RESEARCH ARTICLE

Pharmacobotanical Application of *Ricinus communis* Seed Oil in Formulation and Evaluation of Herbal Emulgel for the Treatment of Psoriasis

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ABSTRACT

Inflammatory and immune-mediated skin disease, psoriasis. It's common for psoriasis to be seen in people all over the globe. Drugs are most effectively delivered through the topical route for treating skin conditions. An attempt was made to increase the effectiveness of topical treatment for psoriasis by using emulgel compositions containing *Ricinus communis* seed oil. In order to create the gel, the extract was mixed with liquid paraffin, olive and coconut oils, and Carbopol 936 and 940 gelling agents. The viscosity and glossiness of the emulgel were achieved using herbal extracts. When tested for physicochemical criteria, the developed formulations were found to be acceptable in every way. These findings imply that topical gel therapy for psoriasis is becoming more effective. Due to the emulgel improved penetration, the herbal gel has more effectiveness.

Keywords: Emulgel, Psoriasis, *Ricinus communis*.

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INTRODUCTION

Psoriasis is a chronic inflammatory autoimmune disease of the skin. It is possible to classify psoriasis into mild, moderate, and severe forms based on the severity of the disease's signs and symptoms. The most frequent signs and symptoms are areas of itchy, scaly skin that are white or red in color. Itchiness, red scalps, white scales, and rashes are all signs of psoriasis. Psoriasis often affects the skin, joints, and nails. Although there are other clinical forms of psoriasis, the plaque kind is the most prevalent and affects the majority of individuals throughout the globe. Psoriasis is a painful and disfiguring skin condition that is not contagious and has an impact on the patient's mental well-being as well as their physical well-being. Traditional treatments for psoriasis are many. Topical and systemic treatments, as well as phototherapy and its combinations[1,2] all fall under this category. There are a variety of drawbacks to long-term administration of these medications due to side effects, such as hepatotoxicity (hepatosis), nephrotoxicity (nephrotoxicity), carcinogenicity, and widespread immunosuppression.[3,4] On the other hand, short-term psoriasis therapy causes the illness to go into remission or alleviates the patient's symptoms. Psoriatic arthritis, a kind of seronegative arthritis, is often associated with psoriasis, as are mental illness, cardiovascular disease,

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Table 1: Preliminary screening data of *R. communis* extract

Constituents (Bioactive)	*Extract (Ethanolic)*
Alkaloids	++
Flavonoids	++
Carbohydrates	--
Glycosides	++
Saponins	++
Steroids	++
Tannins	++
Triterpinoids	--

and other disorders.[5] This necessitates developing novel therapeutic options for psoriasis that have minimal or no adverse effects while being effective.

Most of the population relies on herbal treatment, with roughly 75 to 80% of all people using plant extracts and active ingredients in traditional therapy. A decline in the use of herbal remedies occurred with the introduction of modern medicine. Still, developments in phytochemistry and the discovery of plant chemicals that are helpful against certain ailments have reignited interest.[6] Patients prefer herbal remedies to conventional ones because they feel they are less harmful to them. Aside from the fact that herbal medications have a great deal more structural diversity and many modes of action than synthetic chemicals, they also tend to be less expensive. Psoriasis may be effectively treated using herbal medications with fewer side effects and lower prices than traditional treatments. Psoriasis sufferers have access to a wide range of natural medicines and formulations. Search for a newer replacement is ongoing.[7]

A member of the Euphorbiaceae family, *Ricinus communis* is also known as "castor plant," "palm of Christ," "Endi," "Errandi," "Diveli," and Jada (Oriya), as well as other names such as Verenda (Bengali), "Endi," and "Errandi" in other dialects. Ornamental varieties of this plant may be found all across the tropics. Its oil-bearing seeds are the primary reason for its widespread cultivation. The oil found in seeds is called fixed oil (45–52%). This plant grows wild in Indian forests and is widely farmed throughout the country, mostly in the presidencies of Madras, Bengal, and Bombay. An annual shrub with little grey (white) seeds with brown markings, a perennial bushy shrub with huge fruits, and enormous red seeds provide around 40% of the plant's oil.[8]

Emulgel is a novel topical medication delivery method combining emulsion and gel. Like an emulsion or gel, it offers a two-stage control release. An innovative new formulation class, gel distributes drugs more quickly than ointment, cream, or lotion. Skin problems may be treated using an emulgel formulation that incorporates a medication. For a variety of reasons, topical application of medicinal substances is preferable to oral delivery. A typical emulsion gets turned into an emulgel as a result of the presence of gelling chemicals in the water during the emulsion process. Use of translucent gels in cosmetics and pharmaceuticals has increased in the principal category of semisolid preparations.[9] Emulgels are thixotropic, greaseless, freely smooth and creamy, easily reversed, emollient, non-staining, have a long shelf life, are bio-friendly, transparent, and are visually appealing.[10] They too have a pleasing appearance.

In this study, a novel herbal emulgel containing *R. communis* seed extract was created and assessed using a liquid paraffin, olive oil, coconut oil, oil phase and the gelling agents Carbopol 934/or Carbopol 940 as that of the gelling agents.

MATERIALS AND METHODS

The common ragweed an ethanolic extract of the seeds was made in the laboratory. In Mumbai, Merck Labs produced Carbopol 934 and Carbopol 940. Fisher Scientific in Mumbai provided the methyl and propyl parabens. Loba Chemie in Mumbai produces this liquid paraffin. They bought olive and coconut oils at the local store. Analytical-grade ingredients were used in all of the recipes.

METHODOLOGY

Extraction

R. communis seedlings were thoroughly pulverized and clear of debris before being separated in a soxhlet apparatus utilizing ethanol as the menstruum, and the results were positive. The distillation procedure resulted in a more concentrated extract. The solvent was then evaporated further by drying the extract in the shade. Desiccators were used to preserve

Table 2: Formulation of Emulgel

Ingredients	Formula-1	Formula-2	Formula-3	Formula-4	Formula-5	Formula-6
R. communis extract	01	01	01	01	01	01
Carbopol 940	01	01	01	-	-	-
Carbopol 934	-	-	-	01	01	01
Liquid paraffin	7.5	-	-	7.5	-	-
Olive oil	-	7.5	-	-	7.5	-
Coconut oil	-	-	7.5	-	-	7.5
Propylene glycol	05	05	05	05	05	05
Methyl Paraben	0.030	0.030	0.030	0.030	0.030	0.030
Propyl Paraben	0.030	0.030	0.030	0.030	0.030	0.030
Distilled Water	q. s	q. s	q. s	q. s	q. s	q. s

Table 3: Physicochemical observation data of emulgel formulations

S. No	Formulation code	Appearance	Homogeneity	Consistency	pH
1	Formula-1	Pale yellow	Fine	Excellent	6.3 ± 0.01
2	Formula-2	Pale yellow	Fine	Excellent	6.3 ± 0.01
3	Formula-3	Pale yellow	Fine	Excellent	5.96 ± 0.01
4	Formula-4	Pale yellow	Fine	Excellent	6.53 ± 0.05
5	Formula-5	Pale yellow	Fine	Excellent	6.08 ± 0.13
6	Formula-6	Pale yellow	Fine	Excellent	6.24 ± 0.40

the dried extract, which was labeled and stored. Table 1 shows the results of testing the extract for a variety of phytochemical ingredients.[11]

Characterization of *R. communis*

Physiochemical Analysis

Analysis of the Physiochemical To identify *R. communis*, different physiochemical characteristics were tested, including description, solubility, pH, and loss on drying (Table 3).

Description

Visual observation was used to assess the physical appearance of an extract of *R. communis.*

Solubility

A *R. communis* extractive then placed within amber-colored glass vials with 10 mL of distilled water. At room temperature, the vials were sonicated for up to two hours. Afterward, the mixtures were centrifuged for five minutes after equilibrating for 24 hours. The Whatman filter paper was used to filter off the supernatant from each vial, which was then diluted with filtered water and examined at 281 nm.

pH

The pH of a 1% w/v concentration of *R. communis* strain with distilled water was determined using a pH metre. *R. communis* extract was used to make the solution.

Loss on Drying (LoD)

Loss on drying (LoD) was determined by weighing 1.5 gm of powder onto a flat porcelain dish and allowing it to dry at room temperature. A 100°C oven was used to dry the powder. It was allowed to cool and the weight loss was measured as moisture.

Microbiological Analysis

The complete plate amount, yeast as well as mould totals, *Escherichia coli, Salmonella spp.* plus *Staphylococcus aureus* remained between the many microbiological tests conducted to determine if the *R. communis* extract was contaminated *(S. aureus).*

Pretreatment of Sample

Preparation of a specimen buffering sodium chloride peptone, pH 7.0, was used to dissolve 10 gm of *R. communis* extract in 100 mL of a buffered solution.

Total plate count

We produced 1-mL of the material, mixed it with 15 mL of soybean-casein digest agar, and then placed it in sterile petri dishes. The petri dish was stirred to ensure an even dispersion of the organisms in the sample. Over the course of three days, plates were incubated between 30 and 35°C. At the conclusion of the third day, the colonies that had developed were counted[7].

Phytochemical Analysis

Following procedures for phytochemical analysis, the extract's active chemical components were determined to be absent.

Test for Tannins

Sample of 1-mL was combined with 5 mL of condensed water for boiling. A solution of 0.1% ferric chloride was then added to the cooled-down sample after the boiling process had been completed. The presence of a brownish green or black coloration can confirm the presence of tannins.

Test for Phlobatannins

The extract (1-mL) was treated with 1% HCl and heated to 90 to 100°C in a water bath. The formation of red precipitate may detect phlobatannins.

Test for Saponins

The extract was combined using 2 mL of condensed water in a test tube containing 1-mL of the strain. The test tube was then placed in a bain-marie filled with boiling water and aggressively shook to bring it to a rolling boil. The occurrence of froth production that lasted for an additional hour is proof that saponins are present.

Test for Terpenoids

Table 4: Physical evaluation data of emulgel formulations

S. No	*Formulation code*	*Spreadability*	*Drug Content*	*Zone of Inhibition (mm)*	*Viscosity*	*Extrudability*
1	Formula-1	66.39	78.1 ± 0.03	20	99	++
2	Formula-2	55.5	84.4 ± 0.55	21.5	97	+++
3	Formula-3	35.5	85.3 ± 0.01	20.4	94	+++
4	Formula-4	81.36	93.6 ± 0.007	20.7	92	++++
5	Formula-5	74	82.9 ± 0.03	20.5	91	++
6	Formula-6	66	83.1 ± 0.01	19.8	90	++

Table 5: *In vitro* drug release from emulgel formulations

S. No	*Time (hours)*	*Formula-1*	*Formula-2*	*Formula-3*	*Formula-4*	*Formula-5*	*Formula-6*
1	0	0	0	0	0	0	0
2	1	10.34	12.44	11.3	10.14	10.34	12.4
3	2	30.20	32.10	30.10	20.20	30.20	30.20
4	3	34.30	38.12	31.30	31.30	34.30	44.30
5	4	40.2	45.32	42.2	34.24	45.2	50.2
6	5	50.41	52.11	52.40	40.41	60.41	70.41
7	6	66.32	60.32	62.12	56.32	76.32	81.32
8	7	74.12	84.12	72.12	74.12	84.12	88.2
9	8	90.25	91.55	91.01	90.25	92.25	90.55

In 5 mL of extract were mixed with 2 mL of chloroform and 3 mL of strong sulfuric acid in a test tube. Flavonoids are detected whenever a yellow colour emerges and then go away when the plant can stand.

Formulation of Emulgel

Table 2 provides the recipe for the different *R. communis* emulgel formulations. Initially, a gel was created by dispersing Carbopol 940 and Carbopol 934 in warm filtered water (80°C), which was then cooled and left overnight. Tween 80 was used to dissolve span 80 in light liquid paraffin, while span 80 was used to dissolve Tween 80 in water. Propylene glycol was used to dissolve methyl and propyl parabens, while water was used to dissolve the medication. Both solutions were then dissolved in aqueous phase. Continuous stirring was used to cool and mix the two phases at room temperature after they had been heated to 70 to 80°C in separate vessels. Emulgel was created by mixing the emulsion with gel in a 1:1 ratio with continuous stirring. Triethanolamine was used to modify the emulgel pH.[12-14]

Evaluation of Prepared Emulgel Formulations

Physical Examination

The color, look, consistency, smoothness, and grit of the emulgel compositions that were created were all evaluated visually for their characteristics (Table 4).

Measurement of pH

The pH of the emulgel formulations was determined with the use of a digital pH meter. Distilled water was used to dissolve one gm of gel, and the mixture was set aside for two hours. The pH of each composition was tested three times and averaged.

Viscosity

Spindle no. 4 of the Brookfield Viscometer at 10 rpm was used to test the viscosity of several emulgel compositions at 25°C by means of Brookfield Viscometer.

Spreadability

The emulgel spreadability was tested 24 hours after it was made. The diameter of the emulgel circle formed when the emulgel is placed among glass plates of certain weight is used to calculate this value. Two plates were placed side-by-side and the weight of one (350 mg) was transferred to the other (500 mg). The diameter of the spread emulgel circle was determined by taking a measurement.

Extrudability

Formulations were placed in the collapsible pipes after putting the emulgel in the container. This allowed for easy extrusion. An application of the amount in gm required to extrude at least 0.5 cm of fluid from the aluminium collapsible tube in 10 seconds was made to calculate the value of gel ejected from the tube. The product's ability to be extruded is determined by the amount of product that was produced. Each formulation's extrudability was tested three times, with the average of the results calculated. In order to figure out the extrudability, we used the following formula:

$$\textbf{Extrudability} = \frac{\text{Applied weight to extrude gel from tube (g)}}{\text{area (cm2)}}$$

Drug Content

It was determined that approximately 1g of emulgel was precisely weighed into a volumetric flask containing about 70 mL of water, and that approximately 70 mL deionized water was also added. The volume was increased to 100 mL of distilled water after mixing. An appropriate filter paper was used to remove the impurities from the information. A 1-mL of filtrate was pipetted into a new container. A shimadzu UV-vis

Table 6: Stability Study data of herbal emulgel formulation

S. No	*Formulation*	*Days*	*Appearance*	*pH*	*%Drug Content*
1	Formula-1	30	Dark brown	6.3 ± 0.01	78.1 ± 0.03
2	Formula-2	30	Dark brown	6.3 ± 0.01	84.4 ± 0.55
3	Formula-3	30	Dark brown	5.96 ± 0.01	85.3 ± 0.01
4	Formula-4	30	Dark brown	6.53 ± 0.005	93.6 ± 0.007
5	Formula-5	30	Dark brown	6.08 ± 0.13	82.9 ± 0.03
6	Formula-6	30	Dark brown	6.24 ± 0.4	83.1 ± 0.01

spectrophotometer-1700 at a wavelength of 281 nm was used to quantify the extract spectrophotometrically.

In-vitro diffusion study

In-vitro diffusion tests were performed in Franz diffusion cells to investigate the dissolving release of gels via a cellophane membrane.[7] At 37°C, distilled water was used as a dissolving media for a gel sample (1-gm) that was placed in cellophane membrane.

Each test was replaced with an equal amount of dissolving media at intervals of 1, 2, 3, 4, 5, 6, 7 and 8 hours. Using filtered water as a blank, the drug concentration of the samples was determined.

Extract-excipient Compatibility Study

FTIR spectroscopy experiments were used to determine the extract's compatibility with the specified excipients in a 1:1 combination of extract and excipients. The KBr pellet technique was used for spectroscopic analyses of the physical mixture samples. In order to identify any significant interactions, spectra of both medication and polymer were collected and examined (Table 5).

FTIR Spectroscopy

Attenuated total reflectance (ATR) modes of the Shimadzu FTIR spectrometer Prestige 21 was used to acquire samples' FTIR spectra. 45 scans with a solution of 5 cm^{-1} were used to gather the spectra spanning the range of 4000 to 400 cm^{-1}.

Stability Studies

To determine intermediate and accelerated shelf life, stability tests were performed for three months according to the International Conference on Harmonization (ICH) standards at temperatures of 300°C (65%) and 55% relative humidity (RH), respectively. Changes in pigment, texture, spreadability, pH, and medication concentration were all examined in the formulations (Table 6).

RESULTS AND DISCUSSION

In a soxhlet apparatus, ethanol was used as menstruum to extract the coarsely powdered *R. communis* beans free of debris. The dried extract's phytochemical composition was examined. Early phytochemical screening findings showed the presence of flavonoids, alkaloids, polysaccharides, glycosides, saponins, tannins, as well as steroids, among other compounds. Table 1 shows the findings of the study. The technique of infrared spectroscopy was used to determine the compatibility of the ethanolic extract with the polymers. It was shown that formulations had peak heights comparable to the pure extract. Extract and excipients were shown to have no interaction.[15]

For the purpose of creating an emulgel out from the strain, Carbopol 936 as well as Carbopol 940 gelling agents, as well as liquid glycerin, olive oil, as well as coconut oil, were used in conjunction with the extract. Although thick and yellowish-white in color, the emulgel exhibited a glossy shine. For this experiment, we tested for the emulgel acidity and found that were between 5.96 and 6.53. The viscosity of each formulation was measured using a Brookfield Viscometer. All of the formulae examined had a broad range of results between 90 and 91. (Cp). It was discovered that the emulgel could be easily disseminated with just a little amount of shear using the parallel glass slide method, which was used to all plant emulgel formulations. The densities varied from 35 to 81.6 gm per cubic centimeter. Testing the emulgel extrudability in suitable tubes is shown in Table 3. A UV-visible spectrophotometer was used to determine the herbal emulgel medication content, and the findings varied from 78.1 to 93.6%. Adequate drug release was shown *in-vitro* by using emulgel formulations. Almost all formulations had the best drug release. During 8 hours of dosing, Formulation F5 had a 92.25% drug release rate.[16]

In the end, it was found that the emulgel formulas were reliable. All of the compositions were found to be stable for three months in storage. There were no changes in terms of color, physical appearance, pH, concentration of a drug, rheological properties, or drug release parameters.[17]

CONCLUSION

The castor plant, *R. communis*, is one of the most widely used and most effective medicinal herbs. The pharmacological activities of *R. communis*, as demonstrated in numerous studies, show that the therapeutic benefit is much greater. One of the primary sources of chemicals, both chemically and pharmacologically. The plant's phytochemical components and pharmacological activity are likely to lead to the development of new, very effective medications.

REFERENCES

1. Ahmad I, Mehmood Z, Mohammad F. Screening of some Indian medicinal plants for their antimicrobial properties. Journal of ethnopharmacology. 1998 Sep 1;62(2):183-93.
2. Griffiths CE, Barker JN. Pathogenesis and clinical features of psoriasis. The Lancet. 2007 Jul 21;370(9583):263-71.
3. Hardenia A, Jayronia S, Jain S. Emulgel: An emergent tool in topical drug delivery. International journal of pharmaceutical sciences and research. 2014 May 1;5(5):1653.
4. Jena J, Gupta AK. *Ricinus communis* Linn: a phytopharmacological review. International Journal of Pharmacy and Pharmaceutical Sciences. 2012;4(4):25-9.
5. Kadri A, Gharsallah N, Damak M, Gdoura R. Chemical composition and *In vitro* antioxidant properties of essential oil of *Ricinus communis* L. Journal of Medicinal Plants Research. 2011 Apr 18;5(8):1466-70.
6. Kaur LP. Topical gel: a recent approach for novel drug delivery. Asian journal of biomedical and Pharmaceutical Sciences. 2013 Feb 1;3(17):1.
7. Keseroglu HO, Gonul M. Traditional topical herbal therapies in psoriasis. CELLMED. 2014;4(4):23-1.
8. Kumar L, Verma R. *In vitro* evaluation of topical gel prepared using natural polymer. International journal of drug delivery. 2010 Jan 1;2(1).
9. Lieberman H, Rieger M, Banker GS, editors. Pharmaceutical dosage forms: Disperse systems. CRC Press; 2020 Aug 26.
10. Misal G, Dixit G, Gulkari V. Formulation and evaluation of herbal gel. Indian journal of natural product and resources 2012, 3, 501-505

11. Negi A, Sharma N, Singh MF. Formulation and evaluation of an herbal anti-inflammatory gel containing Eupatorium leaves extract. Journal of Pharmacognosy and Phytochemistry. 2012 Nov 1;1(4):112-7.
12. Rahman M, Alam K, Zaki Ahmad M, Gupta G, Afzal M, Akhter S, Kazmi I, Jalees Ahmad F, Anwar F. Classical to current approach for treatment of psoriasis: a review. Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders). 2012 Sep 1;12(3):287-302.
13. Ramane SB, Syed VN, Biyani KR. Evaluation of wound healing activity of polyherbal gel–a novel herbal formulation. Int J of Res in Pharmaceutical and Biomedical Sciences. 2013; 4:788-94.
14. Traub M, Marshall K. Psoriasis--pathophysiology, conventional, and alternative approaches to treatment. Alternative medicine review. 2007 Dec 1;12(4): 319- 330.
15. Yamini K, Onesimus T. Preparation and evaluation of herbal anti-acne gel. Int J Pharm Bio Sci. 2013;4(2):956-60.
16. Yuqi TT. Review of a treatment for psoriasis using herose, a botanical formula. The Journal of dermatology. 2005 Dec;32(12):940-5.
17. Zarai Z, Chobba IB, Mansour RB, Békir A, Gharsallah N, Kadri A. Essential oil of the leaves of *Ricinus communis* L.: *In vitro* cytotoxicity and antimicrobial properties. Lipids in health and disease. 2012 Dec;11(1):1-7.