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FORMULATION AND EVALUATION OF HERBAL EMULGEL FOR TREATMENT OF FUNGAL INFECTIONS

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ABSTRACT

Fungal infection of the skin is one of the most common dermatological problems for which, delivery of drugs through skin is an effective and targeted therapy in the modern era. In the present study, emulgels containing extract of lemon grass were prepared for treating fungal infections. Initially emulsions containing the extract were prepared using emulsifying agents like tween 80 and span 80. The emulgels were prepared by incorporating the prepared emulsions into gel bases containing Carbopol 934 and Na CMC in the ratio 1:1. All the emulgel formulaions were evaluated for physical appearance, pH, viscosity, spreadability, extrudability and antifungal activities. All formulations exhibited satisfactory results for the evaluated parameters. From the results it was found that the formulation F2 shows better spreadability, extrudability and antifungal activities. By considering these factors it was concluded that the emulgel containing lemon grass oil can be used for treatment of fungal infections effectively.

KEYWORDS: Antifungal activity, Emulgel, Extrudability, Lemon grass oil.

INTRODUCTION

Most of the time, the humans live in peaceful coexistence with the microorganisms that surround them. An infection may emerge only when the defence system is damaged or the concentration of pathogens reach an exceptionally high density. Most infections remain unrecognized but sometimes the infecting agents do elicit a response of the body, which leads to clinical signs and symptoms, a condition known as infectious disease. As strategies to

control bacterial infections in patients improved, fungi became the most hazardous pathogens.[1]

Fungal species are widely distributed in soil, plant debris and organic substrates, and make up approximately 7 percent (6,11,000 species) of all eukaryotic species on earth, although only about 600 species are human pathogens.[2]

Fungal infection of skin is one of the most common dermatological problems throughout the world. Fungal infections occur in human, when an invading fungus occupies an area of the body and is too much for the immune system to handle. The dermatophytic infections, superficial candidiasis of the mouth, skin, or genital tract are the main afflicting conditions of fungal diseases.[3,4,5]

For many decades treatment of such acute disease or a chronic illness has been mostly accomplished by delivery of drugs to patients through various pharmaceutical dosage forms including tablets, capsules, pills, suppositories, cream, gel, ointments, liquids, aerosols and many other formulations as drug carriers. Delivery of drugs through skin is an effective and targeted therapy for local dermatological disorders. Topical drug delivery has gained popularity because it avoids first-pass effects, gastrointestinal irritations and metabolic degradation associated with oral administration.[6]

Topical drug delivery system is the dosage form which is applied on the skin or mucous membranes. Topical drug delivery systems are formulated in different consistency such as solid, semisolid, and liquid. Topical drug delivery offers various advantages like patient compliance, ease of administration, improved drug bioavailability, better physiological and pharmacological response, reduced systemic toxicity and least exposure of drugs to non-infectious tissue/sites, easy termination of the treatment, avoid gastric incompatibilities, minimum fluctuation in plasma levels and suitable for the drug with narrow therapeutic window.[7,8,9]

Many widely used topical formulations like ointments, creams, lotions, gel are associated with disadvantages like stability problems, stickiness and lesser spreading abilities, irritation, allergic reactions, poor permeability and poor absorption. Most of the topical delivery systems have been failed in the administration of hydrophobic drug. To overcome this limit, approach of emulgel has been designed.[8,9]

Emulgel

When emulsions are incorporated into gel bases, the dosage forms are referred as emulgels. Emulgels are emulsions, either of the oil-in-water or water-in-oil type, which is gelled by mixing with a gelling agent. Water-in-oil emulsions are employed more extensively for emollient actions and for the treatment of dry skin while oil-in-water emulsions are most useful in general cosmetic, acts as a water washable drug bases. Hydrophobic drugs can be formulated as emulgels because it contains both oil and aqueous phase. Now a days Emulgels are emerging as a potential drug delivery system in the area of dermatology.[9,10,11]

MATERIALS AND METHODS

Lemon grass leaves were obtained from local market, Mangalore. The solvent N-Hexane was obtained from Loba Chemie. Carbopol 934, Span 80, Tween 80, Propyl Paraben and Tri Ethanol Amine were obtained from HiMedia. Na CMC was obtained from Yarrow Chem Products. Propylene Glycol was obtained from Finar and the Ethanol was obtained from KSBCL. All ingredients and reagents used are of analytical grade.

METHODS

Extraction of Lemon Grass Oil[12]

Extraction of Lemon grass oil was done by solvent extraction method.

Yield of oil that obtained was calculated by the formula.

Yield of essential oil = quantity of essential oil (g) obtained /quantity of raw materials (g) used.

Phytochemical Analysis[13,14]

The phytochemical analysis of lemongrass extract was carried out by performing various chemical tests like Test for alkaloids (Mayer's test), phenols (ferric chloride test), flavonoids (lead acetate test), tannins (Braymer's test), saponins (foam test), cardiac glycosides (Keller killiani test) and test for terpenoids and steroids.

Preparation of emulgel containing extract of lemon grass[15]

The gel bases were prepared by using Na CMC and Carbopol 934. Required quantity of Na CMC was dispersed in heated purified water (80°C), allowed to cool and left overnight. Carbopol 934 was dispersed in distilled water and stirred vigorously for some time. Triethanolamine was added drop wise to adjust the pH to 6 - 6.5 and was left for one day.

The oil phase of the emulsion was prepared by mixing Span 80 with light liquid paraffin while the aqueous phase was prepared by mixing Tween 80 with purified water. Propyl paraben was added to propylene glycol whereas the extract was added to ethanol, and both the solutions were mixed with prepared aqueous phase. Both prepared oily and aqueous phases were separately heated to 70° to 80°C; then the oily phase was added to the aqueous phase with continuous stirring and cooled to room temperature. The resulting emulsion was then mixed with the prepared gel bases in 1:1 ratio with gentle stirring to obtain the emulgel. The details of different batches of emulgel formulations are given in table I.

Table 1: Composition of Herbal Emulgel.

Ingredients	Formulation Code					
	F1	F2	F3	F4	F5	F6
Lemon Grass Extract (g)	1	1	1	1	1	1
Carbopol 934(g)	0.5	-	1	-	2	-
Na CMC(g)	-	0.5	-	1	-	2
Light Liquid Paraffin (ml)	2.5	2.5	2.5	2.5	2.5	2.5
Span 80 (ml)	1.25	1.25	1.25	1.25	1.25	1.25
Tween 80 (ml)	2.5	2.5	2.5	2.5	2.5	2.5
Propyl Paraben (g)	0.25	0.25	0.25	0.25	0.25	0.25
Propylene Glycol (ml)	2.5	2.5	2.5	2.5	2.5	2.5
Ethanol (ml)	5	5	5	5	5	5
Tri Ethanol Amine (ml)	q.s	q.s	q.s	q.s	q.s	q.s
Water sufficient for 50g	q.s	q.s	q.s	q.s	q.s	q.s

Evaluation of Emulgels

Prepared emulgel formulations were subjected to various evaluation parameters as follows.

Physical appearance[16]

The prepared emulgel formulations were examined visually for their colour, consistency and phase separation.

pH[16]

Digital pH meter was used for measuring the pH of prepared emulgels. 1gm of emulgel was dissolved in 100 ml of distilled water and was placed for 2 hrs. Glass electrode was dipped in the above solution and pH values were noted.

Viscosity[15]

The viscosity of various emulgel formulations was measured by using Brookfield Viscometer.

(LVDV-II). Required quantities of the emulgels were taken in a beaker and the viscosity was noted.

Spreadability[17]

Spreadability was measured in terms of diameter of emulgel spread area produced upon application of specified weight. It was measured by placing approximately 1gm of the emulgel formulations between the two glass slides of same dimensions (20cm*20cm). Weight of about 1000gm was placed on the upper glass slide and allowed the emulgel to spread. After about 1min the weight was removed, and diameter of spread area was measured.

Extrudability[17,18]

The standard capped collapsible aluminium tubes were filled with prepared emulgel formulations and were sealed by crimping to the end. The weights of the tubes were recorded. The tubes were placed between two glass slides and weight of 1kg was placed over the slides and then the cap was removed. The quantity of the extruded gel was collected and weighed. The % of gel extruded was calculated, recorded.

Antifungal Activity[17,18]

Antifungal activity of the emulgels was determined by agar well diffusion method. Certain volume of fungal suspension(yeast) was poured into sterilized sabouraud's agar media and mixed well. About 20ml of this media was poured aseptically in petri dish and kept till the solidification. The wells are made in the agar plates using a sterile cork borer. The prepared wells were filled with antifungal emulgel formulation. The plates were incubated at 18-24℃ for 72 hrs. Antifungal activity was determined in terms of zone of inhibitions which was measured using antibiotic zone reader.

RESULTS AND DISCUSSIONS

In the present study, total six formulations of herbal emulgels were prepared from the extract of lemon grass. The extraction was carried out by solvent extraction method and the yield of oil obtained after extraction was 1.7%.

The results obtained for the experiments conducted are as follows.

Phytochemical analysis of lemongrass extract

The results of phytochemical analysis showed the presence of phytochemicals namely, alkaloids, phenols, flavonoids, tannins, cardiac glycosides and terpenoids. Obtained results are given in table II and figure 1.

Table 2: Results of Phytochemical Analysis.

Chemical Test	Observation	Results
Test for alkaloids	White precipitate	Positive
Test for phenols	Reddish brown precipitate	Positive
Test for flavonoids	Yellow precipitate	Positive
Test for tannins	Blue green colour	Positive
Test for cardiac glycosides	Formation of brown ring	Negative
Test for terpenoids	Dark brown colour	Positive
Test for steroids	No dark blue colour	Negative

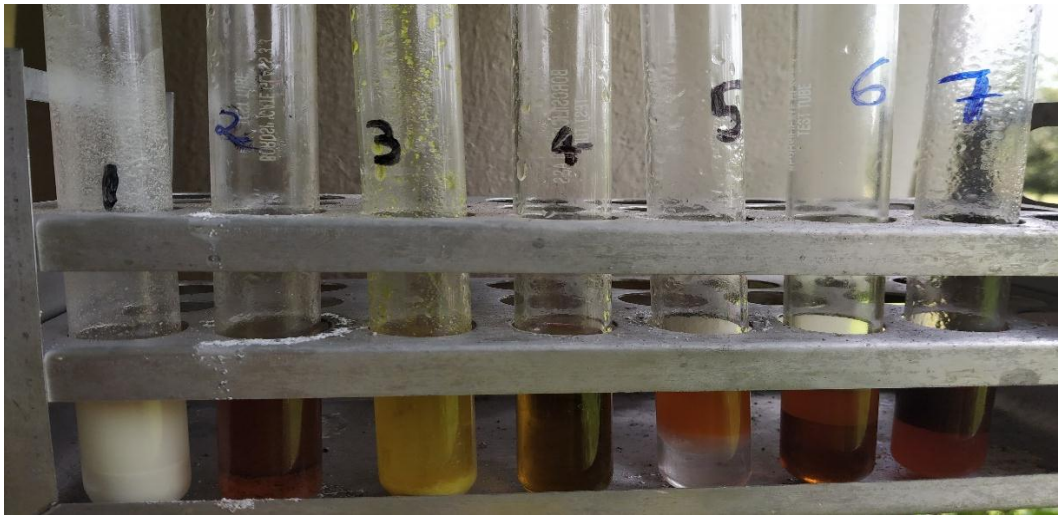

Fig. 1: Results of Phytochemical Analysis.

Physical appearance of the formulations

The prepared formulations were yellow and pale pink in colour. The consistency was found to be good to excellent and there was no phase separation in the formulations. Observed results are given in table III.

Table 3: Physical characteristics of emulgel formulations.

Formulation Code	Colour	Consistency	Phase separation
F1	Yellow	Excellent	No phase separation
F2	Pale pink	Excellent	No phase separation
F3	Yellow	Good	No phase separation
F4	Pale pink	Good	No phase separation
F5	Yellow	Good	No phase separation
F6	Pale pink	Good	No phase separation

Prepared emulgels were evaluated for pH, Viscosity, spreadability, extrudability and antifungal activities. pH of all the formulations was found in the range of 5.8 to 6.1 which suits the skin pH indicating skin compatibility. The value of viscosity was found in the range of 1920 to 67560cps. The results of the spreadability indicated that the emulgels were easily spreadable. From the obtained results it was found that the concentration of gelling agent had influence on the spreadability and extrudability of the emulgels. Lower the polymer concentration, higher was the spreadability and extrudability. Details of the obtained results are given in table IV.

Table 4: pH, Viscosity, Spreadability and Extrudability values of emulgel formulations.

Formulation Code	pH	Viscosity (cps)	Spreadability (cm)	Extrudability (%)
F1	5.9	63820	6.6	83.44
F2	6.1	1920	9.8	90.05
F3	5.8	65320	5.9	82.14
F4	6.0	2720	8.5	83.16
F5	6.0	67560	5.3	81.17
F6	5.8	2850	7.2	80.66

Antifungal Activity

From the results it was found that all formulations have shown satisfactory inhibition of fungal growth. It was observed that the inhibition rate of different formulations varied with change in the polymer concentration. Lower the concentration of polymer, greater was the diffusion of formulation in the agar media and hence the zone of inhibition. The data of antifungal activity of all formulations is given in table V and figure 2.

Table 5: Antifungal activity of emulgel formulations.

Formulation code	F1	F2	F3	F4	F5	F6
Zone of inhibition (mm)	17	19	15	16	12	13

Fig. 2: Antifungal activity of emulgel formulations F2, F3 and F6.

CONCLUSION

The above study was a satisfactory attempt to formulate herbal emulgel containing the extract of lemon grass for treatment of fungal infections. The formulations exhibited satisfactory results for all the evaluated parameters. Over all the formulations, F2 formulation was concluded as the best formulation, as it has shown excellent spreadability, extrudability and antifungal activity.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

REFERENCES

1. Wisplinghoff H, Seifert H, Wenzel RP, Edmond MB. Current trends in the epidemiology of nosocomial bloodstream infections in patients with hematological malignancies and solid neoplasms in hospitals in the United States. Clinical Infectious Diseases, 2003 May 1; 36(9): 1103-10.
2. Badiee P, Hashemizadeh Z. Opportunistic invasive fungal infections: diagnosis & clinical management. The Indian journal of medical research, 2014 Feb; 139(2): 195.
3. Kaushik K, Agarwal SH. The Role of Herbal Antifungal Agents for the Management of Fungal Diseases: A Systematic Review. Asian Journal of Pharmaceutical and Clinical Research, 2019; 12(7): 34-40.
4. Shoham S, Levitz SM. The immune response to fungal infections. British journal of haematology, 2005 Jun; 129(5): 569-82.
5. Ravikant Kaur T, Gupte S, Kaur M. A review on emerging fungal infection & their significance. Journal of bacteriology and mycology, 2015; 1(2): 39-41.
6. Kasar PM, Kale KS, Phadtare DG. Formulation and evaluation of topical antifungal gel containing itraconazole. Research Journal of Topical and Cosmetic Sciences, 2018; 9(2): 49-52.
7. Sreevidya VS. An overview on emulgel. International Journal of Pharmaceutical and Phytopharmacological Research, 2019; 9(1): 92-7.

8. Sah SK, Badola A, Nayak BK. Emulgel: Magnifying the application of topical drug delivery. Indian Journal of Pharmaceutical and Biological Research, 2017 Jan 31; 5(01): 25-33.
9. Bhavyashree, T, Bhute S, Alva SH, Shubhashree AS, Spoorthi C, Rai S *et al*. Emulgel: An effective approach for the topical drug delivery. Journal of Xi'an Shiyou University, Natural sciences edition, 2021; 17(10): 593-603.
10. Kute S, Saudagar R. Emulsified gel A Novel approach for delivery of hydrophobic drugs: An overview. Journal of Advanced Pharmacy Education & Research. 2013; 3(4): 368-76.
11. Redkar MR, Patil SV, Rukari TG. Emulgel: A modern tool for topical drug delivery. World Journal of Pharmaceutical Research, 2019 Jan 29; 8(4): 586-97.
12. Suryawanshi MA, Mane VB, Kumbhar GB. Methodology to extract essential oils from lemongrass Leaves: solvent extraction approach. International research journal of engineering and technology, 2016; 3(8): 1775-80.
13. Gupta PK, Rithu BS, Shruthi A, Lokur AV, Raksha M. Phytochemical screening and qualitative analysis of Cymbopogon citratus. Journal of Pharmacognosy and Phytochemistry, 2019; 8(4): 3338-43.
14. Alzobaay AH, Kadhim BH. Phytochemical Screening, Chemical Composition and Antibacterial Activity of Lemongrass (Cymbopogon citratus) Leaves Extracts. Indian Journal of Natural Sciences, 2018; 9(51): 15306-15.
15. Khullar R, Kumar D, Seth N, Saini S. Formulation and evaluation of mefenamic acid emulgel for topical delivery. Saudi pharmaceutical journal, 2012 Jan 1; 20(1): 63-67.
16. Sultana SS, Swapna G, Lakshmi GS, Swathi S, Jyothi GN, Devi AS. Formulation and evaluation of herbal emulgel of Lantana camara leaves extract for wound healing activity in diabetic rats. Indo American Journal of Pharmaceutical Research, 2016; 6(8): 6404-17.
17. Bhavyashree T, Chandur VK, Shabaraya AR. Formulation and evaluation of gel containing extract of Camellia sinensis for treatment of periodontitis. World Journal of Pharmaceutical Sciences, 2021; 9(5): 79-84.
18. Pranali S, Charushila S, Sayali C, Namrata M. Design and Characterisation of Emulgel of an Antifungal drug. Journal of Pharmaceutical Sciences and Research, 2019 Jun 1; 11(6): 2357-61.