

Formulation, Development, and Phytochemical Evaluation of Herbal Syrup Containing *Bacopa monnieri* Extract

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Abstract: *This study focuses on the formulation and evaluation of a stable and palatable herbal syrup utilizing Bacopa monnieri (Brahmi), a renowned Ayurvedic medicinal plant celebrated for its neuroprotective, antioxidant, and cognitive-enhancing properties, the research highlights the historic and statistical dependence of global populations on plant-based primary healthcare. To create an accessible oral dosage form suitable for pediatric and geriatric patients, an aqueous extract of Bacopa monnieri was prepared using the traditional decoction (Kwath) method. Preliminary phytochemical screening of the extract confirmed the robust presence of key bioactive secondary metabolites, including alkaloids, flavonoids, saponins, glycosides, tannins, and phenolic compounds, which are responsible for its therapeutic activities such as memory retention and stress reduction. The extracted material was subsequently blended with sucrose, glycerine, citric acid, and sodium benzoate to form a 100 ml syrup formulation. Comprehensive evaluation of the prepared syrup demonstrated satisfactory organoleptic and physicochemical properties, featuring a clear, homogeneous, brownish-green appearance, a characteristic herbal odor, and a sweet, slightly bitter taste. Physicochemical testing revealed an optimal pH of 5.6, a viscosity of 68 cP, and a specific gravity of 1.21, all falling within standard acceptable limits for oral herbal preparations. Stability testing indicated that the formulation remained homogeneous over time, showing zero signs of sedimentation, phase separation, or microbial contamination.*

Keywords: Bacopa monnieri, Brahmi, Herbal Syrup, Decoction Method, Phytochemical Screening, Physicochemical Evaluation, Cognitive Enhancer

I. INTRODUCTION

Since prehistoric times man has always been dependent upon the plants for his food, shelter and health. The relationship between man and plants is as old as history of mankind and likewise indigenous knowledge about plant is as old as human civilization (Charak, 1969).

Plants have been used in number of systems of medicine in the whole world including India. Atharvaveda suggest that man learnt the therapeutic value of plants by observing the behaviour of wild animals and birds in disease (Sushrut, 1972). India is well known as important source of various medicinal herbs and shrubs. These plants are used to treat various diseases and disorders in India dates back to the times of "Rigveda" (3500-1800BC). Later, most important and the authentic works on Indian medicinal plants is found in the classics of Ayurveda i.e. Charka Samhita, Sushrut Samhita and Astangahridaya which are believed to have been written in the pre-Buddhist period, i.e., before 600 B.C. These works incorporate 700-800 drugs of medicinal value used in several preparations for the treatment of various diseases (Gupta, 1972).



Plants have a vital role in the human civilization (Yousaf Zubaida et.al., 2004, Hill A.F., 1952). Medicinal herbs are regarded as an effective source of traditional as well as modern medicine (Yousaf Zubaida et.al., 2004, Abatan et.al., 1986). All the traditional medicines have their roots in house remedies and this knowledge is transferred from one generation to another with the passage of time (Yousaf Zubaida et.al.,2004). The fact is that all the indigenous herbal or esteem system of medicines is entirely based on the properties of these plants.

According to World Health Organization as much as 80% of population in developing countries Is dependent on plants for primary health care. Statistical data reveal that as many as 3226 out of 4752 communities in India are dependent on traditional medicine derived from plants. A status report on ethnobiology in India, undertaken by Ministry of Environment and Forests has Indicated that the tribal communities use over 7500 species of plant for medicinal purpose (Anonymous, 1994; Misra, 2009). WHO estimates that 4 billion people, 80% of the world population, presently use herbal medicine for some aspect of primary healthcare. Herbal medicine is a major component in all indigenous people’s traditional medicine and a common element in ayurvedic, homeopathic, naturopathic, traditional, oriental, and Native American. Indian system of medicine. Recently the world health organisation estimated that 80% of people worldwide rely on herbal medicine are available and are prescribed by 70% of German Physicians (Bhauta Poonam, 2012; Akanksha et.al.,2010; Ong ES, 2004).

For investigation of natural products, two methods are selected; first is laboratory based called classical method relies on previous taxonomic findings, random screening methods and phytochemical factors. Second method, which is now becoming more popular in all researchers, in search of conventional texts and herbal medicine use, including oral interviews with traditional Indigenous healers – the ethnobotanical route (Williams, 2001). Patently the modern drug industry has been developed to a considerable degree as a result of plant-based traditional medicines. According to literature survey in 2001, 88, active compounds isolated from 72 medicinal plants have been introduced as modern drug therapy, with many being considered as the active principle responsible for their ethnopharmacological use (Fabricant et al., 2001, Bindseil et al., 2001).

1.1 Plant Profile

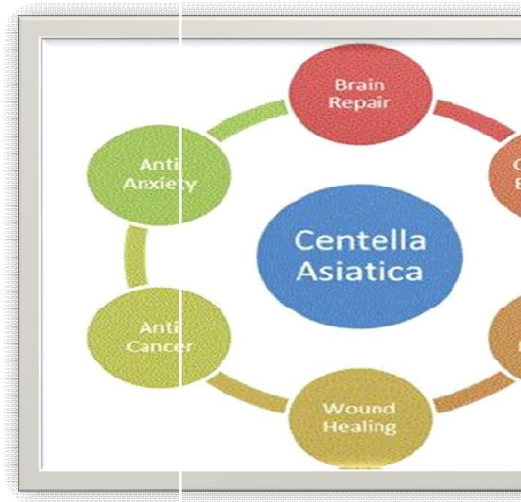


Figure:1.1





1.1.1 Biological Source

- Brahmi is obtained from the fresh and dried leaves and stems of the Plant *Bacopa monnieri* belonging to the family Plantaginaceae.

1.1.2 Taxonomical Classification (33)

Botanical Name	<i>Bacopa monnieri</i>
Family Name	Plantaginaceae
Kingdom	Plantae
Division	Tracheophyta
Class	Magnoliopsida
Order	Lamiales
Family	Plantaginaceae
Genus	<i>Bacopa</i>
Species	<i>monnieri</i>

1.1.3 Vernacular Name

Arabic	Zara Zab
Bombay	Bama
English	Water Hyssop, Thyme leaved gratiola, Indian pennywort, Herb of grace
Hindi	Brahmi, Jalnim, Barambhi
Kannada	Nirubrahmi, Kiru brahmi, Neeruppigida, Jala Brahmi
Malay	Bremi
Malayalam	Brami, Nirbrahmi
Marathi	Nirbrahmi
Persian	Jaranab
Sanskrit	Aindri, Brahmi, Gundala, Indravalli, Jalasaya, Matyaksi,
Sinhala	Lunuwila



1.1.4 Geographical Distribution

It is indigenous to Madagascar. It is found to the tropical regions like India, Nepal, Sri Lanka, China, Pakistan, Taiwan, Vietnam tropical and Southern Africa, Australia Caribbean.

1.1.5 Morphology

Colour: Leaves are green in colour.

Odour: Characteristic.

Taste: Bitter.

Herpestis: creeping, Monnieri- necklace.

Habit: It is small, glabrous succulent, Creeping herb with ascending branches 20Cm or more long. It spreads on ground.

Stem: 10-30 cm long, rooting at the nodes, Branches numerous, ascending.

Leaves: Leaves are about 2cm, Sessile, decussate, 6-25 by 2.5- 10 mm, Obovate- Oblong or Spathulate, rather fleshy, dotted with black specks, very obtuse, quite entire; nerves obscure.

Flowers: Flower are bluish white in colour, Solitary, Axillary, Bracteoles 5 mm long, linear; pedicles 0.6-3.2 cm long, slender.

Calyx: Globous, divided to base; upper sepals 6 by 3-4mm, ovate, acute; the other 4 sepals slightly shorter than upper; the 2 inner lateral ones 1.5 mm wide, lanceolate, acute.

Corolla: Pale blue or white, 8 mm long lobes nearly equal, rounded, strangled when fresh with shining dots.

Anthers: Bluish Purple;

Pollen: White

Capsule: 5mm long, ovoid, acute, pointed with the style-base, glabrous.

Seed: Minute and numerous, Oblong, striate, pale, 0.85mm long.

1.2 Medicinal uses and significance

Brahmi is used for Alzheimer's disease, improving memory, anxiety, attention deficit hyperactivity disorder, allergic conditions, irritable bowel syndrome, and as a general tonic to fight stress.

1.2.1 Other species

List of the species of the genera with activity.

Sr. no.	Botanical Name of Species	Family	Activity & uses	Plant Part Used
1.	Water hyssop (Bacopa monnieri)	Plantaginaceae	For instance, Bacopa monnieri is known to improve memory and cognitive function, while Centella asiatica is used to treat anxiety and depression	Flower, leavers
2.	Gotu kola (Centella asiatica)	Apiaceae	Anti-inflammatory and antioxidant properties.	Flower

1.2.2 Chemical Constituents

It consists of Saponin glycosides such as Brahmoside (triglyceride of brahmic acid with Rhamnose, glucose and arabinose), Brahminoside (Tetraglycoside of brahmic Acid),

Thankunoside: on hydrolysis a triterpenes acid, thankunic- acid, glucose and rhamnose, Asiaticoside, and Oxyasiaticoside

It consists of Triterpene Acids such as Brahmic acid, iso-brahmic acid, Asiatic acid, Madasiatic acid, Madacass acid, Centic acid and Centoic acid. C. Bacopa is consist of Tannins.



It consists of Flavonoid glycosides such as 3-glycosylquercetin and 3-Glucosylkaempferol.

It contains the Hydrocotyline alkaloids.

It consists of Sterol such as Stigmasterol, β - sitosterol.

It consists of Amino acid such as Aspartic acid, glycine, glutamic acid.

The herb contains the alkaloids brahmine, herpestine (C₃₄H₄₆N₂O₆) and a mixture of three bases.

The herb also contains the saponins, monnierin (C₅₁H₈₂O₂₁.3H₂O); hersaponin and Bacoside A [C₄₁H₆₈O₁₃.4 H₂O] and bacoside B [C₄₁H₆₈O₁₃.5 H₂O] Other constituents present in the plant are D-mannitol, betulinic acid, β —sitosterol, stigmasterol and its ester, heptacosane, octacosane, nonacosane, triacontane, hentriacontane, dotriacontane, nicotine, 3-formyl-4-hydroxy -2H-pyran (C₆H₆O₃), luteolin, and its 7-glucoside. The presence of α alanine, aspartic acid, glutamic acid and serine is also reported. The leaves contain sterol (C₂₆H₄₆O.H₂O) (34).

1.3 Reported Pharmacological Properties

Anti-Asthmatic Activity: Bacopa monneiri BM shows anti asthmatic activity due to its

Bronchodilatory effects : Relaxing airway smooth muscles.

Anti-inflammatory properties : Reducing inflammation in airways.

Antioxidant activity : Reducing oxidative stress in lungs.

extract possessed relaxant properties in tracheal muscle of rabbit and guinea-pigs with a partial contribution by (beta)-adrenoreceptor and prostaglandins (35). It also produced broncho dilation in anaesthetized rats (36) supported the traditional use of This plant in for various respiratory ailments (37). Bronchodilator property of extract may be reflected by antagonism of arbachols-induced effects on inspiratory and expiratory pressures. Extract exhibited a dual action on bronchoconstriction induced by carbachol. At low doses (25 and 37 mg/kg), predominantly inhibited inspiratory pressure, but at a high dose (50 mg/kg) inhibited only expiratory pressure. This property of the plant extract implies that more than one mechanism of action may be responsible for broncho-dilation. Some of the possible mechanisms include (beta)adrenoreceptor activation, muscarinic receptor antagonism, prostaglandin release or interference with calcium mobilization. A more recent study by the same authors demonstrates the calcium antagonistic activity is present in ethanol extract of BM (38). In addition, it has been reported that BM methanolic extract exhibited a potent mast cell stabilizer, indicating the potential usefulness of BM leaves in allergic conditions (39).

Anti-cancer Activity:

Pretreatment with BM significantly reduced the acute stress (AS)-induced increase in the ulcer index, adrenal gland weight, plasma glucose, aspartate aminotransferase (AST), and creatine kinase (CK) (40) in cancerous patients. This was due to presence of bacosides present in BM, which have anticancer activity. Methanolic extract exhibited potent mast cell stabilizer (41) activity. Bacopa monneri is a known hyper accumulator of cadmium, chromium, lead & mercury and used for Phyto remedy (42).

Antidepressant Activity:

Methanolic extract of BM possess potential antidepressant activity in rodent. When given in the dose of 20 and 40 Mg/kg, orally for 5 days, the extract was found to have significant antidepressant activity in forced swim and learned helplessness models of depression and was comparable to that of imipramine (43)

Anti-inflammatory Activity:

Bacopa monneri has the ability to inhibit inflammation through modulation of proinflammatory mediator release (44) i.e., it possesses significant anti-inflammatory activity that may well be relevant to its effectiveness in the healing of various inflammatory conditions in traditional medicine (45). It also significantly inhibited 5-lipoxygenase (5-LOX), 15-LOX and cyclooxygenase-2 (COX-2) activities (46). This activity may be due to presence of the triterpenoids and Bacosides in it.



Anti-nociceptive Activity:

Aqueous extract of Bacopa Monneri (AEBM) exhibits analgesic activity through multiple pain pathways (47) i.e., involvement of β 1-adrenergic, α 2 -adrenergic receptors and 5-HT receptors in analgesic activity. It was also observed that when AEBM was given in combination with naloxone did not increase the latency for analgesic effect, which indicates involvement of opioid receptors in analgesic activity.

Anti-stress Activity:

Standardized extract of BM possesses an adaptogenic activity. Pretreatment with low dose of BM extract significantly reversed changes in ulcer index and plasma AST only, whereas the pretreatment with higher dose significantly reversed changes in ulcer index, adrenal gland weight, CK, and AST. (48)

Anti Spasmodic Activity:

BM extract have spasmodic activity in smooth muscles due to inhibition of calcium influx via both voltage and receptor-operated calcium channels of the cell membrane. However, the absence of any modification if either nor-adrenaline or caffeine-induced contractions in the presence of BM extract suggests that this natural compound has no detectable effect on mobilization of intracellular calcium (49).

Anxiolytic effect:

The higher doses of BM extract produced significantly greater anxiolytic effects compared to LZP (50). However, BM has a distinct advantage over lorazepam (LZP) since it does not induce amnesia and has a memory-promoting action in animals and man. These results were also observed by Shanker and Singh and reported that BM extract possessed an anxiolytic effect.

Cardiovascular Activity:

Ethanol extract of BM, shown cardiac depressive activity on left ventricular contractility, heart rate and coronary flow in isolated rabbit heart (51). It also demonstrated that protective effect of BM on pulmonary artery and aorta (52).

Gastroprotective Activity:

The anti-ulcer and ulcer-healing activities of the Bacopa monneri extract may be due to its effects on various mucosal offensive and defensive factors (53). It also has beneficial role in intestinal spasm such as irritable bowel syndrome (54). It may be due to spasmodic activity on intestinal smooth muscle, via inhibition of calcium influx across cell membrane channels. Fresh BM juice (BMJ) and BM extract has been reported to have significant anti ulcerogenic activity (55,56,57).

II. REVIEW OF LITERATURE

Bhandari et al. (2020)

Bhandari and coworkers reviewed the phytochemical diversity of Bacopa monnieri and reported that dammarane-type triterpenoid saponins are the principal bioactive compounds present in the plant. The review emphasized that bacosides possess antioxidant, neuroprotective, anti-inflammatory, and memory-enhancing activities. The authors also discussed chromatographic methods for qualitative and quantitative estimation of bacosides in herbal formulations

Saha et al. (2020)

Saha and colleagues summarized the phytochemical and neuropharmacological profile of Bacopa monnieri. Their review highlighted the role of Bacopa extracts in improving learning ability, memory retention, and cognitive performance. The study also described tissue culture and in vitro propagation techniques for large-scale production of medicinally important metabolites.



Jeyasri et al. (2020)

Jeyasri and coworkers applied cheminformatics and system pharmacology approaches to identify multiple neurological targets of Bacopa monnieri bioactive compounds. The study identified more than 50 active phytoconstituents interacting with hundreds of neurological receptors and enzymes associated with Alzheimer's disease and neurodegenerative disorders.

Sukumaran N.P. and Amalraj A. (2021)

Sukumaran and Amalraj studied the neuropharmacological mechanisms of Bacopa monnieri and demonstrated that bacosides enhance nerve impulse transmission and synaptic communication. Their work highlighted the role of Bacopa in improving learning and memory retention.

Russo A. and Borrelli F. (2021)

Russo and Borrelli investigated the antioxidant and free radical scavenging activity of Bacopa monnieri. The researchers found that Bacopa extract significantly reduced oxidative stress and lipid peroxidation in neuronal cells.

Rauf K. et al. (2022)

Rauf and colleagues evaluated the anti-inflammatory and neuroprotective properties of Bacopa phytoconstituents. Their study demonstrated inhibition of inflammatory mediators such as cyclooxygenase (COX-2) and nitric oxide synthase (iNOS).

Aguiar S. and Borowski T. (2023)

Aguiar and Borowski reviewed the therapeutic potential of Bacopa as a nootropic herb. They explained that bacosides improve cerebral blood flow and support neuronal repair mechanisms. The review validated the traditional Ayurvedic use of Bacopa for brain .

III. AIM AND OBJECTIVES

Aim

To formulate and evaluate a herbal syrup containing Bacopa monnieri extract for its potential cognitive enhancing, antioxidant, and neuroprotective activities with acceptable physicochemical and organoleptic properties.

Objectives

1. To collect, identify, and authenticate the plant material of Bacopa monnieri.
2. To prepare the extract of Bacopa monnieri using a suitable extraction method.
3. To perform phytochemical screening tests for identification of active chemical constituents present in the extract.
4. To formulate a stable and palatable herbal syrup containing Bacopa monnieri extract.
5. To evaluate the prepared syrup for physicochemical parameters such as:
 - o pH
 - o Viscosity
 - o Specific gravity
 - o Density
 - o Appearance
 - o Color
 - o Odor
 - o Taste
6. To assess the stability and homogeneity of the prepared herbal syrup.
7. To study the therapeutic potential of Bacopa monnieri as a natural cognitive enhancer and antioxidant agent.
8. To develop an effective herbal formulation with improved patient compliance and acceptability.
9. To compare the obtained evaluation results with standard acceptable limits for herbal syrups.
10. To promote the use of herbal medicinal plants in modern pharmaceutical formulations.



IV. MATERIAL AND METHODOLOGY

Ingredients	Role
Sucrose	Sweetning agent
Glycerine	viscosity enhancer
Sodium benzoate	Preservative
Citric acid	Ph modifire
Purified water	Vehicle

Material required

Active ingredient Dried whole plant powder of bacopa monnieri.

4.1 Methodology

Preparation of Bacopa monnieri

Decoction (Kwath)

Principle : Boiling plant material in water to extract active constituent.

4.2 Procedure

The herbal syrup containing extract of Bacopa monnieri was prepared using the decoction (Kwath) method. Initially, 25 g of coarsely powdered dried plant material of Bacopa monnieri was accurately weighed and transferred into a clean beaker. About 400 ml of purified water was added to the plant material and allowed to soak for approximately 30 minutes in order to enhance the extraction of active constituents. The mixture was then heated on a mild flame and allowed to boil gently until the volume was reduced to approximately one-fourth of the original volume (about 100 ml). After boiling, the decoction was filtered while still warm using a muslin cloth to remove solid particles and obtain a clear extract. If required, the filtrate was further concentrated to obtain the desired strength of the extract.

For the preparation of the herbal syrup, the obtained extract was mixed with sucrose as a sweetening agent, glycerine as a viscosity enhancer, citric acid as a pH modifier, sodium benzoate as a preservative, and a suitable flavouring agent to improve palatability. Purified water was added as the vehicle to adjust the final volume of the formulation. The mixture was stirred continuously until a uniform and homogeneous syrup was obtained. Finally, the prepared syrup was transferred into clean, airtight containers and stored in a cool and dry place for further evaluation.

4.3 Formulation of herbal syrup.

Ingredient	Quantity
Bacopa decoction	25-30ml
Sucrose	60-66g
Glycerine	5ml
Sodium benzoate	0.1g
Citric acid	0.05g
Purified water	up to 100ml

4.4 Evaluation of Herbal Syrup

Parameter	Expected Result
Colour	Brownish green
Odour	Characteristic



Taste	Sweet, Slightly bitter
Appearance	Clear, free from particles

Physiochemical Evaluation

pH

pH is defined as the negative logarithm of hydrogen ion concentration present in a solution. It is used to measure the acidity or alkalinity of a substance.

Measure using digital pH meter

Ideal range : 4.5 – 6.0

Viscosity

Viscosity is the measure of the internal resistance offered by a liquid to its flow. It indicates how thick or thin a liquid is.

Measure using Brookfield viscometer

Ensures pourability and mouthfeel

Phytochemical screening

Saponins

Alkaloids

Flavonoids

Stability Studies:

Storage conditions:

Room temperature

Observe at intervals :

pH

Colour change

Precipitation

Odour

Microbial growth

Advantages of Decoction Method

Alcohol – free extraction

Traditional Ayurvedic relevance

Cost effective

Safe for children

Simple equipment required

Limitations

Shorter shelf life of decoction

Possible microbial growth

Lower extraction of non-polar constituents

Batch variability



V. RESULT AND DISCUSSION

5.1 Results

The herbal syrup formulated using *Bacopa monnieri* extract was evaluated for various physicochemical and organoleptic parameters. The formulation showed satisfactory appearance, stability, and homogeneity. The syrup was found to be clear, smooth, and free from particulate matter. The prepared formulation exhibited a characteristic herbal odor with a sweet taste, making it acceptable for oral administration.

The phytochemical screening of *Bacopa monnieri* extract confirmed the presence of important bioactive constituents such as alkaloids, flavonoids, saponins, glycosides, tannins, and phenolic compounds, which are responsible for its therapeutic activity.

Observation Table for Phytochemical Screening

S. No.	Phytochemical Test	Observation	Result
1	Alkaloids (Mayer's Test)	Cream colored precipitate formed	Positive (+)
2	Flavonoids (Shinoda Test)	Pink/red coloration observed	Positive (+)
3	Saponins (Foam Test)	Persistent foam formed	Positive (+)
4	Tannins (Ferric Chloride Test)	Blue-black coloration appeared	Positive (+)
5	Glycosides (Keller-Killiani Test)	Brown ring observed	Positive (+)
6	Phenolic Compounds	Dark blue coloration formed	Positive (+)
7	Proteins	No violet color observed	Negative (-)
8	Carbohydrates	Reddish precipitate formed	Positive (+)

5.2 Evaluation Parameters of Herbal Syrup

Parameter	Observation/Result
Color	Brownish green
Odor	Characteristic herbal odor
Taste	Sweet and slightly bitter
Appearance	Clear and homogeneous
pH	5.6
Viscosity	68 cP
Specific Gravity	1.21
Stability	Stable
Sedimentation	Absent

5.3 Discussion

The formulated herbal syrup containing *Bacopa monnieri* extract showed satisfactory physicochemical and organoleptic properties. The syrup was homogeneous, visually appealing, and easy to pour due to its suitable viscosity. The pH of the formulation was found to be within the acceptable range for oral herbal preparations, indicating good stability and compatibility.

Phytochemical screening confirmed the presence of various secondary metabolites including alkaloids, flavonoids, saponins, glycosides, tannins, and phenolic compounds. These constituents are reported to possess antioxidant, neuroprotective, adaptogenic, and cognitive-enhancing activities. The presence of bacosides in *Bacopa monnieri* may contribute significantly to the therapeutic effectiveness of the syrup.

The viscosity of the syrup was found to be appropriate for oral administration, ensuring better patient compliance and ease of handling. No sedimentation or phase separation was observed during the evaluation period, indicating good stability of the formulation.



The sweet taste and characteristic odor improved the palatability of the syrup, making it more suitable for pediatric and geriatric patients. Overall, the study demonstrated that *Bacopa monnieri* can be successfully formulated into a stable and effective herbal syrup with promising therapeutic potential.

VI. CONCLUSION

Bacopa monnieri, commonly known as Brahmi, is an important medicinal herb widely used in the Ayurvedic system of medicine for enhancing memory, intelligence, concentration, and overall brain function. The plant is rich in biologically active compounds such as bacosides, alkaloids, flavonoids, saponins, tannins, and phenolic compounds, which contribute to its pharmacological properties. In the present study, the extract of *Bacopa monnieri* was successfully prepared using a suitable extraction method and was further subjected to phytochemical screening tests.

The phytochemical investigation confirmed the presence of several important secondary metabolites including alkaloids, flavonoids, glycosides, saponins, tannins, and phenolic compounds. These phytoconstituents are reported to possess antioxidant, neuroprotective, anti-inflammatory, adaptogenic, and cognitive-enhancing activities. The presence of these compounds indicates the therapeutic importance of the prepared formulation and supports the traditional medicinal value of *Bacopa monnieri*.

The herbal syrup was formulated using suitable pharmaceutical ingredients to improve stability, taste, and patient acceptability. The prepared syrup showed satisfactory organoleptic characteristics such as attractive appearance, pleasant odor, acceptable color, and sweet taste with slight herbal bitterness. The formulation was found to be smooth, homogeneous, and free from particulate matter or sedimentation, indicating proper mixing and good formulation quality.

Various physicochemical evaluation parameters including pH, viscosity, specific gravity, and stability were determined to ensure the quality of the prepared syrup. The pH of the syrup was found to be within the acceptable range for oral herbal formulations, indicating that the formulation is stable and suitable for administration. The viscosity of the syrup was also appropriate, providing ease in pouring and handling while maintaining uniform consistency. No signs of phase separation, microbial growth, or instability were observed during the study period, which confirmed the stability of the formulation.

The prepared herbal syrup may serve as a beneficial natural formulation for cognitive enhancement, memory improvement, stress reduction, and general brain health. The syrup dosage form offers several advantages such as ease of administration, better patient compliance, improved palatability, and suitability for pediatric and geriatric patients. Herbal syrups are also considered safer with fewer side effects compared to synthetic formulations when used appropriately.

This study also highlights the growing importance of herbal medicines and plant-based pharmaceutical formulations in modern healthcare systems. With increasing awareness regarding the adverse effects of synthetic drugs, herbal formulations are gaining popularity due to their natural origin, therapeutic efficacy, and safety profile. The successful preparation and evaluation of *Bacopa monnieri* syrup demonstrate the potential of medicinal plants in the development of effective herbal pharmaceutical products.

In conclusion, the present work establishes that *Bacopa monnieri* can be successfully formulated into a stable and effective herbal syrup possessing desirable physicochemical and therapeutic properties. The formulation showed promising characteristics and may be used as a natural cognitive enhancer and antioxidant supplement. Further advanced pharmacological, toxicological, and clinical studies can be carried out to evaluate the long-term efficacy, safety, and commercial applicability of the prepared herbal syrup formulate

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