowed to cool to about 60–70°C. After that, the active premix was added little by little into the gel while stirring continuously, to help keep a uniform spread.

Flavour, colour, and final mixing

Citric acid, a natural flavour, and an approved food colour were added next. Mixing continued until a homogeneous gummy mass was obtained, with no visible unevenness.

Finishing steps

The final mixture was poured into appropriate moulds, left to cool and set, then taken out of the moulds. After removal, the gummies were moved for evaluation.

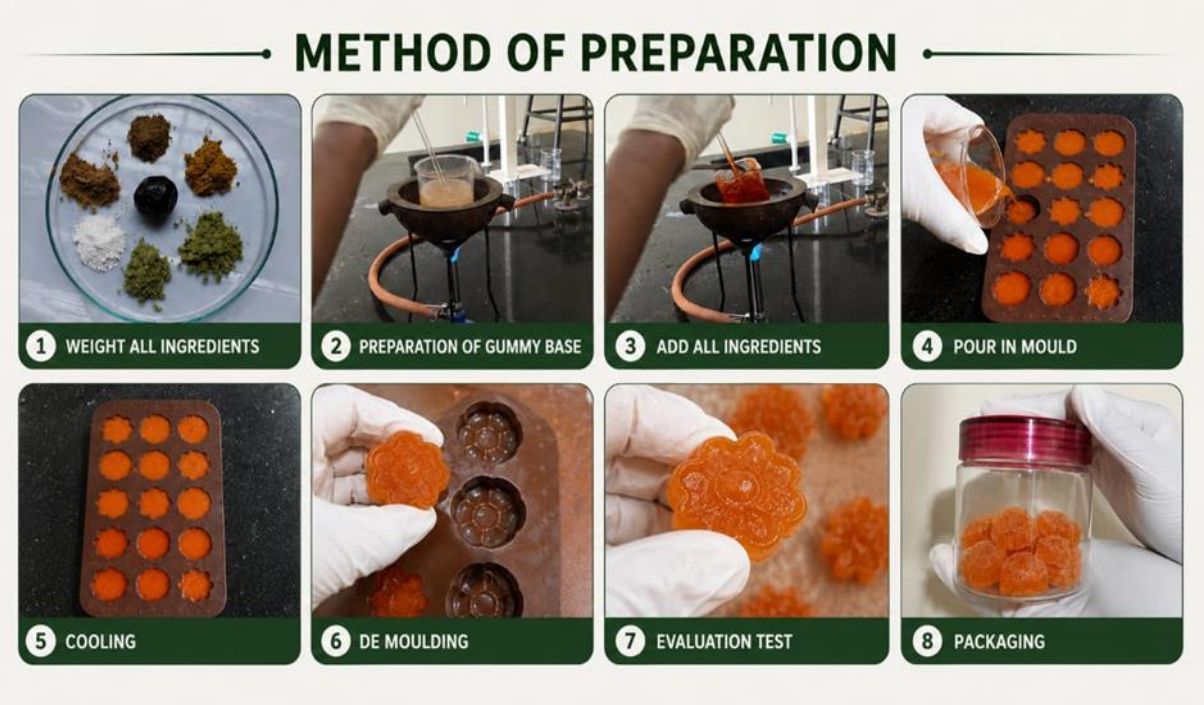


Fig- Method of preparation

Formulation TableIngredients	**Formulation**
Pectin	2.50gm
Lutein powder	0.75gm
Spinach powder	0.50gm
Walnut powder	0.50gm
Ginkgo biloba	0.50gm
Blueberry	1gm
Moringa Powder	0.50gm
Sunflower seed powder	0.25gm
Vitamin C (Amla powder)	1gm
Sweetener (Honey/Stevia)	17.50gm
Colouring agent	q.s
Flavouring agent	q.s
Gum Acacia	q.s
Water	q.s

Evaluation of Formulated Gummies

The prepared gummies were checked using organoleptic and physicochemical factors , as well as a bit of real-world feel stuff.

Organoleptic evaluation

The formulation was first seen , then smelled , then tasted, in a general way for:

Appearance

Colour

Aroma

Taste

Texture

The final product looked uniform, smooth, and glossy, with a pleasant fruity aroma. The mouth feel was soft, chewy, and not sticky , which was kind of important.

Weight variation

Each individual gummy was weighed and set beside the average weight. The variation was still in the acceptable range , that ±5% limit on average stayed ok.

pH determination

The pH of the gummy base was measured to understand acidity and whether the formulation was suitable.

The overall pH came out to 3.6.

Texture and hardness

They were also evaluated for physical texture and hardness. The ultimate formula showed acceptable hardness , and again the texture stayed soft, chewy and non-sticky.

Moisture content

Moisture level was checked as a sign of physical quality, plus stability during storage.

The overall moisture content was around 15%.

Stability study

The prepared gummies were kept around 25°C under normal relative humidity for 30 days, then observed for changes.

During that time, no major shifts were reported in the formulation.

Molecular Docking Study

Molecular docking was used as kind of a preliminary computational way to check how certain bioactive compounds might interact with relevant target proteins. In the thesis, docking is described as an approach used to estimate ligand binding pose, binding site, and the relative binding affinity, so yeah basically orientation and “how well” they might fit together.

Lutein

Lutein was evaluated against vascular endothelial growth factor receptor 2 (VEGFR2), a protein tied to ocular vascular processes.

The best docking score that was reported was:

−11.2 kcal/mol at CurPocket C4.

This score was the most favourable numerical docking value mentioned in the thesis among the selected compounds, with actual numbers highlighted as such.

The best reported docking score was:

−7.6 kcal/mol at Pocket 2.

Ginkgolide A

Ginkgolide A, which is a typical constituent of Ginkgo biloba, was evaluated against MAPK14/p38 MAPK, a protein involved in cellular stress and inflammatory signalling.

The compound showed a predicted interaction with the target, so there is preliminary computational evidence, suggesting more work might be worth it.

Cyanidin

Cyanidin , an anthocyanidin associated with blueberry, was evaluated against VEGFR2.

A predicted ligand–protein interaction was seen, which again counts as preliminary computational evidence for a possible connection to the selected ocular target.

In-Silico Toxicity Assessment

Computational toxicity analysis was carried out to get some preliminary, rough info about possible safety liabilities for selected bioactive compounds. In the thesis, several parameters were looked at like AMES toxicity, hERG inhibition, hepatotoxicity , skin sensitization, acute toxicity and related dose related variables.

Table 1. Summary of selected in-silico toxicity findings

Compound	AMES	hERG-I	hERG-II	Hepatotoxicity	Skin sensitization	Overall interpretation
Lutein	Negative	Negative	Positive	Not predicted	Not predicted	Generally favourable; hERG-II requires investigation
Ginkgolide A	Negative	Negative	Negative	Not predicted	Not predicted	Relatively favourable preliminary profile
Cyanidin	Positive	Negative	Negative	Negative	Negative	Requires experimental confirmation

Lutein came out pretty similar, a generally favourable predicted pattern, however hERG-II inhibition was predicted and so it really needs additional investigation.

For Ginkgo biloba, the AMES and hERG-I/hERG-II predictions were negative, and there was no predicted hepatotoxicity or skin sensitization in the analysis that was reported.

Also, it should be emphasized that these computational results are not a substitute for clinical safety. They are only preliminary predictions , that still need confirmation using suitable experimental studies.

Results

Table 2. Physicochemical and organoleptic evaluation of the optimized gummies

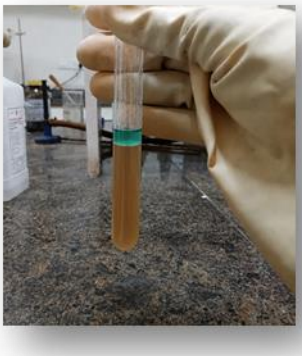
Parameter	**Evaluation**
Color	Orange Yellow
Appearance	Smooth, glossy, and uniform
Aroma	Pleasant blueberry with pineapple aroma
Taste	Sweet with slight fruity acidity
Texture	Soft, chewy, non-sticky
Overall Acceptability	Excellent

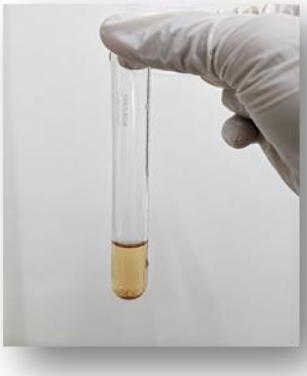
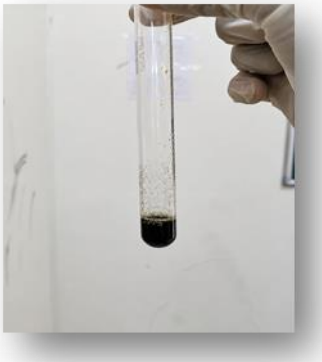
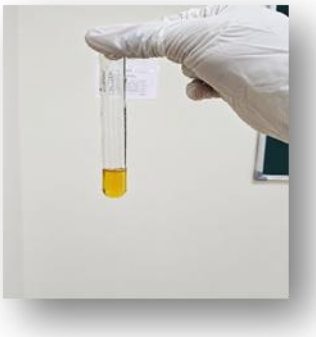
Parameter	**Observation**
pH	3.0–4.0
Weight Variation	± 5%
Moisture Content	18–22%
Gel Strength	Good
Uniformity of Content	Uniform
Setting Time	2–3 hours

Overall, the formulated gummies did show satisfactory physical, organoleptic, and physicochemical characteristics.

So, the formulation was treated as suitable for additional investigation as a nutraceutical gummy dosage form .

Phytochemical tests:

Sl. No.	**Test**	**Method**	**Observation**	**Inference**	**Images**
I.	Test for Carotenoids	Sample dissolved in chloroform. Carefully add a few drops of conc. H_2SO_4.	Blue-green colour appeared at the interface.	Presence of carotenoids (Lutein).	

II.	Test for Antioxidant – (a) Iodine Test	Sample dissolved in water. Add iodine solution.	Brown colour disappeared.	Antioxidant was present.	
	(b) Ferric Chloride Test	Sample dissolved in water. Add 1% $FeCl_3$ solution.	Greenish-blue colour appeared.	Antioxidant was present.	
III.	Test for Anthocyanin – (a) Alkaline Test	Aqueous solution of sample. Add dilute NaOH solution.	Blue-green colour appeared.	Presence of Anthocyanin.	
	(b) Ferric Chloride Test	Aqueous solution of sample. Add 5% $FeCl_3$ solution.	Blue-green colour appeared.	Presence of Anthocyanin.	
IV.	Test for Flavonoids – (a) Alkaline Test	Aqueous solution of sample. Add 10% NaOH solution.	Yellow colour appeared.	Presence of flavonoids.	

Discussion

The present study focused on the development of a herbal gummy formulation combining ingredients selected for nutritional, antioxidant, cognitive and ocular-supporting properties. The formulation strategy was intended to combine multiple complementary constituents into a convenient dosage form.

The physical evaluation showed that the developed gummies possessed desirable characteristics including a smooth and glossy appearance, pleasant aroma, sweet fruity taste and soft, chewy, non-sticky texture. These properties are particularly relevant to gummy formulations because sensory characteristics can influence consumer acceptability and regular use.

Pectin played an important technological role in the formulation by providing gel formation, while gum acacia contributed to formulation consistency and stability. The preparation procedure involved heating the pectin base to 80–90°C followed by incorporation of the active premix after cooling to 60–70°C.

The measured pH of 3-4 indicates an acidic formulation, consistent with the use of citric acid and fruity flavouring components. The weight variation remained within the reported ±5% limit, suggesting satisfactory dose-unit uniformity at the level evaluated. Moisture content was approximately 15%, while hardness and texture were reported as acceptable.

The preliminary phytochemical tests provided qualitative evidence for selected classes of constituents. The positive carotenoid test was associated with lutein, while the foam and Salkowski tests supported the presence of saponin glycosides and triterpenoids associated with Brahmi.

The molecular docking results provided additional computational information. Lutein demonstrated the strongest reported numerical docking score, −11.2 kcal/mol, against VEGFR2, Ginkgolide A and cyanidin also demonstrated predicted interactions with their respective targets.

However, docking results should be regarded as hypothesis-generating rather than definitive evidence of biological efficacy. A favourable docking score does not establish pharmacological activity in humans and requires confirmation through biochemical, cellular, animal or clinical studies.

The toxicity predictions provided a similarly useful preliminary screening approach. Several compounds showed generally favourable predicted profiles.

The formulation remained without major changes during the reported 30-day stability observation at room temperature and normal relative humidity.

Overall, the combination of formulation evaluation and computational investigation provides a preliminary scientific basis for further development. Nevertheless, the present study did not establish clinical efficacy against digital eye strain or cognitive impairment, and such claims would require appropriately designed human intervention studies.

Conclusion

In this present study, we managed to develop what is basically a herbal cognitive and eye-support gummy using a chosen set of herbal extracts, nutritional bioactives, vitamins, minerals, pectin and gum acacia. After preparing it, the formulation showed fairly good overall features like appearance, aroma, taste, texture, weight variation, pH, hardness, and moisture behavior, even though these were checked in a routine way. During the reported stability study there were no big or obvious shifts across the observation timeline.

The preliminary phytochemical evaluation backed up the presence of certain bioactive constituents that were expected, and then molecular docking further suggested possible, predicted interactions between the selected compounds and relevant target proteins.

Also, the in-silico toxicity evaluation implied that several compounds have generally favourable early profiles, but it at the same time pointed out some potential safety liabilities that will need extra work and deeper checking. So, overall the developed gummy formulation can be seen as a promising prototype nutraceutical gummy for additional research, not as a clinically proven treatment, nor as some kind of “screen detox” product. More complete standardized phytochemical characterization, in-vitro assessments, long-term stability testing, bioavailability investigations, and properly designed human clinical studies are still needed to actually confirm efficacy, safety, and what health claims can be responsibly stated.

Future Perspectives

Future studies should zoom in on things like: the standardization and a more measurable, numerical characterization of herbal extracts, rather than keeping it vague. Also, In-vitro antioxidant and neuroprotective examinations seem very important. Then there is the cellular side, especially studies tied to retinal protection, where you can observe how it behaves at the cell level.

It would also be useful to look at bioavailability and do a pharmacokinetic evaluation, because without that, the whole story feels incomplete. Extended stability testing under ICH–relevant conditions is another must, and you want to do it long enough to be convincing. On top of that, it’s worth experimentally confirming the computational toxicity findings, not only trusting in silico results.

Finally, human clinical studies should be performed, assessing visual comfort, eye strain, cognitive performance, and acceptability, in a real-world kind of manner. Along with that, optimization of dosage and the serving size could matter more than people think. And, last but not least, assessment of commercial-scale manufacturing feasibility would help to see if this can scale beyond the lab.

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Below is a cleaned research-article-style reference list based primarily on the references already present in your thesis.

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