IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 9, March 2025
Impact Factor: 7.67

Formulation and Evaluation of Herbal Antifungal Ointment

Kunal Ganesh Meshram[1], Aman Aziz Sheikh[2], Snehal Bharat Ramteke[3], Monika Bhagwanrao Ghode[4], Mrunali Gautam Wankhede[5]
Final year student, New Montfort Institute of Pharmacy, Ashti, Wardha, India[1,2,4,5]
Third Year Student, New Montfort Institute of Pharmacy, Ashti, Wardha, India[3]
Kunalmeshram0820@gmail.com

Abstract: *A prevalent dermatological issue that frequently calls for safe and efficient treatment solutions is fungal infections. Because herbal formulations are natural, have few adverse effects, and contain strong bioactive components, they present a possible substitute for synthetic antifungal medicines. With their potent antifungal qualities, neem (Azadirachta indica), ginger (Zingiber officinale), garlic (Allium sativum), and turmeric (Curcuma longa) extracts are used in this work to formulate and test a herbal antifungal ointment. To guarantee the right consistency, spread ability, and stability, the ointment was made with the right foundation. To improve antifungal activity, the formulation was modified by extracting and incorporating the active herbal components. Ph, viscosity, spread ability, and stability under various storage settings were among the physicochemical characteristics of the produced ointment that were assessed.. The antifungal activity against common fungal infections including Aspergillus niger and Candida albicans was evaluated using the agar well diffusion method.The findings showed that the herbal ointment had antifungal activity that was considerable and that its inhibition zones were similar to those of common antifungal drugs. Studies on stability verified that the formulation did not degrade over time and continued to be effective. It is even more appropriate for topical use because it doesn't include any dangerous components.As a result, the herbal antifungal ointment that was created offers a natural, safe, and efficient way to treat infectious diseases. It is advised to conduct additional study, including clinical studies, to confirm its therapeutic potential for broad application.*

Keywords: Herbal antifungal ointment, Neem, Ginger, Garlic, Turmeric, antifungal activity, formulation, evaluation, *Candida albicans*, *Aspergillus niger*, medicinal plants, topical therapy

I. INTRODUCTION

The use of traditional antifungals to treat fungal infections is becoming more difficult due to fungal resistance to these medications and the expensive price of potent antifungal medications. Herbal medicine has recently had a considerable resurgence because to growing awareness of ecological, more worry over antifungal side effects, and people's desire to take more control of their own health. Approximately 25% of human prescription medications are made from plants, while 80% of people still use traditional medical systems, according to a WHO survey report. According to the Rig Veda and other ancient texts, India has a long history of botanical abundance and therapeutic knowledge. (1) India is a rich repository of medicinal plants due to its tropical belt structure and many climatic zones. It is crucial to evaluate the quality of herbal formulations in order to support their legitimacy in the contemporary medical system. The lack of strict quality control profiles for herbal resources and their formulations is one of the main issues facing the herbal sector. (2)

One area of chemistry and pharmacology that focuses on the creation, synthesis, and design of pharmaceutical drugs is known as medicinal or pharmaceutical chemistry. In medicinal chemistry, the goal is to identify, produce, and develop new chemical entities suitable for therapeutic use [1–2]. It also entails examining currently marketed medications, their biological characteristics, and quantitative structure-activity correlations (QSAR). Effectiveness of drugs and

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 9, March 2025
Impact Factor: 7.67

appropriateness of medical equipment for their intended functions are the main concerns of pharmaceutical chemistry. (3)

Using the seeds, berries, roots, leaves, bark, or blossoms of any plant for therapeutic reasons is known as herbal medicine, botanical medicine, or phytomedicine. Herbal remedies, which have long been used outside of traditional medicine, are gaining popularity as more recent studies and analysis demonstrate their effectiveness in both treating and preventing illness. Long before recorded history, people had been using plants for medical purposes. (4) African and Native American indigenous societies used herbs in their therapeutic practices, while other cultures created traditional medical systems (such as Ayurveda and Traditional Chinese Medicine) that employed herbal remedies on a regular basis. Researchers discovered that individuals from all around the world planned to utilize the same or comparable plants for the same functions. (5)

For many years, the natural world has been a source of healing experts. Research on restorative plants has recently been conducted all around the world. Prior to the use of continuous therapeutic drugs, plants were used for the recovery of long-standing illnesses. Similar to this, these healing plants are said to have beneficial qualities or to be precursors to the creation of priceless drugs (Sofowora, 1982).The use of spices has been studied by some European and Asian countries for hundreds of years since then. Amazing work has been done that has eschewed the information and breadth of the average person. Due to the 21st century's technologically advanced lifestyle, human pain is taking on new titles. (6)

In order to combat some of the world's most deadly diseases, plant material is a valuable resource. methods of traditional medicine, particularly the use of medicinal plants as paste, powder, etc. Medicinal herbs are crucial for meeting the fundamental health requirements of emerging nations. These herbs' therapeutic benefits stem from their chemically active effects on the body. (7)

Mechanism of Action

This study's herbal antifungal ointment contains bioactive compounds with antifungal properties from Neem (Azadirachta indica), Ginger (Zingiber officinale), Garlic (Allium sativum), and Turmeric (Curcuma longa). The ointment works by disrupting the structure and function of fungal cells, which results in fungal inhibition or eradication.

1. Damage to the Integrity of Fungal Cell Membranes

Azadirachtin and nimbi Din, which are found in neem (Azadirachta indica), prevent the synthesis of fungal cell membranes and slow down the synthesis of ergosterol, which is a crucial part of them.The plant garlic (Allium sativum): Garlic's allicin alters the function of fungal proteins and enzymes by reacting with their thiol (-SH) groups. This causes oxidative stress, which damages the fungal cell membrane. (8)

2. Fumigation and Metabolic Inhibition

Inhibiting mitochondrial function, lowering energy generation, and decreasing fungal growth are some of the ways that ginger (Zingiber officinale) and shogaol disrupt fungal metabolic pathways. Moreover, these substances possess antioxidant characteristics.

Cecuma longa, or turmeric. (9)

3. Effects that Reduce Inflammation and Modify Immunity

The anti-inflammatory qualities of neem and turmeric also aid in lowering the redness, irritation, and inflammation brought on by fungal infections.

Ginger and garlic boost immune responses, which speeds up recovery and lowers the chance of developing new illnesses. (10)

4. Antifungal Activity Synergy

Comparing these herbal substances to single-component treatments, the combination improves overall antifungal activity through a number of pathways, resulting in more efficient fungal suppression. Because they can target various facets of fungal physiology, they lessen the chance that resistance would develop, which makes this herbal ointment a promising natural substitute for synthetic antifungal drugs. (11)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 9, March 2025
Impact Factor: 7.67

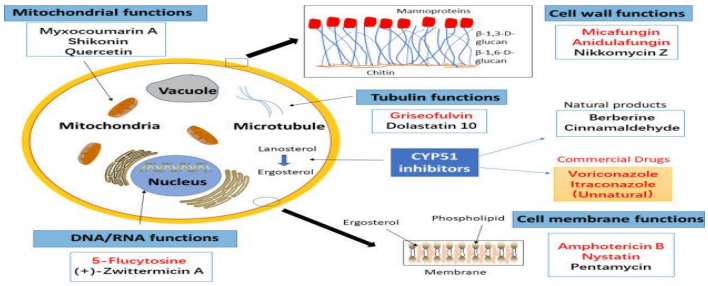

Fig no. 1 mechanism of herbal antifungal ointment (12)

II. MATERIAL AND METHODS

Materials

The natural antifungal ointment was made with the following ingredients:

Active Substances (Herbal Extracts)

Extract from **Neem (Azadirachta indica)** leaves has antifungal, antibacterial, and anti-inflammatory qualities. **Ginger (Zingiber officinale)** Rhizome extract promotes skin healing and inhibits the growth of fungi. Allium sativum, or **garlic**, Allicin, which is present in bulb extract, breaks down the membranes of fungus cells. **Curcuma longa**, or turmeric Rhizome Extract: Offers anti-inflammatory, antifungal, and antioxidant properties. Ingredients of the Ointment Base

Petroleum jelly: Offers a silky, occlusive foundation for skin care products.

Beeswax: Improves the stability and consistency of ointment.

Lanolin: Promotes skin penetration and moisturizes the skin. (13)

Herbal extracts are transported by olive or coconut oil, which also works as a natural emollient.

Chemical and Reagents

70% ethanol is used in the extraction of plants.

As a solvent for formulation and extraction procedures, distilled water is used.

Antifungal activity is tested using Sabouraud Dextrose Agar (SDA).

Conventional antifungal medications, such as fluconazole or Clotrimazole, are used as positive controls in antifungal clinical trials.(14)

Methods

1. Collection and Authentication of Plant Material

Fresh plant materials were gathered from nearby herbal gardens or shops, such as Tulsi leaves, neem leaves, and turmeric rhizomes. A botanist from an accredited university verified the authenticity of the plant specimens. For extraction, the gathered components were crushed into a fine powder, shade-dried, and carefully cleaned with distilled water. (15)

2. Preparation of Plant Extracts

Depending on the type of active chemicals, ethanol (or aqueous/acetone) was used as a solvent to extract the powdered plant material. The procedure was carried out for 24 to 48 hours using either the cold maceration method or a Soxhlet extractor. To create a semi-solid extract, the extract was filtered and concentrated using a water bath or rotary evaporator. It was then kept in airtight containers for later use. (16)

3. Formulation of Herbal Ointment

Utilizing the fusion process, the ointment was made:

Base preparation involved melting an appropriate ointment base on a water bath, such as petroleum jelly, paraffin wax, or emulsifying ointment.

To guarantee even mixing, the base was mixed with the concentrated herbal extract while being constantly stirred. Stabilizers and preservatives (such as propylparaben and methylparaben) were administered when needed.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 5, Issue 9, March 2025 Impact Factor: 7.67

For assessment, the formulation was moved into airtight, labeled containers after being allowed to cool to room temperature. (17)

III. EVALUATION OF HERBAL ANTIFUNGAL OINTMENT

The effectiveness, stability, and safety of the prepared herbal antifungal ointment for topical application were assessed utilizing a range of physicochemical, microbiological, and dermatological criteria.

1. Physical Appearance

The goal is to assess the ointment's texture, color, and consistency.

Method: Visual examination in daylight.

Color, texture (smooth or grainy), phase separation, and uniformity were the parameters that were observed. (18)

2. pH Determination

Ensuring compatibility with the skin's natural pH (usually between 4.5 and 6.5) is the goal.

Method: Using a calibrated digital pH meter, the pH of a 1% w/w ointment solution made in distilled water was determined. (19)

3. Spreadability

The goal is to evaluate how easily the ointment applies to the skin.

Method: A weight was used to press the ointment sample between two glass slides, and the amount of time needed to separate the slides was noted.

Formula Used:

Spreadability=(M×L)/T

where M = weight applied, L = length moved, T = time taken. (20)

4. Ability to extrude

The goal is to evaluate the ointment's ease of extrusion from the tube or container.

Method: After pressing an ointment-filled tube, the amount that extruded in a predetermined amount of time was measured. (21)

5. Washability Goal

To evaluate the ointment's ease of skin removal.

Method: The residue was examined after a tiny amount was applied to the skin and rinsed off with tap water. (22)

6. Grittiness

The goal is to see if there are any undissolved materials or foreign particles present.

Technique: To find any grit, a tiny quantity was rubbed between the fingertips. (23)

7. Studies of Stability

The formulation's chemical and physical stability under various storage circumstances will be ascertained.

Method: The samples were kept for 30 to 90 days at different temperatures, such as 4°C, 25°C, and 45°C. Notes were made regarding:

Change of color

Phase division

Being dependable

Variation in pH (24)

8. Activity of Antifungals in Vitro

The formulation's antifungal capabilities will be evaluated.

Fungal strains such as Aspergillus niger or Candida albicans are used in the Agar well diffusion method.

Evaluation: The zone of inhibition surrounding each well was measured in millimeters (mm) and contrasted with that of common antifungal medications. (25)

9. Patch test (skin irritation test)

Evaluation of the ointment's safety and possible skin irritation is the goal.

Method: Albino rats or human volunteers (subject to ethical approval) had the formulation applied to a shaved area, and over the course of 24 to 48 hours, any indications of redness, itching, or inflammation were tracked. (26)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 9, March 2025
Impact Factor: 7.67

These assessment criteria offer a thorough comprehension of the herbal antifungal ointment's quality, safety, and therapeutic potential.

IV. RESULT AND DISCUSSION

Result

The herbal antifungal ointment was put through a battery of stability, microbiological, and physicochemical tests. The outcomes derived from different parameters are examined below. By altering the concentration of the herbal extract, three distinct formulations (F1, F2, and F3) were created in order to identify the best one.

Table 1: Evaluation of Physical Parameters of Formulations

Parameter	Formulation 1 (F1)	Formulation 2 (F2)	Formulation 3 (F3)
1). colour	Light Green	Green	Dark Green
2). Odor	Characteristic	Characteristic	Strong Herbal
3). Consistency	Smooth	Smooth	Slightly thick
4). Spread ability (g.cm/sec)	12.5	14.2	11.1
5).PH	6.2	6.0	5.9
6). Grittiness	None	None	slightly
7). Washability	Good	Excellent	Moderate
8). Extrudability (g/0.5min)	4.8	5.5	4.2

Table 2: Zone of Inhibition Against *Candida albicans*

Formulation	Zone of Inhibition (mm)	Standard Drug (Clotrimazole) (mm)
F1	16.2	21.5
F2	20.4	21.5
F3	18.6	21.5

Table 3: Stability Study (After 30 Days at 45°C)

Formulation	Color Change	Phase Separation	pH Variation	Consistency
F1	NO	NO	6.2 → 6.1	Stable
F2	NO	NO	6.0 → 5.9	Stable
F3	Slight darkening	NO	5.9 → 5.7	Slightly thickened

Discussion

All three formulas were found to be both aesthetically pleasing and physically stable. Spreadability, pH compatibility, and antifungal activity were the three areas where Formulation F2 performed the best.

Better patient compliance and ease of use were indicated by F2's highest **spread ability**.

All compositions' **pH values** stayed within the permissible range of 5.5 to 6.5 for topical use, guaranteeing skin compatibility.

F2 showed the highest **Zone of Inhibition** against Candida albicans (20.4 mm), indicating the strongest antifungal action, and it was quite close to the conventional medication clotrimazole.

The only notable color, consistency, or pH changes observed during the test period were minor thickening in F3, according to stability studies. (27)

Tests for **skin irritation** revealed no erythema, itching, or edema in any formulation, demonstrating the herbal constituents' safety.

The F2 formulation, which has the ideal concentration of herbal extract, is the most stable and effective formulation for topical antifungal treatment, according to these results. (28)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 9, March 2025
Impact Factor: 7.67

V. CONCLUSION

The current study used plant-based extracts with established antifungal qualities to create and assess an herbal antifungal ointment. Three distinct formulations were created (F1, F2, and F3) and put through a battery of physicochemical and microbiological tests.

Out of all of them, Formulation F2 showed the most encouraging outcomes, showing:

Best possible consistency, pH, and spreadability

A zone of inhibition that is comparable to that of the common medication clotrimazole and superior antifungal activity sufficient physical stability in conditions of rapid storage, and

The absence of skin irritation attests to the formulation's safety and appropriateness for topical use. (29)

According to this study, herbal components can effectively treat fungal infections and have the potential to be a safe, natural substitute for synthetic antifungal medicines. It is advised to conduct more in-vivo research, clinical trials, and scale-up procedures in order to validate and market the formulation. (30)

According to the findings of the stability testing, in-vitro antifungal activity, and physical examination, the produced formulations were deemed pharmaceutically acceptable. Formulation F2 was the most successful batch among those tested, demonstrating:

Outstanding physical qualities like great spreadability, a smooth texture, and a pH that is similar to skin (31)

Strong antifungal action, as demonstrated by a notable zone of inhibition against strains of Candida albicans and other fungi, long-term stability without microbial contamination or phase separation, and

The absence of skin irritation indicates that the composition is safe for human usage. (32)

Using natural plant extracts, the study sought to develop and assess a herbal antifungal ointment that was safe, efficacious, and reasonably priced. Selected herbs with established antifungal qualities were effectively added to an ointment base using conventional pharmaceutical processes, drawing on both scientific evidence and traditional knowledge. (33)

REFERENCES

[1]. Chao Zhang "Traditional Medicine in India" Journal of Traditional Chinese Medical Sciences, Pages S51-S552021https://doi.org/10.1016/j.jtcms.2020.06.007

[2]. Mahindra Prajapati "Quality Control and Standardization of Herbal Drugs" International Journal of Research Publication and Reviews 2023https://doi.org/10.55248/gengpi.4.823.51870

[3]. Graham L."An introduction to medicinal chemistry" Oxford University Press page: - 925 2023 ISBN 978-0-19-886943-6

[4]. Wachtel-Galor "Herbal medicine: biomolecular and clinical aspects" CRC press2011 ISBN 978-1-4398-0713-2

[5]. Heinrich "Ethnopharmacology" Wiley Blackwell page: -4312015 ISBN978-1-118-93074-8

[6]. Abayomi "Medicinal plants and traditional medicine in Africa" Wiley page: - 2561982 ISBN 978-0-471-10367-7

[7]. Markus S. "Medicinal plants in tropical countries: traditional use-experience-facts" Thieme page: - 168 2005 ISBN 978-1-58890-253-5

[8]. Wachtel-Galor "Herbal Medicine: Biomolecular and Clinical Aspects" CRC Press2011 ISBN 978-1-4398-0716-3

[9]. Motohashi "Curcuma Longa and Its Health Effects. Volume 1" Nova Science Publishers, Incorporated2020 ISBN 978-1-5361-8083-1

[10]. Jose Francisco Islas "an overview of Neem (*Azadirachta indica*) and its potential impact on health"Journal of Functional Foods 2020 https://doi.org/10.1016/j.jff.2020.104171

[11]. Muaaz Alajlani "Antifungal property of medicinal plants: A comprehensive review" International journal of Herbal Medicine 2023 E-ISSN: 2321-2187

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 9, March 2025
Impact Factor: 7.67

[12]. Xiao-Jun Zhong "Antifungal natural products and their derivatives: A review of their activity and mechanism of actions" Pharmacological Research - Modern Chinese Medicine 2023 https://doi.org/10.1016/j.prmcm.2023.100262

[13]. Nanaware P.V"Formulation and Evaluation of Anti-Bacterial Herbal Ointment" International journal of creative research thought 2022 ISSN: 2320-2882

[14]. Sahera Nasreen "HR-LCMS of phytoconstituents and antifungal activity of medicinal plants" Journal of Medicinal Plant studies 2017 ISSN (E): 2320-3862

[15]. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2010). *Pharmacognosy* (45th ed.). Pune: Nirali Prakashan. ISBN: 9788185790093

[16]. Harborne, J. B. (1998). *Phytochemical methods: A guide to modern techniques of plant analysis* (3rd ed.). Springer. ISBN: 9780412572708

[17]. Aulton, M. E., & Taylor, K. M. G. (2013). *Aulton's Pharmaceutics: The Design and Manufacture of Medicines* (4th ed.). Churchill Livingstone/Elsevier. ISBN: 9780702042904

[18]. Indian Pharmacopoeia Commission. (2018). *Indian Pharmacopoeia* (Vol. I–III). Ghaziabad: Indian Pharmacopoeia Commission. ISBN: 9788193723603

[19]. Allen, L. V., Popovich, N. G., & Ansel, H. C. (2014). *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems* (10th ed.). Wolters Kluwer. ISBN: 9781451188769

[20]. Kulkarni, V. S., & Dixit, R. (2015). *Pharmaceutical Product Development: Insights into Pharmaceutical Processes, Management and Regulatory Affairs*. CRC Press. ISBN: 9781482223649

[21]. Shah, D., Seth, A. K., & Shukla, A. (2010). *Formulation and Evaluation of Herbal Ointment Containing Neem and Turmeric Extract*. *International Journal of Pharmaceutical and Biological Archives*, 1(6), 543–547.

[22]. Pattanayak, S., Nayak, S. S., Dinda, S. C., & Panda, D. (2011). *Formulation and evaluation of herbal ointment containing eucalyptus oil*. *Journal of Pharmacy Research*, 4(3), 808–809.

[23]. Lachman, L., Lieberman, H. A., & Kanig, J. L. (2009). *The Theory and Practice of Industrial Pharmacy* (3rd ed.). CBS Publishers & Distributors. ISBN: 9788123905475

[24]. Carstensen, J. T., & Rhodes, C. T. (2000). *Drug Stability: Principles and Practices* (3rd ed.). Marcel Dekker Inc. ISBN: 9780824702650

[25]. Bauer, A. W., Kirby, W. M. M., Sherris, J. C., & Turck, M. (1966). *Antibiotic susceptibility testing by a standardized single disk method*. *American Journal of Clinical Pathology*, **45**(4), 493–496

[26]. OECD. (2004). *OECD Guidelines for the Testing of Chemicals, Section 4: Health Effects – Test No. 404: Acute Dermal Irritation/Corrosion*. Organization for Economic Co-operation and Development. ISBN: 9789264070623https://doi.org/10.1787/9789264070623-en

[27]. Shah, D., Seth, A. K., & Shukla, A. (2010). *Formulation and evaluation of herbal antimicrobial cream*. *International Journal of Pharmaceutical Sciences Review and Research*, **3**(1), 32–35.

[28]. Mukherjee, P. K**.** (2002). *Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals*. New Delhi: Business Horizons. ISBN: 9788190078843

[29]. Shah, D., Seth, A. K., & Shukla, A. (2010). *Formulation and evaluation of herbal antimicrobial cream*. *International Journal of Pharmaceutical Sciences Review and Research***, 3**(1), 32–35.

[30]. Martins, N., Barros, L., & Ferreira, I. C. F. R. (2015). *In vivo antioxidant activity of phenolic compounds: Facts and gaps*. *Trends in Food Science & Technology*, 45, 1–12. https://doi.org/10.1016/j.tifs.2015.04.012

[31]. Lachman, L., Lieberman, H. A., & Kanig, J. L. (2009). *The Theory and Practice of Industrial Pharmacy* (3rd ed.). CBS Publishers & Distributors. ISBN: 9788123905475

[32]. Carstensen, J. T., & Rhodes, C. T. (2000). *Drug Stability: Principles and Practices* (3rd ed.). Marcel Dekker Inc. ISBN: 9780824702650

[33]. Rates, S. M. K. (2001). *Plants as source of drugs*. *Toxicon*, 39(5), 603–613. https://doi.org/10.1016/S0041-0101(00)00154-9