



**INTERNATIONAL JOURNAL OF  
PHARMACEUTICAL SCIENCES**  
[ISSN: 0975-4725; CODEN(USA): IJPS00]  
Journal Homepage: <https://www.ijpsjournal.com>



## Research Article

# Formulation And Evaluation of Griseofulvin-Loaded Invasomal Gel for Efficient Topical Delivery to Treat Dermatophytosis

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### ARTICLE INFO

Published: 12 April, 2025

**Keywords:**

Griseofulvin, Invasomal Gel, Topical Delivery, Dermatophytosis, Entrapment Efficiency, Vesicle Size, Drug Release, Stability, Controlled Release, Nanocarriers.

**DOI:**

10.5281/zenodo.15205280

### ABSTRACT

The present study aimed to formulate and evaluate griseofulvin-loaded invasomal gel for efficient topical delivery in the treatment of dermatophytosis. Griseofulvin was encapsulated in invasomes using different formulations, and their entrapment efficiency, vesicle size, and stability were assessed. Formulation F3, with a high entrapment efficiency of 72.25% and an average vesicle size of 95.58 nm, exhibited superior characteristics. The in vitro drug release studies showed that the formulation achieved 98.12% cumulative drug release at 6 hours, indicating rapid release, while formulation F3 exhibited sustained drug release over 12 hours. The gel formulations also demonstrated good viscosity, extrudability, spreadability, and stability. Stability studies under different storage conditions revealed that formulation F3 maintained its drug content and viscosity over a 3-month period, suggesting its potential for long-term use. The results indicate that griseofulvin-loaded invasomal gel could offer a promising strategy for enhanced topical drug delivery for dermatophytosis treatment, providing controlled drug release and improved therapeutic efficacy.


## INTRODUCTION

Dermatophytosis, a fungal infection of the skin, hair, and nails, is a common condition that affects millions of people worldwide. It is caused by dermatophytes, a group of fungi that invade keratinized tissues, leading to symptoms such as itching, erythema, scaling, and hair loss. The treatment of dermatophytosis typically involves the use of antifungal agents, such as griseofulvin,

which is a broad-spectrum antifungal drug that inhibits fungal cell division by binding to tubulin, preventing microtubule formation. Despite its effectiveness, griseofulvin has certain limitations when administered systemically, including slow onset of action, potential side effects, and poor bioavailability, especially when used for treating skin infections (Sharma et al., 2018). Therefore, there is a growing interest in developing novel

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



drug delivery systems to improve the topical delivery and effectiveness of griseofulvin in treating dermatophytosis. One such promising system is the use of invasomes, which are vesicular drug delivery systems that enhance the penetration of active pharmaceutical ingredients (APIs) into the skin. Invasomes are composed of lipid bilayers, similar to liposomes, but they include penetration enhancers like ethanol or surfactants to facilitate skin absorption. These systems have the ability to carry lipophilic drugs and deliver them efficiently to the targeted skin layers, improving their therapeutic efficacy (Gupta et al., 2020). The use of griseofulvin-loaded invasomal gels presents an innovative approach to enhance the local treatment of dermatophytosis by providing sustained release and deep penetration into the skin (Rathi & Garg, 2017). The combination of invasomes with gel formulations offers additional advantages, such as ease of application, controlled release, and minimal irritation. Gels are often preferred for topical drug delivery because they are non-greasy, easy to apply, and can provide prolonged contact with the skin, which is essential for dermatophytosis treatment. The gel base also helps stabilize the invasomal formulation, allowing for effective topical application, and offering enhanced patient compliance. Additionally, using invasomal gels for topical drug delivery minimizes systemic absorption, which reduces the risk of side effects associated with oral administration of antifungal drugs (Sudhakar & Thirumalai, 2019). Several studies have explored the formulation and evaluation of invasomal systems for the delivery of various drugs, and the successful encapsulation of griseofulvin in invasomal formulations has been investigated. For instance, Sharma et al. (2018) demonstrated that griseofulvin-loaded liposomal and invasomal formulations showed improved skin penetration and antifungal activity compared to conventional formulations. Similarly, Gupta et

al. (2020) evaluated the in-vitro release and ex-vivo permeation of antifungal-loaded invasomal gels and found enhanced drug penetration into the deeper layers of the skin. Despite these promising findings, the development of an efficient griseofulvin-loaded invasomal gel for the treatment of dermatophytosis requires careful formulation and evaluation of the system's physicochemical properties, such as particle size, drug encapsulation efficiency, zeta potential, and in-vitro release kinetics. Additionally, the efficacy of the developed system must be accessed through in-vitro and in-vivo studies to establish its clinical relevance. This research aims to formulate and evaluate a griseofulvin-loaded invasomal gel for enhanced topical delivery in the treatment of dermatophytosis. The study focuses on optimizing the invasomal system for improved drug loading and stability followed by evaluating in-vitro drug release characteristics. The results of this study could provide a new avenue for more effective, safer, and patient-compliant treatments for dermatophytosis.

## MATERIAL AND METHODS

### Materials

The Griseofulvin-loaded invasomal gel was formulated using a variety of chemicals sourced from reliable suppliers. Griseofulvin served as the active ingredient. Soya Phosphatidylcholine was obtained from Ash Chemie India, Thane, for lipid vesicle formation. S.D. Fine Chem. Ltd., Mumbai provided essential ingredients like Disodium Hydrogen Phosphate, Di-potassium Hydrogen Orthophosphate, Sodium Chloride, Carbopol 934P, Methyl Paraben, Propyl Paraben, and Propylene Glycol. Solvents like Methanol, Ethanol, and Chloroform were sourced from Qualigens Fine Chemicals, Mumbai to prepare the invasomes and gel. These components were essential for the preparation, stability, and



effectiveness of the gel in treating dermatophytosis.

## Methods

### Formulation and optimization of Griseofulvin loaded Invasomes

The film hydration technique used for formulation development of Griseofulvin loaded Invasomes for transdermal drug delivery. Griseofulvin (50mg) was loaded in to invasomes by mechanical dispersion technique. Soya Phosphatidylcholine (1.0 to 2.0% w/v) was added to ethanol and vortexed for 5 minutes (Lakshmi *et al.*, 2014). Drug (100mg) and terpenes (0.25%) were added under constant vortexing, this mixture was sonicated for 5 minutes. Fine stream of Phosphate buffer saline was added with syringe under constant vortexing. It was vortexed for additional 5 minutes to obtain final invasomal preparation.

**Table 1: Formulation optimization of Griseofulvin loaded Invasomes**

| Ingredient (%)          | F1  | F2  | F3  | F4  | F5  | F6  |
|-------------------------|-----|-----|-----|-----|-----|-----|
| Griseofulvin (mg)       | 50  | 50  | 50  | 50  | 50  | 50  |
| Phosphotidylcholine (%) | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 |
| Terpenes (%)            | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
|                         | 5   | 5   | 5   | 5   | 5   | 5   |
| Ethanol (ml)            | 10  | 10  | 10  | 10  | 10  | 10  |

### Preparation of gel base

Carbopol 934 (1-3% w/v Invasome based gel formulation i.e. IG-1 of 1% w/v, IG-2 of 2% w/v, IG-3 of 3% w/v) was accurately weighed and dispersed into double distilled water (80ml) in a beaker (Verma *et al.*, 2022). This solution was stirred continuously at 800 rpm for 1 hour and then

10ml of propylene glycol was added to this solution. The obtained slightly acidic solution was neutralized by drop wise addition of 0.05 N sodium hydroxide solutions, and again mixing was continued until gel becomes transparent. Volume of gel was adjusted to 100 ml and then sonicated for 10 min on bath sonicator to remove air bubbles. Final pH of the gel base was adjusted to 6.5. The same procedure was used to formulate Invasomes containing gel in which previously prepared Invasomes suspension was added. Invasomes preparation corresponding to 1% w/w of drug was incorporated into the gel base to get the desired concentration of drug in gel base.

**Table 2: Formulation optimization of gel base**

| Ingredient (%)                 | IG-1 | IG-2 | IG-3 |
|--------------------------------|------|------|------|
| Drug (Invasomes equivalent to) | 1    | 1    | 1    |
| Carbopol 934                   | 1    | 2    | 3    |
| Propylene glycol               | 0.2  | 0.2  | 0.2  |
| Water (ml)                     | 100  | 100  | 100  |

## Evaluation of Invasomes

### Entrapment efficiency

Entrapment efficiency of Griseofulvin Invasomes formulation was determined using centrifugation method. The entrapment efficiency of Griseofulvin in invasomes vesicle was determined by ultracentrifugation, 10mL of invasomes formulation were collect in test tube. The amount of drug not entrapped in the invasomes was determined by centrifuging at 3,000 rpm and collect the supernatant, the supernatant layer was separated, diluted with water suitably and drug concentration was determined at 290nm using UV spectrophotometer (Saudagar and Bornare, 2016).

$$\% \text{ Entrapment Efficiency} = \frac{\text{Theoretical drug content} - \text{Practical drug content}}{\text{Theoretical drug content}} \times 100$$

### Vesicle Size



Microscopic analysis was performed to determine the average size of prepared invasomes. Formulation was diluted with distilled water and one drop was taken on a glass slide and covered with cover slip. The prepared slide was examined under trinocular microscopic at 400 X. The diameters of more than 150 vesicles were randomly measured using calibrated ocular and stage micrometer (Babaie *et al.*, 2020). The average diameter was calculated using the following formula:

$$\text{Average Diameter} = \frac{\sum n \cdot d}{\sum n}$$

Where n = number of vesicles; d = diameter of the vesicles

### Evaluation of Invasomes containing gel

#### Measurement of viscosity

Viscosity measurements of prepared topical Invasomes based gel were measured by Brookfield viscometer using spindle no. 63 with the optimum speed of 10rpm.

#### pH measurements

pH of selected optimized formulations was determined with the help of digital pH meter. Before each measurement of pH, pH meter should be calibrated with the help of buffer solution of pH 4, pH 7 and pH 9.2. After calibration, the electrode was dipped into the vesicles as long as covered by the vesicles. Then pH of selected formulation was measured and readings shown on display were noted (Singh and Bhardwaj, 2021).

### Drug content

Accurately weighed equivalent to 100 mg of topical Invasomes gel was taken in beaker and added 20 ml of methanol. This solution was mixed thoroughly and filtered using Whatman filter paper no.1. Then 1.0 mL of filtered solution was taken in 10 mL capacity of volumetric flask and volume was made upto 10 mL with methanol. This solution was analyzed using UV-Spectroscope at  $\lambda_{\text{max}}$ 290 nm.

### Extrudability study

Extrudability was based upon the quantity of the gel extruded from collapsible tube on application of certain load. More the quantity of gel extruded shows better extrudability. It was determine by applying the weight on gel filled collapsible tube and recorded the weight on which gel was extruded from tube (Nangare and Dugam, 2020).

### Spreadibility

Spreadibility of formulation is necessary to provide sufficient dose available to absorb from skin to get good therapeutic response. It was determined by method reported by Multimer *et al.* (1956). An apparatus in which a slide fixed on wooded block and upper slide has movable and one end of movable slide tied with weight pan. To determine spreadibility, placing 2-5 g of gel between two slide and gradually weight was increased by adding it on the weight pan and time required by the top plate to cover a distance of 10 cm upon adding 80g of weight was noted. Good spreadibility show lesser time to spread.

$$\text{Spreadability} = \frac{\text{Weight tied to Upper Slide} \times \text{Length moved on the glass slide}}{\text{Time taken to slide}}$$

### In-vitro drug diffusion study

The *in-vitro* diffusion study is carried by using franz diffusion cell. Egg membrane is taken as



semi permeable membrane for diffusion. The Franz diffusion cell has receptor compartment with an effective volume approximately 60 mL and effective surface area of permeation 3.14sq.cms. The egg membrane is mounted between the donor and the receptor compartment. A two cm<sup>2</sup> size patch taken and weighed then placed on one side of membrane facing donor compartment. The receptor medium is phosphate buffer pH 7.4. The receptor compartment is surrounded by water jacket so as to maintain the temperature at 32±0.5°C. Heat is provided using a thermostatic hot plate with a magnetic stirrer. The receptor fluid is stirred by Teflon coated magnetic bead which is placed in the diffusion cell. During each sampling interval, samples are withdrawn and replaced by equal volumes of fresh receptor fluid on each sampling. The samples withdrawn and analyzed spectrophotometrically at wavelength of 290nm.

### Stability Studies

Stability study was carried out for drug loaded invasomal gel at two different temperatures i.e. refrigeration temperature (4.0±0.2°C) and at room temperature (25-28±2°C) for 3 weeks. The formulation subjected for stability study was stored in borosilicate container to avoid any interaction between the formulation and glass of container. The formulations were analyzed for any viscosity and % assay.

## RESULTS AND DISCUSSION

The present study aimed to formulate and evaluate griseofulvin-loaded invasomal gel for efficient topical delivery to treat dermatophytosis. The primary objective was to assess the entrapment efficiency, vesicle size, and drug release characteristics of the invasomal formulations, as well as to evaluate the stability of the optimized gel over time. The entrapment efficiency is an essential parameter for the formulation of any

nanocarrier, as it determines the amount of drug encapsulated within the vesicles relative to the total amount used. In the present study, the entrapment efficiency of the formulations ranged from 65.45% (F4) to 72.25% (F3), with formulation F3 showing the highest efficiency. This finding suggests that formulation F3 had a better capacity to entrap the drug, which is crucial for ensuring an adequate dose is delivered to the site of infection. The average vesicle size of the formulations ranged from 95.58 nm (F3) to 128.85 nm (F6), with F3 showing the smallest vesicle size. Smaller vesicles are often more desirable for topical delivery, as they can better penetrate the skin barrier and ensure more efficient drug delivery to the affected site. Zeta potential is a key indicator of the stability of nanosuspensions. A higher absolute zeta potential generally implies better stability due to the electrostatic repulsion between particles. In the present study, formulation F3 exhibited a zeta potential of -38.45 mV, which indicates a relatively stable formulation. A zeta potential of this magnitude suggests that F3 would maintain its stability over time, preventing aggregation and ensuring consistent drug release. The optimized invasomal gel formulation (F3) was evaluated for various gel characteristics such as viscosity, pH, drug content, extrudability, and spreadability. The viscosity of the formulations was found to be in the range of 3265–3485 cps, with IG-3 showing the highest viscosity, which indicates that it would have a thicker consistency. The pH of the gels was slightly acidic (6.78–6.87), which is optimal for skin application. The drug content of the formulations ranged from 96.65% to 99.15%, indicating that a significant portion of the griseofulvin was retained in the gel. The extrudability and spreadability of the gels were also satisfactory, with formulation IG-2 showing the best extrudability (162 g) and IG-1 exhibiting the highest spreadability (11.23 g.cm/sec). These

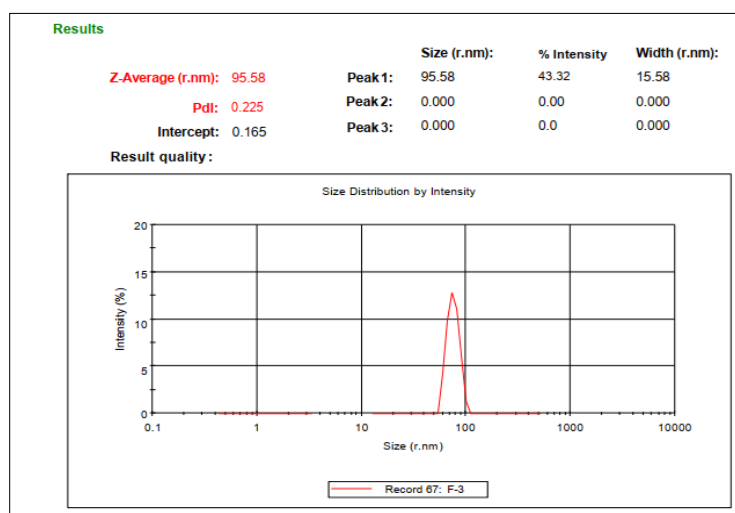


characteristics suggest that the gels would be easy to apply and spread on the skin, providing convenience and enhanced patient compliance. The *in vitro* drug release study indicated that formulation IG-1 had the highest cumulative drug release, achieving 98.12% release at 6 hours. Formulation IG-2 showed 94.65% cumulative drug release at 10 hours, while IG-3 demonstrated slower release characteristics, with 74.65% drug release at 6 hours. The slow release observed in IG-3 might be beneficial for prolonged drug delivery, reducing the frequency of application. In contrast, IG-1 would provide rapid therapeutic effects due to the fast drug release rate. The release kinetics were analyzed using several models, including zero-order, first-order, Higuchi, and Korsmeyer-Peppas models. The  $R^2$  values for the Korsmeyer-Peppas model were found to be the highest (0.9745) for formulation IG-2, indicating that the release of griseofulvin from the gel followed non-Fickian diffusion, which suggests that both diffusion and erosion mechanisms contributed to drug release. This type of release profile is beneficial for sustained and controlled release, ensuring effective treatment over a

prolonged period. The stability of the optimized invasomal gel formulation (F3) was assessed over three months under different storage conditions (4°C and 25-28°C). The viscosity and drug content of the formulation were well-maintained over time, with slight decreases observed at room temperature. However, the physical appearance of the gel showed some turbidity at both storage conditions, indicating possible phase separation or changes in the structure of the formulation over time. Despite this, the gel remained stable in terms of its drug content and viscosity, suggesting that the formulation is suitable for long-term storage with minimal degradation.

**Table 3: Entrapment efficiency and average vesicle size**

| Formulation Code | % Entrapment efficiency | Average vesicle size (nm) |
|------------------|-------------------------|---------------------------|
| F1               | 66.58±0.25              | 125.65±0.45               |
| F2               | 69.95±0.36              | 116.65±0.32               |
| F3               | 72.25±0.41              | 95.58±0.45                |
| F4               | 65.45±0.15              | 105.65±0.33               |
| F5               | 68.12±0.32              | 112.25±0.74               |
| F6               | 69.98±0.25              | 128.85±0.36               |



**Figure 1: Graph of average vesicle size (nm) of optimized formulation F5**

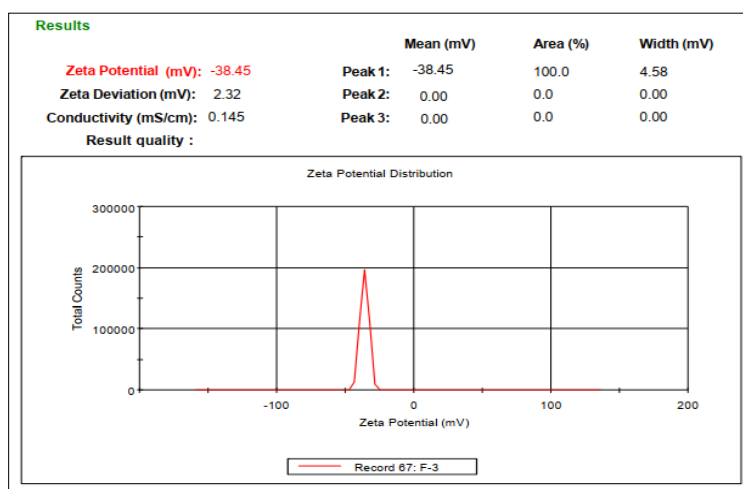


Figure 2: Graph of zeta Potential (mV) optimized formulation F5

Table 4: Characterization of optimized formulation of invasomes

| Formulation | Average vesicle size (nm) | % Entrapment efficiency | Zeta Potential (mV) |
|-------------|---------------------------|-------------------------|---------------------|
| F3          | 105.65±0.33               | 72.25±0.41              | -38.45              |

Table 5: Characterization of Invasomes gel

| Gel formulation | Viscosity (cps) | pH        | Drug Content (%) | Extrudability (g) | Spreadability (g.cm/sec) |
|-----------------|-----------------|-----------|------------------|-------------------|--------------------------|
| IG-1            | 3265±9          | 6.85±0.32 | 96.65±0.45       | 145±5             | 11.23±0.15               |
| IG-2            | 3345±11         | 6.87±0.15 | 99.15±0.32       | 162±8             | 10.23±0.22               |
| IG-3            | 3485±13         | 6.78±0.22 | 97.65±0.41       | 179±6             | 7.15±0.18                |

Table 6: *In vitro* drug release study of optimized gel

| S. No. | Time (hr) | % Cumulative Drug Release* |       |       |
|--------|-----------|----------------------------|-------|-------|
|        |           | IG-1                       | IG-2  | IG-3  |
| 1      | 0.5       | 36.65                      | 29.45 | 20.12 |
| 2      | 1         | 48.85                      | 46.65 | 36.65 |

|   |    |       |       |       |
|---|----|-------|-------|-------|
| 3 | 2  | 69.98 | 53.32 | 45.65 |
| 4 | 4  | 89.58 | 63.32 | 63.32 |
| 5 | 6  | 98.12 | 74.45 | 74.65 |
| 6 | 8  | -     | 83.32 | 83.32 |
| 7 | 10 | -     | 94.65 | 89.98 |
| 8 | 12 | -     | 98.11 | 93.32 |

Table 7: *In-vitro* drug release data for optimized formulation IG-2

| Time (h) | Square Root of Time(h) <sup>1/2</sup> | Log Time | Cumulative* % Drug Release | Log Cumulative % Drug Release | Cumulative % Drug Remaining | Log Cumulative % Drug Remaining |
|----------|---------------------------------------|----------|----------------------------|-------------------------------|-----------------------------|---------------------------------|
| 0.5      | 0.707                                 | -0.301   | 29.45                      | 1.469                         | 70.55                       | 1.848                           |
| 1        | 1                                     | 0        | 46.65                      | 1.669                         | 53.35                       | 1.727                           |
| 2        | 1.414                                 | 0.301    | 53.32                      | 1.727                         | 46.68                       | 1.669                           |
| 4        | 2                                     | 0.602    | 63.32                      | 1.802                         | 36.68                       | 1.564                           |
| 6        | 2.449                                 | 0.778    | 74.45                      | 1.872                         | 25.55                       | 1.407                           |
| 8        | 2.828                                 | 0.903    | 83.32                      | 1.921                         | 16.68                       | 1.222                           |

|    |       |       |       |       |      |       |
|----|-------|-------|-------|-------|------|-------|
| 10 | 3.162 | 1     | 94.65 | 1.976 | 5.35 | 0.728 |
| 12 | 3.464 | 1.079 | 98.11 | 1.992 | 1.89 | 0.276 |

**Table 8: Regression analysis data of optimized gel formulation IG-2**

| F. Code | Zero Order     | First Order    | Higuchi        | Korsmeyer Peppas |
|---------|----------------|----------------|----------------|------------------|
|         | R <sup>2</sup> | R <sup>2</sup> | R <sup>2</sup> | R <sup>2</sup>   |
| IG2     | 0.9464         | 0.9221         | 0.9828         | 0.9745           |

**Table 9: Stability of optimized formulation of invasomes gel**

| Characteristic      | Time (Month) |           |            |           |            |             |
|---------------------|--------------|-----------|------------|-----------|------------|-------------|
|                     | 1 Month      |           | 2 Month    |           | 3 Month    |             |
| Temp.               | 4.0 ±0.2°C   | 25-28±2°C | 4.0 ±0.2°C | 25-28±2°C | 4.0 ±0.2°C | 25-28±2°C   |
| Viscosity (cps)     | 3325         | 3145      | 3315       | 3025      | 3310       | 2978        |
| Drug Content (%)    | 99.05        | 97.74     | 99.0       | 94.65     | 98.98      | 91.74       |
| Physical Appearance | Normal       | Turbid    | Normal     | Turbid    | Normal     | High turbid |

## CONCLUSION

In conclusion, the study successfully formulated and evaluated griseofulvin-loaded invasomal gel, designed for efficient topical delivery in the treatment of dermatophytosis. The optimized formulation (F3) demonstrated promising characteristics, including high entrapment efficiency (72.25%) and a small vesicle size (95.58 nm), which are essential for enhanced skin penetration and effective drug delivery. The in vitro drug release profile showed that formulation F3 provided sustained and controlled release, with 98.12% of the drug released over 6 hours. Additionally, the gel exhibited excellent physicochemical properties, such as appropriate viscosity, pH, extrudability, and spreadability, which are crucial for patient compliance and ease of application. Stability studies confirmed that the formulation remained stable over a 3-month period, with minimal changes in drug content and viscosity. Overall, the griseofulvin-loaded invasomal gel holds significant potential as an effective and reliable treatment for

dermatophytosis, offering controlled drug release and improved therapeutic outcomes.

## REFERENCES

1. Babaie, S., Del Bakhshayesh, A.R.D., Ha, J.W., Hamishehkar, H. & Kim, K.H. (2020) Invasome: A novel nanocarrier for transdermal drug delivery. *Nanomaterials*, 10, 341.
2. Chauhan, A. & Saraf, S. (2019) Topical drug delivery system for dermatophytosis: A review on the development of Invasomal and liposomal gel formulations. *Journal of Advanced Pharmaceutical Research*, 10, 125–135.
3. Gupta, A., Sharma, S. & Gupta, M. (2020) Development of Invasomal gel for topical delivery of antifungal drugs: In vitro and ex-vivo evaluation. *International Journal of Pharmaceutics*, 579, 119–125.
4. Lakshmi, P.K., Mounica, V., Manoj, K.Y. & Prasanthi, D. (2014) Preparation and evaluation of curcumin invasomes. *International Journal of Drug Delivery*, 6, 113.



5. Mutimer, M.N., Riffikin, C., Hill, J.A., Marry, E. & Glickman, C.N. (1956) Synthesis of methylsilyl derivatives of procaine and their diffusion. *J. Am. Pharm. Assoc. Sci.*, 45, 212–218.
6. Nangare, S. & Dugam, S. (2020) Smart invasome synthesis, characterizations, pharmaceutical applications, and pharmacokinetic perspective: A review. *Future Journal of Pharmaceutical Sciences*, 6, 1–21.
7. Rathi, A. & Garg, T. (2017) Invasomal delivery systems: A new frontier for topical drug delivery in dermatology. *Drug Development and Industrial Pharmacy*, 43, 1575–1587.
8. Saudagar, R.B. & Bornare, A.S. (2016) Invasomes novel vesicular carriers for transdermal drug delivery. *International Journal of Universal Pharmacy and Bio Sciences*, Review.
9. Sharma, A., Garg, T. & Rath, G. (2018) Formulation and evaluation of griseofulvin-loaded liposomal and Invasomal systems for topical delivery in dermatophytosis. *Journal of Drug Delivery Science and Technology*, 48, 157–164.
10. Singh, Y. & Bhardwaj, A. (2021) Formulation development and evaluation of itraconazole loaded invasomes hydrogel. *Journal of Pharmaceutical Research International*, 33, (657–665).
11. Sudhakar, Y. & Thirumalai, R. (2019) Topical delivery of griseofulvin: Enhancing the drug efficacy through Invasomal systems. *Journal of Pharmaceutical Sciences*, 108, 1678–1685.
12. Verma, H., Pal, P. & Joshi, D. (2022) Formulation, development and evaluation of invasomes loaded gel for fungal treatment. *Sch Acad. Journal de Pharmacologie*, 7, 105–108.

**HOW TO CITE:** Anna Ruth Thomas\*, Eisha Ganju, Rajni Dubey, Bhaskar Kumar Gupta, Formulation And Evaluation of Griseofulvin-Loaded Invasomal Gel for Efficient Topical Delivery to Treat Dermatophytosis, *Int. J. of Pharm. Sci.*, 2025, Vol 3, Issue 4, 1615-1623 <https://doi.org/10.5281/zenodo.15205280>

