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Development and Evaluation of Withania Coagulans Syrup for Anti-Inflammatory Activity in Arthritis Management

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Abstract: *The rising incidence of arthritis has prompted the exploration of plant-based therapies as adjuncts or alternatives to conventional anti-inflammatory medications. This study aimed to formulate and evaluate an anti-inflammatory syrup incorporating Withania coagulans Dunal, a medicinal plant known for its therapeutic properties, to manage arthritis symptoms effectively.An aqueous extract of Withania coagulans was used to develop a syrup formulation optimized for stability, taste, and bioavailability. The anti-inflammatory activity of the formulation was assessed using both in-vitro assays and in-vivo models, including the measurement of inflammatory biomarkers and paw edema in animal models of arthritis. The syrup exhibited significant anti-inflammatory effects, comparable to those of standard pharmaceutical agents, while demonstrating an improved safety profile and reduced side effects.The formulation displayed favorable physicochemical properties and remained stable over time. These findings indicate that a Withania coagulans-based syrup may offer a natural, effective, and safer alternative for the management of arthritis. It holds potential to enhance patient quality of life and reduce reliance on long-term pharmacological treatments. Further clinical studies are recommended to validate its therapeutic efficacy and safety in human populations. Future research will focus on refining the formulation to ensure efficacy, palatability, and long-term safety.*

Keywords: Withania coagulans, Arthritis, Anti-inflammatory syrup, Formulation, Evaluation

I. INTRODUCTION

Arthritis

Arthritis is a widespread condition affecting millions globally, marked by joint pain, stiffness, and swelling. The most common forms osteoarthritis and rheumatoid arthritis are driven by chronic joint inflammation that leads to tissue damage and reduced mobility. Standard treatments such as NSAIDs, corticosteroids, and DMARDs aim to control symptoms and disease progression but are often associated with significant side effects, including gastrointestinal discomfort, cardiovascular complications, and long-term toxicity. These drawbacks highlight the urgent need for safer, more sustainable alternatives, especially for chronic use.

Syrup

In response, there has been growing interest in plant-based therapies that offer anti-inflammatory benefits with fewer side effects. *Withania coagulans* Dunal, a medicinal plant used in traditional systems of medicine, has shown promise due to its anti-inflammatory, immunomodulatory, and analgesic properties. Despite its known benefits, research on its application in user-friendly and effective formulations remains limited. Developing a syrup using *Withania coagulans* presents a novel approach particularly beneficial for pediatric and elderly populations by offering improved taste, ease of administration, and potentially enhanced bioavailability. This liquid formulation may improve patient compliance and therapeutic outcomes. By combining traditional herbal knowledge with modern pharmaceutical techniques, this research seeks to create a safe, natural, and effective alternative to conventional arthritis therapies, with the potential to improve long-term quality of life for patients.

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Objectives:

To Formulate and optimization of Withania coagulans syrup.

To development of herbal syrup of Withania coagulans plant in reducing inflammation

To develop a palatable anti-inflammatory syrup.

To develop suitable dosage form, from the active chemical moiety extracted from plant by using modern pharmaceuticals approach.

To evaluate the physical properties (colour, taste, consistency, pH) of the syrup.

To standardize innovative and effective herbal product.

Plant Profile:

Parameter	Information
Plant	**Withania Coagulans Dunal** 
Taxonomical Classification	Kingdom: Plantae Division: Magnoliophyte Class: Magnolipsida Order: Solanales Family: Solanaceae Genus: Withania Species: Withania Coagulan
Chemical Constitute	Alkaloids Withanine: Withanolides: Steroidal Lactones (Withanolides) Withaferin A Withanolide D
Uses	Anti-Diabetic Agent Anti-Inflammatory Antioxidant Digestive Health

MATERIAL AND MATHODS:

Method of Extraction

The extract of *Withania coagulans* (Dunal) fruit powder was prepared using the decoction method.

Dried fruits of *Withania coagulans* (Dunal) were first ground into a fine powder using a mechanical grinder.

20 grams of the resulting fruit powder were placed in a volumetric flask, and 70 mL of water was added.

The mixture was then heated on water bath with continuous shaking for 50 minutes.

After heating, the mixture was allowed to cool for 1 hour and then filtered using Whatman filter paper.

The filtrate was concentrated using a hot water bath.

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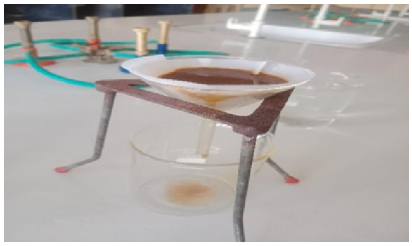
The final extract was stored under cool conditions, and the required amount was used as needed.

Formulation Procedure for Syrup:

1) Collect the raw material that is the fruits of Withania coagulans and dry them thoroughly under shade to retain their natural properties.
2) Perform the extraction process on the dried fruits using the decoction method to obtain the extract.
3) Prepare simple syrup as the base for the formulation of the final syrup.
4) Take a beaker, add water to it and place the beaker in a water bath.
5) Then, add the required quantities of honey and sodium benzoate. Stir continuously until a homogeneous mixture is formed.
6) Add a few drops of flavouring essence to the mixture to enhance its taste and aroma.
7) Add the prepared herbal extract to the syrup base and mix thoroughly to ensure uniform consistency.
8) Prepare a minimum three separate batches of the syrup.
9) Perform the physical, chemical, and stability tests on the prepared syrup.



Sr No.	Ingredients	F1 Batch (100 ml)	F2 Batch (100 ml)	F3 Batch (100 ml)
1	Withania coagulans Fruit extract (Active Ingredient)	50 ml	50 ml	50 ml
2	Honey (Sweetener)	5 ml	10 ml	20 ml
3	Sodium benzoate (Preservative)	5 gm	5 gm	5 gm
3	Orange essence (Flavouring agent)	1 ml	3 ml	5 ml
4	Distilled water (Vehicle)	qs.	qs.	qs.