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DEVELOPMENT AND EVALUATION OF ANTI-FUNGAL EMULGEL FROM EXTRACTS OF PHYLLANTHUS NIRURI LINN LEAVES

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Abstract
The experiment was performed to see the activities of the Emulgel from Phyllanthus niruri Linn Leaves using different gelling agents such as Carbapol 934, Carbapol 940, and HPMC. Different evaluation parameters were involved to see the activity of the Emulgel, i.e., viscosity, spreadability, extrudability, drug content, and in vitro drug release studies. The results showed that Emulgel could release the drug at a constant rate for the defined period, and even drug content was similar across the triplicates of the different formulations. The spreadability and viscosity of the formulation were excellent. However, the formulation prepared using Carbapol 940 was the best among all the other formulations. The present study's focus was to develop the herbal Emulgel of Phyllanthus niruri linn.
Keywords: Herbal Emulgel, Phyllanthus niruri, Anti-fungal Emulgel

1. Introduction

Fungal diseases are the primary cause of mortality and morbidity worldwide. The amount of multi-drug-resistant microbes and the development of strains with lower susceptibility to antibiotics are constantly growing[1]. This is due to the widespread usage of antibiotics with a broad spectrum and immunosuppressive substances. This led to research for new antifungal drugs from various sources, such as medicinal plants. Synthetic drugs are not just expensive and unsuitable for treating ailments but can also have dangerous negative side consequences[2]. Traditional medicine makes use of numerous herbal extracts to treat fungal diseases. Some of them have been evaluated for antifungal activity in vitro[3].

Various kinds of treatments are available to treat or prevent fungal infections. Certainly, herbal origin treatments are more effective and have fewer side effects than other treatments[4]. Among the topical formulation, i.e., Gel, Emulgel, lotion,

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and creams, the uses of Emulgel have been widely accepted and routinely used to treat fungal infections[5].

As Phyllanthus niruri linn has been proven effective in eliminating fungal and microbes, the use has expanded its efficacy to the maximum levels. The Emulgel formulations are easy to use, non-greasy, and effective. They can absorb more water, cross-linked with the gelling agent, and release the drug when necessary. The literature review suggested that the formulations made by Phyllanthus niruri linn leaves have the maximum drug release in the in vitro drug release studies[6].

2. Materials and Methods

2.1. Material

The leaves of the Phyllanthus niruri were collected directly from the nursery near the ACME research Solutions laboratory, Delhi. The leaves were kept for drying after they were thoroughly washed with fresh water to remove the dust and debris of the particle. The leaves were shaded and dried in a closed container for a minimum of 10 days. The material was grinded using the grinder, and the fine powder was filtered using the s number. The physical assessment of the leaves of the plants was satisfactorily done with the method explained by Saurabh Chaudhary et al. (2016).

2.2. Extraction of the Leaves[7]

The leaves of the Phyllanthus niruri were extracted using the hot Soxhlet apparatus method. The grinded leaves powder was filled in the round bottom flask and subjected to extraction using three different solvents methanol, ethanol, and water. These three solvents were selected for the extraction process due to their polarity and extractive values. The final solvent was selected based on the percentage yield. Three different solvents were used at different temperatures and times (Methanol- 80°C, 8h, Ethanol- 60°C, 8h, and water 100°C for 8h). The extracts were stored and air dried. These extracts were subjected to phytochemical screening and extractive values.

2.3. Chemicals

The chemicals used in the study were laboratory grade and extra pure. The entire chemicals were bought from the Loba chemicals, CDH and ISOCHEM.

2.4.Phytochemicals Screening [8]

The extract of the Phyllanthus niruri leaves was subjected to phytochemical screening. The qualitative tests of phytochemicals were performed to identify the several phytochemicals present in the leaves of Phyllanthus niruri. The procedure was followed as described by Basak P. et al. (2018) (Table-1).

2.5.Formulation of Emulgel [9]

The herbal Emulgel of Phyllanthus niruri leaves was prepared using Carbapol 934, Carbapol 940, and HPMC. To formulate the Emulgel, the Gel was prepared

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first using gelling agents (1%) in hot water and kept overnight for stabilization. The gel was subjected to the assessment, i.e., clarity and presence of the particles. The oil phase of the Emulgel was prepared using span 20, dissolved in the liquid paraffin wax, and the water phase was prepared using the Tween 20 in water.

The preservatives and surfactants were mixed, and methyl and propylparaben were mixed with the Propylene glycol. These two phases and the preservatives are mixed while heating the formulation. Simultaneously, the drug extract was dissolved in the water and mixed with the final mixture. Both the phases were mixed at 1:1 at the temperature of 75°C.

The formed Emulgel was then subjected to pH testing and other evaluation parameters. The pH was maintained near the 7 (skin pH) and adjusted by adding the tri-ethanolamine. The formula of the herbal Emulgel is given in Table 2.

2.6.Evaluation parameters

a. Physical Examination[10]

Physical examinations were carried out by visually inspecting the formulations for the properties like color, transparency, consistency, homogeneity, and grittiness (Table-3).

b. pH determination[11]

1g of the herbal Emulgel was dissolved in 100mL of RO water and left for 2-3h to ensure the formulation was uniformly mixed with water. The pH was taken using a digital pH meter. The pH reading was taken in triplicates, and took the average of all the readings with standard deviation (Table 4).

c. Viscosity[12]

The viscosity of the herbal Emulgel was recorded at two different RPMs. The digital viscometer was used to evaluate the viscosity (iGenelab model number-). Each formulation recorded the viscosity at room temperature three times (Table 5).

d. Spreadability[13]

The spreadability was performed for the herbal Emulgel using glass plates. The circle's diameter was measured after putting it on the glass plate. An exact 300mg of the formulation was taken in the glass plate and dropped by another glass plate at a distance of 5cm. The circle of the Emulgel was measured on the plate (Table 6).

e. In vitro drug Release[14]

The drug release studies were done using the diffusion cell apparatus. A small amount of the herbal Emulgel was placed on the dialysis membrane. The dialysis membrane was attached between the donor and receptor and filled with phosphate-buffered 6.8pH. The buffer was maintained at 37ºC and constantly stirred with the help of a magnetic stirrer. Each receptor was filled with the 10mL buffer. While spreading the Emulgel, the membrane should not be forced downwards. This process of the drug content release was done for 8h. Each time the small

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amount (1mL) of the buffer was taken and analyzed in the UV-VIS spectrophotometer (iGenelab Model no.), the same amount of the buffer was replaced with the previous one. The analysis was done in triplicates and recorded (Table 7).

f. Extrudability[15]

The formulated Emulgel was assessed by its extrudability using the collapsible aluminum tubes. The amount of the gel extruded from the tube is considered its extrudability. It requires the applied force in grams to extrude 0.5 cm of the gel ribbon in the 10seconds. The formulations are considered excellent if more quantity comes by applying the constant force (Table-8).

Extrudability = applied weight to extrude gel from tube (g)/area (cm2)

g. Drug Content[16]

To determine the drug content in the herbal formulation, 1g of the Emulgel was taken and dissolved in 50mL water. The water was then transferred to the conical flask and mixed thoroughly. Then, the supernatant was filtered using the Whatman filter paper. The approximately 0.1mL of the filtrate was again diluted with the 10mL of the water. The solution was then evaluated for its drug content at 215nm using the UV-VIS spectrophotometer (Table-9&10).

3. Results and Discussion

Phyllanthus niruri leaves are widely used for their anti-microbial and anti-fungal activities. The literature also revealed that leaves have good anti-fungal activity. Hence, the Emulgel formulation of Phyllanthus niruri leaves was formulated because it is easy to design, non-sticky, and apply.

The leaves of Phyllanthus niruri were collected from the nursery and shaded dried. The leaves were grinded to the powder and extracted by the soxhlation process using methanol, ethanol, and water as the menstruum.

The phytochemical results revealed that Phyllanthus niruri leaves have an enormous amount of alkaloids, saponins, flavoinoid, and tannins.

The extract was formulated using Carbapol 934, Carbapol 940, and HPMC as the gelling agent mixed with the paraffin wax and preservatives. The drug was mixed with the water, the oil phase was formulated using Tween 20, and the water phase was formulated using span 20. Both the phases were equally mixed at the ratio of 1:1.

The prepared formulations were brown, and their appearance was smooth with a glossy surface. The pH was also neutral, ranging between 5.97±0.21 to 6.20±0.10. The viscometer and results evaluated the viscosity showed that all the formulations contained uniformity and viscous consistency.

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The spreadability was evaluated using the glass plate method; the results showed even spreadability for all the formulations. The uniformity and consistency of the formulation were even. The formulations were easily spread with a small amount of force for spread. The spreadability was found to as 10.21±1.05 to 10.98±0.35.

Extrudability was measured using the collapsible tubes. The formulation comes easily when applied force. The ribbon of the Emulgel was consistently coming out at the defined time and found excellent.

The Franz diffusion cell apparatus analyzed the Emulgel formulation's drug content release. A small amount of the drug was applied to the membrane and analyzed by the UV-VIS spectrophotometer. The process was consistently performed for 8h. Every hour the 1mL of the drug mix was taken and analyzed in the spectrophotometer at 215nm. The exact amount of the buffer solution is replenished every time. The drug release of the formulation was found at maximum for formulation number 2 (94.88) and the minimum for formulation 3 (88.91).

The drug content was identified as the maximum for formulation number 2 (93.83±0.4) and minimum for formulation number 1 (91.93±0.72).

The results could conclude that the F2 formulation did better for all the evaluation parameters.

4. Conclusion

The present study evaluated the different Emulgel formulations of Phyllanthus niruri leaves. All the formulations showed satisfactory results. The herbal Emulgel was evaluated for parameters such as Viscosity, spreadability, pH, extrudability, and In vitro drug release.

The Formulation F1 Showed the maximum drug release in the in vitro drug release study.

Hence, Phyllanthus niruri leaves can be formulated for dermatological applications.

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5. Tables

Table-1: Phytochemical Screening

Sn.	Test	Solvents		
		Methanol	Ethanol	Water
1	Alkaloids	+	+	+++
2	Carbohydrates	+	-	++
3	Saponins	+	+	++
4	Glycosides	+	++	++
5	Steroids	+	+	-
6	Phenolics	+	+	++
7	Flavonoids	+	+++	++

Table-2: Formulae of Emulgel

Sn.	Ingredients	Formulations		
		F1	F2	F3
1	Leaf Extract	1	1	1
2	Carbopol 940	1	NA	NA
3	Carbopol 934	NA	1	NA
4	HPMC	NA	NA	1
5	Liquid paraffin	7.5	7.5	7.5
6	Propylene glycol	5	5	5
7	Methyl Parabene	0.03	0.03	0.03
8	Propyl Parabene	0.03	0.03	0.03
9	Water	qs	qs	qs

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Table-3: Physical Examinations

Sn.	Formulations	Triplicates	Transparency	Color	Uniformity	Particles
1	F1	1	Opaque	Brownish White	Uniform	None
2		2	Opaque	Brownish White	Uniform	None
3		3	Opaque	Brownish White	Uniform	None
4	F2	4	Opaque	Brownish White	Uniform	None
5		5	Opaque	Brownish White	Uniform	None
6		6	Opaque	Brownish White	Uniform	None
7	F3	7	Opaque	Yellow Whitish	Uniform	None
8		8	Opaque	Yellow Whitish	Uniform	None
9		9	Opaque	Yellow Whitish	Uniform	None

Table-4: pH of Emulgel

Sn.	Formulations	Triplicates	pH
1	F1	1	6.20±0.10
2		2	
3		3	
4	F2	4	6.17±0.31
5		5	
6		6	
7	F3	7	5.97±0.21
8		8	
9		9	

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Table-5: Viscosity of Emulgel

Sn.	Formulations	Triplicates	Viscosity (cps)	
			0.5 RPM	1 RPM
1	F1	1	586.9±12.40	306.4±19.97
2		2		
3		3		
4	F2	4	464.1±22.24	226.8±6.16
5		5		
6		6		
7	F3	7	607.4±4.90	307.2±2.40
8		8		
9		9		

Table-6: Spreadability of Emulgel

Sn.	Formulations	Triplicates	Spreadability (cm/sec)
1	F1	1	10.98±0.35
2		2	
3		3	
4	F2	4	10.98±1.19
5		5	
6		6	
7	F3	7	10.21±1.05
8		8	
9		9	

Table-7: In vitro drug release of Emulgel

Sn.	Time (h)	F1	F2	F3
1	0	0	0	0
2	1	10.23	9.47	11.46
3	2	27.43	29.33	26.47
4	3	34.24	38.47	29.50
5	4	50.49	59.04	49.35
6	5	59.10	60.56	60.11
7	6	61.63	72.20	67.54
8	7	78.18	84.47	77.54
9	8	89.22	94.88	88.91

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Table-8: Extrudability of Emulgel

Sn.	Formulations	Triplicates	Extrudability
1	F1	1	++
2		2	++
3		3	++
4	F2	4	++
5		5	+++
6		6	++
7	F3	7	++
8		8	++
9		9	++

Table-9: Drug Content of Emulgel

Sn.	Formulations	Triplicates	Drug Content at 215nm
1	F1	1	91.1
2		2	92.4
3		3	92.3
4	F2	4	94.2
5		5	94.2
6		6	93.1
7	F3	7	90.2
8		8	91.4
9		9	90.5

Table-10: Drug Content of Emulgel

Sn.	Formulations	Triplicates	Drug Content at 215nm
1	F1	1	91.93±0.72
2		2	
3		3	
4	F2	4	93.83±0.4
5		5	
6		6	
7	F3	7	90.70±0.62
8		8	
9		9	

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6. References

1. Iyer, M. S., Gujjari, A. K., Paranthaman, S., Abu Lila, A. S., Almansour, K., Alshammari, F., ... & Gowda, D. V. (2022). Development and Evaluation of Clove and Cinnamon Supercritical Fluid Extracts-Loaded Emulgel for Antifungal Activity in Denture Stomatitis. Gels, 8(1), 33.
2. Pranali, S., Charushila, S., Sayali, C., & Namrata, M. (2019). Design and Characterisation of Emulgel of an Antifungal drug. Journal of Pharmaceutical Sciences and Research, 11(6), 2357-2361.
3. Tanaji, D. N. (2018). Emulgel: A comprehensive review for topical delivery of hydrophobic drugs. Asian Journal of Pharmaceutics (AJP): Free full text articles from Asian J Pharm, 12(02).
4. Akram, A., Khalid Khan, M., & Ali Khan, B. (2021). Preparation, characterizations and evaluation of antifungal activity of eugenol-linalool emulgel against anthrophilic dermatophytic trichophyton rubrum. Main Group Chemistry, (Preprint), 1-15.
5. Redkar, M. R., Patil, S. V., & Rukari, T. G. (2019). Emulgel: A modern tool for topical drug delivery. World Journal of Pharmaceutical Research, 8(4), 586-597.
6. Yuniati, Y., & Rollando, R. (2018). Isolation of antibacterial compounds from endophyte fungal of fusarium sp. In phyllanthus niruri linn. Leaves. Journal of Pharmaceutical Sciences and Research, 10(2), 260-264.
7. Abubakar, A. R., & Haque, M. (2020). Preparation of medicinal plants: Basic extraction and fractionation procedures for experimental purposes. Journal of pharmacy & bioallied sciences, 12(1), 1.
8. Basak, P., Adhikary, T., Das, P., & Biswas, S. (2018, September). Phytochemical analysis and comparative study of antibacterial effect of turmeric extracts using different solvent. In IOP Conference Series: Materials Science and Engineering (Vol. 410, No. 1, p. 012018). IOP Publishing.
9. Patel, N., Kumar, N., Singh, A., & Gupta, A. (2021). Formulation and optimization of synthetic polymer based herbal emulgel for anti-microbial activity. Journal of Innovations in Applied Pharmaceutical Science (JIAPS), 37-42.
10. Akram, A., Khalid Khan, M., & Ali Khan, B. (2021). Preparation, characterizations and evaluation of antifungal activity of eugenol-linalool emulgel against anthrophilic dermatophytic trichophyton rubrum. Main Group Chemistry, (Preprint), 1-15.
11. Charyulu, N. R., Joshi, P., Dubey, A., & Shetty, A. (2021). Emulgel: A Boon for Enhanced Topical Drug Delivery. Journal of Young Pharmacists, 13(1), 76.
12. Goyani, M., Akbari, B., Chaudhari, S., & Jivawala, R. (2018). Formulation and evaluation of topical emulgel of antiacne agent. Int J Adv Res Rev, 3(7), 52-68.
13. Khan, Barkat Ali, Arshad Ali, Khaled M. Hosny, Abdulrahman A. Halwani, Alshaimaa M. Almehmady, Muhammad Iqbal, Waleed S. Alharbi et al. "Carbopol

DOI: 10.5281/zenodo.6944956
emulgel loaded with ebastine for urticaria: development, characterization, in vitro and in vivo evaluation." Drug Delivery 29, no. 1 (2022): 52-61.
14. Afzal, A., Shah, N. H., Hussain, I., Munawar, S. H., Mumtaz, A., & Qureshi, N. (2022). Preparation of Spilanthes acmella based emulgel: Antimicrobial study and evaluation. Pak. J. Pharm. Sci, 35(1), 287-295.
15. Salih, Z. T., AL_GAWHARI, F. A. T. I. M. A., & RAJAB, N. A. (2018). Preparation, release, rheology and stability of piroxicam emulgel. Int J Appl Pharm, 10, 26-9.
16. Isaac, J. A., Daburi, A., Ifeanyi, B., Ben-Umeh, K. C., Adedokun, A. A., & Builders, P. (2022). Senna podocarpa Emulgel: A Herbal Alternative for Chemical Burn Wound Treatment. Pharmaceutical Fronts, 4(01), e30-e39.