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Formulation and Evaluation of Antimicrobial Foot Cream

Samiksha H. Thakare[1], Prapti M. Jadhav[2], Sagar S. Yeole[3], Ms. Tina G. Shete[4], Dr. Nitin H. Indurwade[5]

[1,2,3]B. Pharm Final Year Student, Department of Pharmacy, Dr. R .Bhoyar Institute of Pharmaceutical Education and Research, Wardha.
[4]Assistant Professor, Department of Pharmacy, Dr. R.G. Bhoyar Institute of Pharmaceutical Education and Research, Wardha.
[5]Principal, Department of Pharmacy, Dr. R.G.Bhoyar Institute of Pharmaceutical Education and Research, Wardha.

ABSTRACT
This study focuses on developing a natural foot cream using Ficus Racemosa (Cluster Fig) and banana peel extracts to help with dry, cracked feet and prevent infections. Since the skin on our feet lacks oil glands, it tends to become dry and cracked, which can lead to bacterial infections, ulcers, and discomfort. The extracts were obtained using simple, natural methods—Ficus Racemosa stem was soaked in a mixture of water and ethanol, while banana peels were blended and filtered. These extracts were then mixed into different foot cream formulations and tested for their texture, pH, ability to spread, stability over time, and antimicrobial properties. The best-performing formulation contained 3% Ficus Racemosa extract and 1% banana peel extract. It effectively fought off bacteria like E. coli, remained stable without major changes in color or consistency, and showed no irritation when applied to the skin. The cream also provided excellent moisturizing and healing effects, making it a safe and effective solution for cracked heels and dry feet. Overall, this herbal foot cream offers a natural, chemical-free alternative for foot care, helping to heal cracks, keep skin soft, and prevent infections. It could be a great option for people looking for a safe and effective way to care for their feet.

Keywords: Anti-Microbial Cream, Foot Cream, Ficus Racemosa, Banana peel.

INTRODUCTION

Unlike the skin on the rest of our body, the skin on our feet is naturally dry. The skin on our feet has no oil glands, so it relies on hundreds of thousands of sweat glands to keep our feet moisturized [1]. Dry feet can range in severity from mild, temporary dry skin to severe dry skin that causes additional problems. Skin can become dry for a lot of causes, but there are ways to prevent dryness, such as keeping our feet hydrated and avoiding rubbing or scratching the skin. In general, cracked heels are noticed in elderly-aged ladies as compared to youthful girls.

Similarly, older women experience this issue far more than older men do [2]. The stratum corneum, the outermost layer of the epidermis made up of dead cells, acts as a barrier to protect underlying tissue from infection, dehydration, chemicals, and mechanical stress. Foot cracks allow bacteria to enter the

body, which can result in foot ulceration, microbial attack, and even amputation. Ignoring one's feet can cause a variety of problems, usually as a result of wearing inappropriate footwear, and infections can arise from the external penetration of dirt, fungi, and bacteria through these cuts and wounds. It has been reported that bacterial decomposition causes foot odors, which is caused by Staphylococcus epidermidis [3].

Additionally, foot diseases can occasionally be caused by germs found in the skin, such as Staphylococcus aureus, Escherichia coli, and Candida albicans. The peepal tree is the popular name for Ficus religiosa. The bark has a gray hue. Bark is said to include 4% tannins, minerals, alkaloids, and certain vitamins. The bark's aqueous extract is reported to have antibacterial properties and is sweet, cooling, and astringent. The bark helps to improve skin texture, heal burns, and reduce inflammatory swellings [4].

Figure No 1: -foot

PLANT PROFILE

1. Ficus Racemosa

2.1. Scientific Classification [5]:-

Kingdom: Plantae
Angiosperms: Flowering plant
Eudicots: More than two seeds
Order: Rosales
Family: Moraceae
Genus: Ficus
Species: F. racemosa
Binomial name: Ficus racemosa L.
Synonyms: Ficus glomerata

Figure No 2:-Leaves and stem of Ficus Racemosa plant

2.Banana

2.1 Scientific Classification [7]:-

1. Kingdom: Plantae
2. Class: Liliopsida (Monocotyledons)
3. Order: Zingiberales
4. Family: Musaceae
5. Genus: Musa
6. Species:Musa acuminate and Musa balbisiana

Figure No 3:- Banana fruit

AIM AND OBJECTIVE

1. Aim: Formulation and Evaluation of Antimicrobial foot cream.

2. Objective:

- To prepare extract of Ficus Racemosa by maceration process.
- To prepare banana peel extract by grinding.
- Phytochemical analysis of extract of Ficus Racemosa.
- Phytochemical analysis of extract of banana peel.
- To set the formulation for foot cream containing Ficus Racemosa extract and banana extract peel extract.
- To formulate stable cream by using Ficus Racemosa extract by proper procedure.
- To evaluate cream by using different tests as organoleptic evaluation, pH, homogeneity, spredability, anti-microbial activity and stability.

MATERIALS AND METHODS

SN	Ingredient	Quantity	Use of Ingredients
1	Steric acid	6 gm	Forms cream base with TEA
2	Cetyl alcohol	0.4 gm	Acts as emollient
3	Beeswax	1.2 gm	Used as oil phase solvent
4	Triethanolamine(TEA)	0.84 ml	Forms cream base with acid.
5	Glycerin	3 ml	Acts as Humectant
6	Sodium Benzoate	0.04 gm	Preservative
7	Vitamin E	1capsule	Antioxidant

8	Distilled water	q.s	Acts as solvent
9	Tea tree oil	2-3 drops	Fragrance
10	Ficus Racemosa extract	3 ml	Has a healing and moisturizing property
11	Banana extract	1 ml	Antimicrobial property

Table no 1: List of ingredients required for antimicrobial foot cream preparation

METHOD USED FOR EXTRACTION

5.1 Extraction of Ficus Racemosa extract: In December, Ficus racemosa stems were gathered from locations in and around the Wardha district. The Wardha local market provided the bananas used in this investigation. After carefully washing the gathered stems with cold water to get rid of contaminants, they were allowed to air dry for two weeks in the shade. After drying, they were ground into a uniform powder with an electric grinder and sieved. A beaker containing about 30g of powered material was macerated for 48 hrs. Using a solvent mixture of ethanol and water (70:30).A concentrated extract was then obtained by filtering the resultant extract and distilling the filtrate. The extract was stored in airtight container for further use.

5.2 Extraction of Banana peel extract: Fresh banana peel were separated from fruit and cut into small pieces. The pieces were the transferred into a grinder with sufficient amount of water and blended for 5-10mins to obtain smooth slurry. The mixture was then poured into a conical flask, sealed properly and allowed to stand for 48-72hrs at room temperature with occasional shaking to enhance extraction process. After extraction period, the mixture was filtered using mucin cloth or filtered paper to remove solid residues. The resulting filtrated was collected in clean beaker and subjected to gentle evaporation in water bath (40-50^{O}C) to remove excess ethanol.

METHOD OF PREPARATION

The formulation of antimicrobial foot cream involves a systematic process, ensuring a smooth and homogenous texture. The preparation involves these steps;

Step 1: Oil phase preparation

After being weighed, the oil phase components-steric acid, beeswax and Cetyl alcohol were put into a 250ml borosilicate beaker. After being heated at 70^{o}C. These components melted and combined to form a homogeneous liquid phase.

Step2: Aqueous phase preparation

Triethanolamine is one of component of water phase. Sodium benzoate and distilled water were measured and placed in a separate 250ml borosilicate beaker. The mixture was heated with continues stirring at 70^{o}C is crucial as excess temperature can cause detoriation.

Step 3: Incorporation of Herbal extracts

To enhance the therapeutic properties of foot cream, three different concentrations of Ficus Racemosa extract(1ml, 3ml and 5ml) and banana peel extract (0.5ml, 1ml and 1.5ml) were added. Additionally Vitamin E and glycerin were included to provide nourishment and hydration to the skin.

Once the herbal ingredients were properly mixed, the aqueous phase was gradually needed to the oil phase while maintaining the consistent temperature of 75^{o}C. This process was accompanied by continuous trituration, ensuring the formation of smooth, uniform cream. Finally the herbal phase was incorporated into mixture and triturated further until fine, homogenous paste was obtained.

The method resulted in well balanced foot cream formulation, enriched with natural antimicrobial properties making it ideal for skin protection and wound healing.

EVALUATION PARAMETER

1. Organoleptic Evaluation
- Colour
- Odour
- Texture
- Consistency
- Physical State
- Homogeneity

2. Physical Evaluation
- PH
- Spredability
- Skin Irritation Test

3. Stability Test

4. Anti-Microbial Test

9. RESULT

1. Organoleptic Evaluation

Sr. No.	Parameters	Observations
1.	Colour	Pinkish White
2.	Odour	Characteristic
3.	Texture	Smooth
4.	Consistency	Homogenous
5.	Physical State	Semi-Solid
6.	Homogeneity	Homogeneous

Table No 2:-Result of Organoleptic Evaluation.

2. Physical Evaluation

Sr.No.	Parameters	Observations
1.	pH	5.39
2.	Spredability	0.132 g.cm/s
3.	Skin Irritation Test	No Irritation

Table No 3:-Result of Physical Evaluation

3. Stability Test

Sr.No	Parameter	Initial Value	After 30 days
1.	Colour	Pinkish White	No Change
2.	Consistency	Homogeneous	No Change
3.	pH	5.39	5.29

Table No 4:-Result of Stability Test

4. Anti-Microbial Test

Sr.No	Name of Bacteria	Zone of Inhibition				
		50 unit/ml	100 unit/ml	200 unit/ml	300 unit/ml	400 unit/ml

1.	E.coli	1.7 cm	1.9 cm	1.8 cm	2.2 cm	2.5 cm

Table No 5:-Result of Anti-Microbial Test

DISCUSSION

In this study, an herbal foot cream was successfully formulated using Ficus Racemosa stem extract and banana peel extract. The research process began with an extensive literature review, followed by the development of multiple formulations with varying concentrations of active ingredients. The final formulation was carefully optimized to meet pharmaceutical standards, particularly for crack healing and skin protection. The prepared foot cream underwent comprehensive evaluation, assessing key parameters such as physical properties, pH, Spreadability and stability. The results confirmed that the formulation effectively functions as a protective barrier for the skin, helping to heal cracks and maintain foot health. To extract the bioactive compounds, and maceration was employed for Ficus Racemosa stem, while banana peel extract was obtained through grinding. The stem extract was further analyzed for its phytochemical composition, confirming the presence of alkaloids, flavonoids and tannins, which contribute to its healing properties. Additionally, the cream provided a moisturizing effect, making it an effective and beneficial solution for foot care.

CONCLUSION

This study focused on the formulation of an herbal foot cream enriched with Ficus Racemosa extract, known for its healing and skin-repairing properties. The developed cream underwent thorough testing, yielding positive results across all evaluated parameters. Its safety and suitability for topical application were confirmed, making it a natural and effective alternative for foot care. The extraction process involved the use of ethanol for Ficus Racemosa stem and distilled water for banana peel extract. When applied as part of foot therapy, the cream showed statistically significant improvements in addressing cracked heels, dryness, and moisturization. It was well-accepted in terms of color, fragrance, and consistency, making it a user-friendly formulation. Formulation demonstrated the best crack-healing properties, while Ficus Racemosa stem extract contributed significantly to its anti-cracking and healing effects. The study aimed to bridge the gaps in commercially available chemical-based foot creams by developing a safe, natural alternative with proven therapeutic benefits. Additionally, Formulation exhibited the highest activity, particularly in moisturization and healing, with no adverse effects observed or reported. Overall, the herbal foot cream proved to be effective solution for foot care, offering a combination of nourishment, protection, and healing.

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