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FORMULATION AND EVALUATION OF ANTIOXIDANT SYRUP FROM ACHYRANTHES ASPERA

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ABSTRACT

The present study focuses on the formulation and evaluation of an antioxidant herbal syrup prepared from Achyranthes aspera (Aghada), a plant widely recognized for its therapeutic potential in traditional medicine. The aerial parts of the plant were subjected to extraction using a suitable solvent system to obtain a concentrated extract rich in bioactive constituents. Preliminary phytochemical screening of the extract revealed the presence of flavonoids, phenolic compounds, alkaloids, and saponins, which are known to exhibit significant antioxidant activity. The antioxidant syrup was formulated using the prepared extract along with suitable excipients such as sucrose, preservatives, and buffering agents to ensure stability, palatability, and safety. The formulated syrup was evaluated for various physicochemical parameters including pH, viscosity, specific gravity, and organoleptic properties. In addition, antioxidant activity was assessed using standard in vitro methods, demonstrating promising free radical scavenging potential attributed to the phenolic and flavonoid content of the extract. The formulation showed acceptable stability and compliance with standard quality control parameters for herbal syrups. The study concludes that Aghada-based antioxidant syrup can serve as a potential natural therapeutic agent, offering an effective and safer alternative to synthetic antioxidants. Further studies are recommended to explore its clinical efficacy and long-term stability.

KEYWORDS: Antioxidant activity, Free radical scavenging activity, DPPH assay, Polyherbal preparation, Medicinal plants, Syrup formulation.

INTRODUCTION

Herbal medicines have gained significant attention worldwide due to their safety, efficacy, and minimal side effects compared to synthetic drugs. The use of plant-based formulations is deeply rooted in traditional systems of medicine such as Ayurveda, where natural products are utilized for the prevention and treatment of various diseases. In recent years, there has been an increasing demand for herbal formulations with antioxidant properties, as oxidative stress is considered a major contributing factor in the development of chronic diseases such as cardiovascular disorders, diabetes, cancer, and neurodegenerative conditions.

Oxidative stress occurs due to an imbalance between the generation of free radicals and the body's ability to neutralize them using antioxidants. Free radicals, including reactive oxygen species (ROS), can damage cellular components such as lipids, proteins, and DNA, leading to cellular dysfunction and disease progression. Antioxidants play a crucial role in scavenging these free radicals, thereby protecting the body from oxidative damage. Although synthetic antioxidants are available, their long-term use has been associated with potential adverse effects, which has led to growing interest in natural antioxidants derived from medicinal plants.

One such important medicinal plant is Achyranthes aspera, commonly known as Aghada. It belongs to the family Amaranthaceae and is widely distributed throughout India. The plant has been traditionally used for various therapeutic purposes, including anti-inflammatory, antimicrobial, diuretic, and hepatoprotective activities. Phytochemical investigations have revealed that Aghada contains a variety of bioactive constituents such as flavonoids, phenolic compounds, alkaloids, saponins, and glycosides. Among these, phenolic compounds and flavonoids are particularly known for their strong antioxidant properties.

Despite its wide range of pharmacological activities, there is limited research focusing on the development of a suitable dosage form of Aghada with enhanced patient acceptability. Syrup formulations are considered one of the most convenient and effective oral dosage forms, especially for pediatric and geriatric patients, due to their ease of administration, improved palatability, and rapid absorption. Additionally, syrups provide a suitable medium for incorporating herbal extracts and ensuring uniform distribution of active constituents.

The formulation of an antioxidant syrup from Aghada requires careful selection of excipients such as sweetening agents, preservatives, and buffering agents to maintain stability, efficacy,

and safety of the product. Evaluation of the formulated syrup is equally important to ensure its quality, which includes assessment of physicochemical parameters such as pH, viscosity, specific gravity, and organoleptic characteristics, along with evaluation of antioxidant activity using standard in vitro methods.

Therefore, the present study aims to formulate and evaluate an antioxidant herbal syrup using Aghada extract, with the objective of developing a stable, effective, and patient-friendly natural antioxidant formulation. This research may contribute to the development of novel herbal therapeutics and promote the use of traditional medicinal plants in modern pharmaceutical formulations.

MATERIALS AND METHODS

Source of plant material

The plant material used in this study was Achyranthes aspera leaves collected from a local herbal garden and authenticated by a pharmacognosy expert. The collected leaves were washed thoroughly with distilled water and shade dried for 7–10 days. The dried leaves were powdered using a mechanical grinder and stored in an airtight container for further use.

Extraction of Achyranthes aspera leaves

The extraction of Achyranthes aspera leaves was carried out by the maceration method. About 500 g of dried leaf powder was soaked in 70% ethanol in a ratio of 1:5 for 72 hours with intermittent stirring. After completion of maceration, the mixture was filtered using muslin cloth followed by filter paper. The filtrate obtained was concentrated using a rotary evaporator at 50°C until a semisolid extract was obtained. The concentrated extract was weighed and stored in a refrigerator for further study.

Phytochemical screening of Achyranthes aspera extract

Preliminary phytochemical screening was performed to identify the presence of alkaloids, flavonoids, phenolic compounds, tannins, saponins, and glycosides.

1. **Alkaloids test**: Extract solution was treated with Mayer’s reagent; cream precipitate indicated presence of alkaloids.
2. **Flavonoids test**: Extract was mixed with NaOH solution; yellow coloration confirmed flavonoids.

3. **Phenolic compounds test**: Ferric chloride solution produced bluish-black coloration indicating phenols.
4. **Saponins test:** Persistent foam formation after shaking with water confirmed saponins.
5. **Tannins test**: Addition of $FeCl_3$ solution produced greenish-black coloration indicating tannins.

Formulation of Achyranthes aspera antioxidant syrup

The antioxidant syrup containing Achyranthes aspera extract was prepared by the heating method. First, all apparatus and bottles were cleaned and sterilized. Sucrose was dissolved in a sufficient quantity of distilled water with continuous heating using a hot plate. Propylene glycol was added slowly, followed by the measured quantity of Achyranthes aspera extract with continuous stirring until a uniform mixture was formed.

Methyl paraben and propyl paraben previously dissolved in a small quantity of warm propylene glycol were added as preservatives. Citric acid was added to adjust the pH and improve taste. Coloring agent is added in small quantity. Flavoring agent was then incorporated into the formulation. Finally, distilled water was added to make up the final volume and the syrup was mixed thoroughly to obtain a homogeneous preparation. The prepared syrup was filled into amber-colored bottles and stored at room temperature.

Table 1. Aghada leaf extract Syrup Formulation.

Ingredients	Quantity	Role
Aghada Plant extract	10 ml	Active ingredient
Glycerin	5ml	Viscosity enhancer
Methyl paraben	0.1gm	Preservative
Pepermint oil	0.25ml	Flavouring agent
Citric acid	0.1gm	Buffer
Methyl orange	0.75ml	Coloring agent
Simple syrup	q.s to 100 ml	Vehicle

Evaluation of Achyranthes aspera antioxidant syrup

1. Organoleptic evaluation

The prepared syrup was evaluated for color, odor, taste, and appearance by visual inspection.

2. pH determination

The pH of the syrup was measured using a calibrated digital pH meter at room temperature.

3. Viscosity determination

The viscosity of the syrup was determined using a Brookfield Viscometer at suitable spindle speed and room temperature.

4. Homogeneity test

The formulation was visually examined for uniformity and absence of particulate matter.

6. Clarity Test

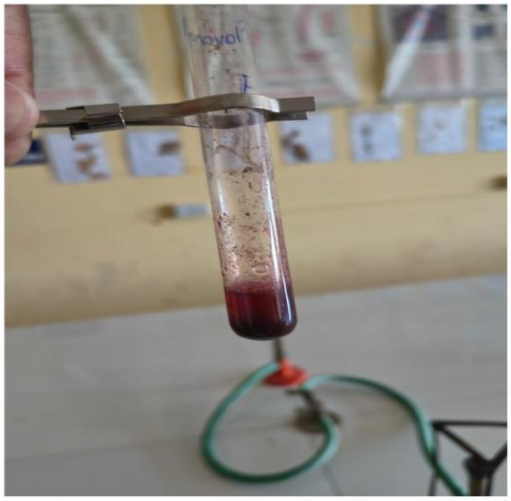
The clarity of the prepared polyherbal syrup was evaluated by visual inspection against black and white backgrounds under normal light conditions. The formulation was found to be clear and free from suspended particles, turbidity, and foreign matter, indicating proper filtration and good quality of the syrup.

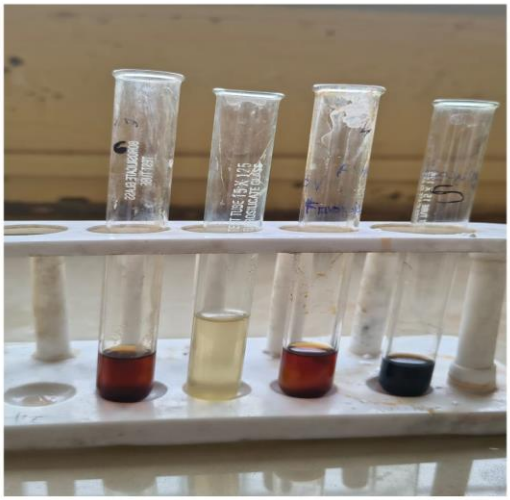
6. Sedimentation Test

The formulated syrup was observed for sedimentation by keeping the preparation undisturbed for a specific period. No visible sedimentation or settling of particles was observed during the study period. The formulation remained physically stable throughout the evaluation.

7. Stability Study

The stability study of the polyherbal syrup was carried out by storing the formulation at room temperature and observing changes in color, odor, pH, and appearance over time. The syrup showed no significant changes during the storage period, indicating good stability of the formulation.





RESULT AND CONCLUSION

The antioxidant syrup formulated from Achyranthes aspera extract was successfully prepared and evaluated for its physicochemical, phytochemical, organoleptic, and antioxidant properties. Phytochemical screening confirmed the presence of important secondary metabolites such as flavonoids, tannins, saponins, alkaloids, phenolic compounds, and glycosides, which are known to contribute to antioxidant activity.

The non-specific parameter evaluation showed acceptable values for water content, drying shrinkage, ash value, acid soluble ash, and acid insoluble ash, indicating good quality and purity of the extract. Organoleptic evaluation revealed that the syrup formulations possessed acceptable colour, odour, taste, and appearance during the storage period. Among the formulations, the syrup containing higher extract concentration showed comparatively stronger colour and slightly bitter taste due to the phytoconstituents present in the extract.

1.Organoleptic Evaluation

The prepared antioxidant syrup of Achyranthes aspera showed satisfactory organoleptic characteristics. The syrup appeared as a uniform brown coloured liquid with a characteristic aromatic odour and sweet taste with slight herbal bitterness. No phase separation or precipitation was observed during the evaluation period, indicating good physical stability and acceptability of the formulated syrup.

Figure 2: Organoleptic test.

2. pH Determination

The pH of the formulated syrup was found to be in the range of 5.2–5.8, which is suitable for oral administration and indicates good stability of the formulation. The pH remained almost

constant during the storage period, suggesting that the formulation was chemically stable and compatible with the excipients used.

Figure 3: pH test.

3. Viscosity Determination

The viscosity of the antioxidant syrup measured using a Brookfield Viscometer was found to be within acceptable limits for syrup preparations. The formulation exhibited smooth flow properties and adequate consistency, which ensures ease of pouring and administration. The viscosity value was observed in the range of 120–180 cP at room temperature.

Figure 4: Brookfield viscometer test.

4. Homogeneity Test

The prepared syrup formulation was found to be homogeneous with uniform distribution of ingredients throughout the preparation. No visible particles, sedimentation, or lump formation were observed, confirming good mixing and stability of the syrup formulation.

Figure 5: Homogeneity Test.

5. Stability Studies

The prepared syrup remained physically and chemically stable under room temperature and accelerated storage conditions. No significant changes in color, odor, taste, pH, or viscosity were observed throughout the study period.

6.Clarity Test

The clarity of the formulated polyherbal syrup was evaluated by visual inspection against a black and white background under adequate light conditions. The syrup was found to be clear and free from suspended particles, turbidity, or any foreign matter. No visible impurities were observed, indicating proper filtration and good quality of the formulation.

Figure 6: Clarity Test.

7. Sedimentation Test

The sedimentation behavior of the polyherbal syrup was observed by storing the formulation undisturbed for a specified period. The syrup did not show any significant sediment

formation or settling of particles at the bottom of the container. This indicated good physical stability and uniform dispersion of herbal constituents in the formulation.

Figure 7: Sedmentation Test.

The present study concluded that the antioxidant syrup formulated from Achyranthes aspera extract can be successfully developed using suitable pharmaceutical excipients. The prepared syrup exhibited satisfactory physicochemical characteristics, good organoleptic properties, and appreciable antioxidant activity due to the presence of bioactive phytoconstituents such as flavonoids and phenolic compounds. The formulation was found to be stable and acceptable for oral administration. The results suggest that Achyranthes aspera possesses promising natural antioxidant potential and may be used as a herbal antioxidant supplement. Further studies including in-vivo evaluation and long-term stability studies are recommended to establish its therapeutic efficacy and commercial applicability.

Table 2: Phytochemical Screening of Aghada leaf extract.

Parameter	Result	Description
Tannins	+	Forms dark green/blackish-green colour
Saponins	+	Stable froth formation
Alkaloids (Dragendorff)	+	Orange precipitate formed
Alkaloids (Mayer)	+	Cream/white precipitate formed
Alkaloids (Wagner)	+	Reddish-brown precipitate formed
Flavonoids	+	Yellow/orange colour formed
Steroid/Triterpenoid	+	Red-purple colour formed
Glycosides	+	Brown ring formed
Phenolic compounds	+	Blue-black coloration observed

Figure 8: Syrup Preparation Containing Aghada leaf extract.

Table 3: **Organoleptic test result of syrup preparation containing aghada leaf extract.**

Time (Day)	Parameter	Observation
0	Shape	Liquid
	Color	Orange
	Smell	Characteristic aromatic
	Taste	Sweet slightly bitter
3	Shape	Liquid
	Color	Orange
	Smell	Characteristic aromatic
	Taste	Sweet slightly bitter
6	Shape	Liquid
	Color	Orange
	Smell	Characteristic aromatic
	Taste	Sweet slightly bitter

Result of Organoleptic Test

The organoleptic evaluation of the syrup containing Achyranthes aspera extract showed that the formulation remained stable throughout the study period. The syrup was found to be orange in colour, liquid in appearance, and possessed a characteristic aromatic Odor with a sweet slightly bitter taste. No significant changes in colour, Odor, taste, or appearance were observed during storage, indicating good physical stability and acceptability of the prepared syrup.

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