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ORIGINAL ARTICLE

Development and Evaluation of Emulgel from Herbal Extract

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ABSTRACT

An emulgel is formed by mixing gel with emulsion to form a dosage. Emulgel is a topical administration method that is known for its dual release control mechanism. The main goal of this work was to formulate an emulgel using the extract from the leaves of *Ehretia acuminata*. The hydroalcoholic extracts were analyzed for phytochemicals and found to include tannins, saponin glycosides, cardiac glycosides, flavonoids, steroids, proteins, carbohydrates, and alkaloids. Emulgel formulations were created with Carbopol 934 and HPMC. The emulgel was assessed using several assessment parameters and the results were documented. Applying the produced emulgel may be useful against several kinds of microbial infections and in promoting wound healing.

Key words: Emulgel, *Ehretia acuminata*

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INTRODUCTION

Topical drug delivery refers to the direct treatment of a skin ailment using a medication-containing formulation applied to the skin. A topical medication delivery system is a dosage form that is administered to the skin or mucous membranes. Topical drug delivery methods come in many consistencies, including solid, semisolid, and liquid formulations. Topical drug delivery provides benefits such as patient adherence, simple administration, enhanced drug absorption, improved physiological and pharmacological response, decreased systemic toxicity, minimal exposure of drugs to non-target tissues, easy treatment discontinuation, prevention of gastric issues, stable plasma levels, and suitability for drugs with a narrow therapeutic range. [1]

Gels are a modern kind of medication which consists of significant quantities of water or alcohol-based liquid inside a structure of solid particles, which may be made of inorganic materials like aluminum salts or organic polymers derived from natural or manmade sources. They include a higher aqueous component which allows for better drug solubility and easier drug migration via a liquid vehicle, in contrast to ointment or cream bases. These are better in terms of functionality and patient satisfaction. Although gels have several benefits, a significant drawback is their ability to transport hydrophobic medicines. Emulgels are developed and used to allow hydrophobic therapeutic components to benefit from the distinctive features of gels, overcoming their limitations. [2]

Combining gels with emulsions creates a kind of dosage form known as Emulgels. Incorporating a gelling agent into the water-based phase transforms a standard emulsion into an emulgel. Lipophilic drugs are confined in the oil-in-water system, whereas hydrophilic drugs are enclosed in the water-in-oil system. [3] It has a dual control release system similar to both emulsion and gel formulations. Gel is a novel formulation that delivers the medicine more rapidly than ointment, cream, and lotion. Formulating drugs in emulgel is appropriate for treating skin diseases. Applying medicinal drugs topically has many benefits compared to other methods of delivery. [4]

MATERIAL AND METHODS

Plant Material Collection:

The leaves of the *Ehretia acuminata* plant were collected from the Amravati area.

Extraction of Plant:

Following a thorough rinsing with distilled water to eliminate impurities and sand, the plant leaves were subjected to shade-drying. Prior to extraction with hydro alcohol, the dehydrated leaves of the plant were coarsely pulverised and subjected to defatting using petroleum ether. The extracts underwent filtration, concentration using solvent distillation, and subsequent evaporation to achieve a state of complete dryness, resulting in the acquisition of a pure extract. [5]

Evaluation of Phytochemical screening of the extract:

A phytochemical analysis was conducted to determine the presence of tannins, glycosides, steroids, flavonoids, alkaloids, carbohydrates, and proteins in the hydro-alcoholic extract of *Ehretia acuminata*. The hydroalcoholic extract underwent chemical analysis to ascertain the existence of several secondary metabolites. [6]

Table No 1: Compositions of different formulations (in % w/w)

Ingredients	F1	F2	F3	F4
Plant Extract	1	1	1	1
Carbopol 934	1	2	-	-
HPMC	-	-	1	2
Liquid paraffin	8	8	8	8
Tween 80	1	1	1	1
Span 80	1	1	1	1
Propylene glycol	4	4	4	4
Methanol	2.5	2.5	2.5	2.5
Methyl paraben	0.03	0.03	0.03	0.03
Propyl paraben	0.01	0.01	0.01	0.01
Triethanolamine	Q.S	Q.S	Q.S	Q.S
Distilled water	Upto 100 gm	Upto 100 gm	Upto 100 gm	Upto 100 gm

Preparation of emulgel

The gel bases were formulated using Carbopol 934 and HPMC. Carbopol 934 was distributed in distilled water and agitated vigorously for a period of time. Triethanolamine was slowly added to bring the pH to 6 - 6.5 and allowed to stand for one day.

The oil component of the emulsion was produced by combining Span 80 with light liquid paraffin, while the aqueous phase was formed by mixing Tween 80 with pure water. Propyl paraben was combined with propylene glycol, while the extract was combined with methanol. Both solutions were then mixed with the prepared aqueous phase. The oily and aqueous phases were heated individually to a temperature between 70°C and 80°C. The oily phase was then combined with the aqueous phase while stirring continuously, and the mixture was cooled to room temperature. The emulsion was combined with the gel bases in a 1:1 ratio by gentle swirling to create the emulgel. Table I provides the specifics of several batches of emulgel formulations. [7]

Evaluation of Emulgel:

1) Physical Examination:

Visual examination was used to evaluate the Emulgel compositions, color, appearance, and consistency post-preparation.

2) Washability test:

Approximately 1 gram of Emulgel is applied to the skin, and its washability with water is manually assessed by visual inspection, with the findings being recorded.

3) Extrudability study:

The Emulgel was dispensed into collapsible metal tubes and extruded through the tubes for observation and recording of findings.

4) Spreadability test:

A 0.5 gram Emulgel was sandwiched between two slides and left undisturbed for 5 minutes without expecting any more spreading. The spread circles' diameters, measured in centimeters, are used to determine spreadability. The findings reflect the cumulative total of three distinct evaluations.

5) pH determination:

The pH of Emulgel is measured using a pH meter. 1 gram of Emulgel was dissolved in 25 ml of distilled water. The electrode was then immersed in the gel formulation for 30 minutes to get a consistent result. The pH of each formulation was tested on two occasions.

6) Rheological investigation:
The emulgel's viscosity was measured using a Brookfield viscometer with spindle L3 and Visco Lead Adv from Brand Fungi lab. The system is linked to a thermostatically regulated circulating water bath maintained at a constant temperature of 25°C. The formulation's viscosity was assessed using a thermostatic jacket and beakers. The measurements were taken while the emulgel's spindle was spinning.

RESULTS:
Phytochemical screening of all solvent extracts of *Ehretia acuminata*
Table No. 2 illustrates the findings from the screening of hydroalcoholic extracts derived from various plants, highlighting the presence of several phytochemical constituents. The analysis revealed the existence of tannins, saponin glycosides, cardiac glycosides, flavonoids, steroids, proteins, carbohydrates, and alkaloids within the hydroalcoholic extract.

Table 02: Results of phytochemical investigation of *Ehretia acuminata*

Chemical constituents	Test	Hydro alcoholic Extract
Alkaloids	Dragendorff's Test	+
	Mayer's Test	+
	Hager's Test	+
	Tannic acid Test	+
Phenolic & Tannins	$FeCl_3$ Solution Test	+
	Lead acetate Test	+
	Acetic acid Test	+
Saponin glycoside	Foam Test	+
Cardiac glycoside	Legal's Test	+
	Keller-Kiliani Test	+
Coumarin glycoside	NaOH + Acid Test	-
Flavonoid	Lead AcetateTest	+
	NaOH + acidTest	-
Steroid	SalkowskiTest	+
Protein	Millon'sTest	+
	XanthoproteicTest	-
Carbohydrate	Molish test	+
	Iodine test	+
	Benedict test	+
	Barfoed test	-
	Fehling test	+

+ indicates presence of constituents; **-** indicates absence of constituents.

Preformulation Studies :
The recorded results of tests of identification of emulgel are given in the Table No 3

Table No 3 : Test of Identification of Emulgel

Sr No	Test of Identification	Result
1	Appearance	Clear - yellow transparent liquid
2	Odour	Characteristic
3	Physical Test	Liquid
8	Auto Ignition	No

Physical examination:
The emulgel compositions prepared were smooth, uniform, and had a thick, creamy yellowish-white look.

Evaluation of Emulgel:
The findings for washability, extrudability, spreadability, pH, and viscosity are shown in Table 4.

Table no 4: Evaluation Test of Emulgel

Batch	Washability	Extrudability	Spreadability (gcm /sec)	pH	Viscosity (cps)
F1	+ + +	+ + +	9.3	5.9	4067
F2	+ + +	+ + +	9.1	6.1	4295
F3	+ + +	+ +	8.3	5.8	4438
F4	+ + +	+ +	8.1	5.5	4312

DISCUSSION

The development and evaluation of an emulgel using a hydroalcoholic extract from the leaves of *Ehretia acuminata* presented promising results, indicating the potential for effective topical delivery. Emulgels, with their unique formulation combining gels and emulsions, provide a superior topical dosage form, particularly for hydrophobic drugs. The study successfully formulated emulgels using two different gelling agents, Carbopol 934 and HPMC, each tested in various compositions, resulting in stable and effective preparations.

The phytochemical screening of the *Ehretia acuminata* extract confirmed the presence of several important bioactive compounds, such as tannins, saponin glycosides, cardiac glycosides, flavonoids, steroids, proteins, carbohydrates, and alkaloids. These compounds are known for their pharmacological properties, such as antimicrobial, anti-inflammatory, and wound-healing capabilities, which highlight the potential therapeutic applications of the prepared emulgel. The absence of coumarin glycosides in the extract had no negative impact on the formulation's desired properties, as the other bioactive compounds played a significant role [5,9-13].

In terms of physical properties, the prepared emulgel formulations demonstrated desirable characteristics, including smoothness, uniformity, and a thick creamy texture, which are important for patient acceptability and ease of application. The physical tests, including spreadability, extrudability, and washability, all showed that the formulations were practical for use as a topical application, with the spreadability of each formulation demonstrating consistent results. F1 and F2 formulations showed better results in terms of extrudability and spreadability compared to F3 and F4, suggesting that the Carbopol 934-based gels provided better performance characteristics than the HPMC-based formulations. The pH of the formulations ranged from 5.5 to 6.1, which is within the acceptable range for topical applications, ensuring that the emulgel is non-irritating to the skin. This pH range is also conducive to maintaining the stability of the bioactive compounds in the extract.

The rheological investigation revealed that the emulgels possessed adequate viscosity, with values ranging from 4067 cps to 4438 cps, ensuring good adherence to the skin while being easily spreadable [12]. The slight variations in viscosity among different batches indicate that the choice of gelling agent and its concentration play a crucial role in the formulation's final texture and application properties.

Overall, the formulated emulgels provided a stable, effective, and user-friendly topical delivery system. Given their enhanced spreadability, adhesion, viscosity, and extrusion properties, these emulgels have the potential to serve as effective therapeutic agents for antimicrobial activity and wound healing. The emulgel formulation, combining the therapeutic benefits of *Ehretia acuminata* with the advantages of topical delivery, represents a promising approach for future development of herbal-based topical medications. Further studies, such as clinical trials, will be necessary to validate the efficacy of these formulations in treating skin conditions and microbial infections in human subjects.

CONCLUSION

The goal of the formulated herbal extract topical product is to provide a stable, safe, effective, and high-quality dosage form. Topical medication delivery is expected to increase in the future to improve patient compliance. The innovative method of medication delivery is gaining popularity due to the emulgel's capacity to enhance spreadability, adhesion, viscosity, and extrusion. Evaluation parameters were studied on prepared emulgels, which included rheological investigations and spreading coefficient tests. Directly applying the emulgel to the afflicted skin region may be an effective way for treating different pharmacological activities like antimicrobial or wound healing.

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