

## DEVELOPING AND TESTING A NATURAL GEL THAT CAN BE APPLIED TO THE SKIN TO HELP ANIMALS WITH ARTHRITIS

Mr. Kiran Dnyaneshwar Mahajan<sup>1</sup>, Ms. Vaishnavi Bhanudas Shingate<sup>2</sup>,  
Ajinkya Sudhir Patil<sup>3</sup>, Sayali vilas chaudhari<sup>4</sup>, Abhay Bhausaheb Patil<sup>5</sup>,  
Pratham Rajesh Koli<sup>6</sup>, Mr. Utkarsh Ravindra Mandage<sup>7</sup>, Mr. Saeed Ahmad Iqbal Ahmad<sup>8</sup>  
<sup>1,2,3,4,5,6,7,8</sup>Dept. of Pharmacy, SNJB, India.

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### ABSTRACT

In this study, we aimed to create and test a special herbal gel that contains extracts from *Cardiospermum halicacabum* and *Vitex negundo* leaves to see if it can help with arthritis in rats. We made twelve different versions of the gel using different ingredients, and we checked how they looked, their thickness, how easy they could be squeezed out, their acidity, how well they spread, and how the active ingredients were released. We also made sure the gel stayed stable over time and didn't cause skin problems. Then, we tested the gel on rats with arthritis. We looked at things like their weight, the swelling in their paws, their blood and other body fluids, and we even checked their tissues under a microscope. We found that one of the gel versions, called F4, worked really well in reducing arthritis symptoms in the rats. This means it might have potential as a treatment for arthritis in the future.

**Keywords-** Arthritis treatment with herbal gel Herbal gel with *Cardiospermum halicacabum* Herbal gel with *Vitex negundo* Medicinal plants for arthritis treatment.

➤ **simple words, these are the main topics we are studying:**

1. Using herbal gel to treat arthritis.
2. Making a gel with *Cardiospermum halicacabum*.
3. Making a gel with *Vitex negundo*.
4. Using plants as medicine for arthritis.

### 1. INTRODUCTION

Arthritis is a condition where the body's immune system goes haywire and affects a small percentage of people globally. The medicines usually given for Rheumatoid Arthritis have side effects like stomach problems, weakened immune system, and disturbances in the body's defense mechanisms. Traditional Indian systems of medicine, like Siddha and Ayurveda, are becoming more popular as alternatives for treating arthritis. Two plants commonly used in these traditional practices for arthritis are *Cardiospermum halicacabum* and *Vitex negundo*. *Cardiospermum halicacabum* (CH) has been used in Chinese medicine for a long time to treat inflammation, rheumatism, and other diseases. Research has shown that it has anti-inflammatory properties and can reduce pain and fever. It also contains various helpful compounds. *Vitex negundo* Linn. (VN) is known as Nirgundi in Hindi and is found in wastelands. It contains several natural substances and has been used for its anti-arthritic, anti-inflammatory, and other beneficial effects. We decided to make a special gel using extracts from these two plants and test it to see if it could help with arthritis. This gel is easy to apply, works directly where it's applied, doesn't cause much discomfort, and doesn't get broken down by the digestive system. Although these plants have been used for medicine in various forms, we focused on using their leaves for our gel because they are commonly used for arthritis treatment in traditional medicine.

### 2. MATERIALS AND METHODS

#### • Materials

We collected fresh leaves of *Vitex negundo* and *Cardiospermum halicacabum* from Palakkad, Kerala, and made sure they were the right plants with the help of an expert. We also got some chemicals like Freund's complete adjuvant, diclofenac sodium, triethanolamine, propylene glycol, and disodium edetate from Sigma-Aldrich USA. For making our gel, we used substances called Carbopol 934 and Carbopol 940, which we got from Loba Chemie Pvt. Ltd. in Mumbai.

#### • Preparing the Plant Extracts

First, we cleaned and dried the leaves properly. Then, we used a special method to extract useful stuff from the leaves. For *Cardiospermum halicacabum*, we used a machine called a Soxhlet extractor with methanol, and for

Vitex negundo, we soaked the leaves in methanol for a week. After that, we filtered the extracts and concentrated them under low pressure using a machine called a rotary evaporator. We stored these extracts at a cool temperature for later use.

- **Animals**

We used Wistar rats, female albino mice, and albino rabbits in our experiments. These animals were kept in a controlled environment with the right temperature, humidity, and lighting conditions.

They had their own cages with clean bedding, and they could eat and drink whenever they wanted. We made sure to follow ethical guidelines for using animals in experiments. A committee that oversees animal experiments approved our research plan, and our college's animal ethics committee also gave their approval.

- **Making the Gel Base**

To create the gel, we first mixed Carbopol 934 with water slowly to avoid lumps. Then, we separately mixed disodium edetate and triethanolamine with water and stirred them. We also mixed propylene glycol with water. Next, we added the disodium edetate and triethanolamine mixture to the Carbopol mixture and adjusted the pH level. Finally, we added the propylene glycol mixture and stirred until we had a clear and consistent gel base.

- **Checking the Quality of the Gel**

We wanted to make sure that the gel we prepared had the right amount of active ingredients. To do this, we took a little bit of each gel formulation (1 gram) and mixed it with a special liquid called methanol. We shook it well to dissolve the active ingredients.

Then, we filtered the solution to get rid of any solid bits, and we took a tiny amount (0.1 mL) of the filtered liquid. We made this tiny amount a bit bigger (10 mL) by adding more methanol to it. Next, we used a special machine that measures how much of the active ingredients are in the liquid by shining a light at it. This light had a specific wavelength of 275 nm, which is the best for measuring these ingredients.

- **Extrudability**

We wanted to see how easily the gel comes out of the tube. So, we took a tube of the gel, squeezed it, and measured how much came out. Then, we calculated the percentage of gel that came out.

- **pH Measurement**

We measured the acidity or alkalinity of the gel using a digital pH meter. We dipped a special glass probe into the gel to get this measurement. We did this three times and took the average.

- **Appearance and Homogeneity**

We looked at the gel to see how it appeared and if it was mixed well.

- **Viscosity**

We measured how thick the gel was using a machine called a Brookfield viscometer. It tells us how easily the gel flows.

- **Spreadability**

We tested how well the gel spreads. We put the gel between two glass slides and pressed them together. Then, we measured how long it took for the top slide to slide off. We did this three times and took an average.

- **In vitro Diffusion Profile**

We studied how the active ingredients in the gel move through rat skin using a special setup. We used rat skin as a barrier and placed the gel on it. We had a liquid on the other side of the skin that was like what's inside our bodies. We took samples of the liquid at different times to see how much of the active ingredients had moved through the skin.

- **Release Kinetics**

We looked at how the active ingredients were released from the gel over time and tried to understand the pattern.

- **Stability Studies**

We checked how the gel's quality changed over 6 months when stored at different temperatures and humidities. We looked at things like color, smell, how well it mixed, pH, thickness, the amount of active ingredients, and if any microbes grew in it.

- **Anti-arthritis Activity**

We tested if the gel worked to reduce arthritis in rats. We divided the rats into groups, applied different things to their joints, and measured their weight and paw size to see if the gel helped with arthritis pain.

- **Hematological Parameters**

We took blood from the rats and checked things like red and white blood cell counts, hemoglobin, and other markers in their blood to understand how the gel affected their health.

- **Biochemical Estimations**

We measured different substances in the rats' blood to see how the gel affected their overall health.

- **Histopathological Investigations**

We looked at the rats' thymus, spleen, and ankle joints under a microscope to see if there were any changes after using the gel.

### 3. STATISTICAL ANALYSIS

We used math to analyze the data and see if the results were statistically significant.

### 4. SKIN IRRITATION STUDY

We applied the gel to the skin of rabbits and checked if it caused any irritation or reaction on their skin over several days.

### 5. CONCLUSION

The gel we made for arthritis treatment seems to work because it contains certain natural substances called luteolin and apigenin. Among our different gel formulations, the one which has 2% of both CHME and VNME and 1.5% of carbopol 934, showed the most promise in treating arthritis. But, we need more studies with real patients to be sure it works well for people with joint problems.

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