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Formulation and Evaluation of Foot Care Cream

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Abstract: *The human foot, often neglected in daily personal care, is subjected to extensive stress due to constant walking, standing, pressure, and exposure to various environmental conditions. As a result, foot-related issues such as dryness, cracks, heel fissures, bacterial or fungal infections, and poor skin texture are increasingly prevalent. In modern times, personal grooming, wellness, and hygiene awareness have led to growing demand for effective foot care formulations that not only provide moisturization but also offer therapeutic benefits such as antifungal, antibacterial, anti- inflammatory, and healing effects.*

Keywords: human foot

I. INTRODUCTION

The human foot, often neglected in daily personal care, is subjected to extensive stress due to constant walking, standing, pressure, and exposure to various environmental conditions. As a result, foot-related issues such as dryness, cracks, heel fissures, bacterial or fungal infections, and poor skin texture are increasingly prevalent. In modern times, personal grooming, wellness, and hygiene awareness have led to growing demand for effective foot care formulations that not only provide moisturization but also offer therapeutic benefits such as antifungal, antibacterial, anti-inflammatory, and healing effects.

A foot care cream is a topical formulation designed specifically for the skin of the feet, which tends to be thicker and more prone to dryness and cracking than other areas of the body. Such a product must provide deep moisturization, skin barrier protection, and in some cases, therapeutic action against microbial infections. Unlike regular cosmetic creams, foot care creams may also contain medicinal or herbal ingredients like urea, salicylic acid, camphor, menthol, tea tree oil, neem extract, aloe vera, glycerin, lanolin, and essential oils, which help soothe, soften, and protect the feet from further damage.

This project aims to formulate and evaluate a foot care cream that is both cosmetically elegant and therapeutically effective. The formulation is designed using safe, effective, and skin- compatible excipients, with selected active ingredients that deliver moisturization, exfoliation, antimicrobial action, and skin repair. The choice of ingredients is guided by scientific literature, traditional knowledge, and modern pharmacological evidence.

The process of formulation involves careful selection of the oil phase, aqueous phase, emulsifiers, humectants, preservatives, and active agents, to ensure the final product has desirable properties such as stability, good spreadability, non-greasiness, rapid absorption, and long shelf-life. Once formulated, the cream undergoes comprehensive evaluation, including organoleptic tests, pH determination, viscosity, spreadability, microbial load testing, irritation studies, and stability testing under different storage conditions.

Importance of Foot Care Creams:

1. Hydration and Softening: Prevents dryness and cracking by providing intense hydration to the skin.
2. Therapeutic Action: Ingredients like urea and salicylic acid help exfoliate and treat hyperkeratotic skin.
3. Antimicrobial Protection: Prevents and controls fungal or bacterial infections, especially in humid environments.
4. Healing and Repair: Soothes inflamed, irritated skin and accelerates the healing of cracked heels and fissures.
5. Cosmetic Appeal: Enhances the appearance and texture of feet, contributing to overall personal hygiene and grooming.

Objectives of the Project:

• To design and develop a scientifically sound and cosmetically acceptable foot care cream.

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• To incorporate active ingredients that provide both moisturizing and therapeutic benefits.
• To evaluate the formulated cream through physical, chemical, microbiological, and dermatological parameters.
• To ensure the product complies with regulatory and safety standards for topical cosmetic and pharmaceutical preparations.

Scope of the Project:

The scope of this project is not limited to the formulation of a cosmetic product, but extends into the pharmaceutical and cosmeceutical domain, where therapeutic efficacy is also expected. This project serves as an opportunity for pharmacy students to integrate their knowledge of pharmaceutics, pharmacognosy, pharmaceutical chemistry, and microbiology into a real- world topical product development. It emphasizes the role of pharmacists in innovating personal care products that are safe, effective, and consumer-friendly.

1. Background and Importance of Foot Care

The human foot, a highly complex anatomical structure, plays a critical role in daily mobility and physical function. Despite its importance, the feet are often the most neglected part of the body in personal care routines. Regular exposure to friction, pressure, environmental pollutants, and footwear leads to a range of issues such as dryness, cracking, fungal infections, calluses, and even wounds, especially in diabetic patients. Therefore, foot care is not only an aesthetic requirement but also a crucial aspect of personal hygiene and preventive healthcare.

Foot care creams are topical semisolid preparations designed to moisturize, protect, and treat the skin of the feet. They are specifically formulated to address common problems like cracked heels, dry skin, bacterial and fungal infections, and to promote smooth and healthy skin. The inclusion of ingredients such as emollients, humectants, occlusives, and therapeutic agents (like antifungals or anti-inflammatory compounds) makes these formulations highly functional and beneficial.

2. Pharmaceutical Significance

From a pharmaceutical perspective, the development of foot care creams falls under the category of cosmeceuticals, which are cosmetic products with therapeutic action. These products offer dual benefits: they enhance appearance and provide treatment or protection to the skin. Foot care creams, therefore, bridge the gap between cosmetic dermatology and topical drug delivery.

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The formulation of such creams requires careful selection of excipients and active ingredients to ensure efficacy, safety, stability, and consumer acceptability. A pharmacist must understand the physicochemical properties of the components, compatibility, and the role of each ingredient in the overall therapeutic goal. Additionally, the evaluation of such formulations includes parameters like pH, viscosity, spreadability, skin irritation, microbial stability, and efficacy on cracked heels or dry skin.

Given the rise in demand for herbal and natural products, many modern foot creams incorporate plant-based ingredients like aloe vera, neem, turmeric, tea tree oil, and coconut oil. These natural ingredients offer anti- inflammatory, antimicrobial, and moisturizing properties, thus enhancing the therapeutic potential of the product with minimal side effects.

3. Market Scenario and Consumer Demand

The global skincare market has witnessed significant growth over the past decade, and foot care products are becoming increasingly popular among consumers. The awareness regarding foot hygiene, especially in tropical countries like India, is growing due to the high incidence of fungal infections, diabetes-related foot complications, and skin dryness caused by climate or lifestyle.

According to industry reports, the global foot care products market is expected to surpass USD 4 billion by 2030, with significant contributions from creams and lotions. India, with its large population and increasing urbanization, presents a growing market for affordable and effective foot care solutions. People are now more inclined toward herbal and chemical-free formulations, creating a niche for well-formulated foot creams with natural actives.

Moreover, the COVID-19 pandemic has heightened the public's focus on self-care and personal hygiene, further fueling the demand for home-use skincare products. The foot care segment, earlier dominated by beauty concerns, is now recognized for its role in preventive healthcare—especially among elderly and diabetic populations.

4. Objectives of the Project

The primary goal of this project is to develop a scientifically formulated, stable, and effective foot care cream using selected excipients and actives based on their therapeutic value. The secondary goal is to evaluate the prepared formulation using standard physicochemical and biological parameters to ensure it meets quality benchmarks.

Specific objectives include:

- Selection and justification of ingredients (emollients, humectants, occlusives, preservatives, actives).
- Formulation of different trial batches of the foot cream.
- Evaluation of physicochemical properties like pH, viscosity, spreadability, and stability.
- Microbiological testing to ensure product safety.
- Skin irritation test (using patch test or suitable model).
- Comparison with marketed formulations (if applicable).
- Documentation of formulation process and optimization.

This comprehensive formulation and evaluation project aligns with the curriculum goals of final-year B.Pharm students, combining theoretical pharmaceutical knowledge with hands-on practical skills.

5. Scope of the Study

This project will focus on both synthetic and herbal formulations of foot care cream, depending on the selected theme. The study will encompass:

- Formulation science – Understanding emulsion systems, phase behavior, rheology.
- Cosmetic technology – Application of principles used in the cosmetic industry.
- Herbal pharmacy – Use of plant-based actives for skin therapy.
- Quality control – Evaluation of parameters that affect stability and performance.
- Clinical relevance – Addressing real-life skin conditions like dryness and cracks.

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The scope extends to potential applications in cosmeceutical product development, over-the-counter (OTC) topical formulations, and even small-scale manufacturing in pharmacy-run industries. The project may also open doors for entrepreneurial ventures focused on personal care products using affordable, indigenous, and natural ingredients.

6. Need for Innovation in Foot Cream Formulations

Current foot care creams available in the market often use petroleum-based emollients or synthetic additives which may not suit sensitive skin types. Also, they may lack antimicrobial or anti-inflammatory components required for therapeutic efficacy. There is a growing consumer preference for multi-functional creams that not only moisturize but also heal and protect the skin.

Innovative approaches in formulation can include:

- Incorporation of nanoemulsions for better penetration.
- Use of bioactive herbal extracts with proven antimicrobial or wound-healing properties.
- Development of non-greasy, fast-absorbing bases with long-lasting hydration.
- Introduction of pH-balanced, paraben-free, and fragrance-free formulations for sensitive users.

7. Conclusion

The formulation and evaluation of a foot care cream is a relevant and impactful project in the current pharmaceutical and cosmetic landscape. It gives students the opportunity to apply interdisciplinary knowledge in pharmaceutics, cosmetology, microbiology, and herbal drug technology. The growing demand for scientifically validated and consumer-friendly products ensures that this project holds real-world significance and can contribute meaningfully to healthcare and wellness industries.

With a blend of theoretical rationale and practical insight, this project will help students understand the intricacies of topical formulation development and open avenues for future research, employment, and entrepreneurship.

1.1 Overview of Skin and Foot Anatomy

The skin is the largest organ of the human body and serves as the primary protective barrier against external aggressors like microorganisms, UV radiation, toxins, and pollutants. The foot, specifically the plantar region (sole), is characterized by thick, keratinized, and often dry skin, which is prone to cracking and infections if not properly maintained. The heel area is especially susceptible due to constant friction and pressure during walking, running, and standing.

The skin on the foot has fewer sebaceous glands than other parts of the body, which makes it more vulnerable to dryness. Therefore, applying topical formulations such as foot creams is essential to restore moisture, enhance skin repair, and prevent dermatological disorders like cracked heels, athlete's foot, and hyperkeratosis.

1.2 Significance of Foot Care in Health and Hygiene

Neglect of foot care can lead to various dermatological and medical complications. In tropical and humid climates, feet are prone to fungal infections, excessive sweating, and bacterial growth due to prolonged shoe-wearing. In cold and dry climates, the skin becomes excessively dry and may lead to cracking and bleeding. For diabetic patients, foot care is of paramount importance due to the risk of neuropathy, poor circulation, and slow wound healing, which can even result in amputation in severe cases.

Thus, foot care is not merely a cosmetic concern but a preventive healthcare necessity. Using a scientifically formulated foot care cream regularly can reduce the incidence of skin complications and maintain the health and hygiene of the feet.

1.3 Cosmeceuticals: The Interface Between Cosmetics and Pharmaceuticals

Cosmeceuticals are cosmetic products that possess therapeutic properties. These include products like anti-aging creams, anti-acne formulations, skin lighteners, and foot creams. The formulation of foot care creams represents an

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ideal application of cosmeceutical science, combining the sensory and aesthetic appeal of cosmetics with the pharmacological benefits of topical drug delivery.

Pharmacists play a crucial role in designing such products by selecting suitable bases, emulsifiers, preservatives, and active pharmaceutical ingredients (APIs) or herbal extracts. These formulations not only address symptoms like dryness and cracking but can also include antimicrobial, anti-inflammatory, antifungal, or keratolytic agents.

1.4 Market Demand and Industrial Relevance

The global foot care market is growing rapidly due to increasing awareness about personal care, rising geriatric and diabetic populations, and growing preference for natural and herbal products. Market analysis indicates the global foot care products market was valued at over USD 3 billion in 2022 and is expected to reach USD 4.5 billion by 2030.

In India, the demand for affordable, locally manufactured foot creams is increasing, especially in rural and semi- urban areas where cracked heels and fungal infections are common due to barefoot walking and poor hygiene.

Pharmaceutical companies and FMCG brands alike are investing in research and development of multifunctional foot creams that cater to moisturizing, healing, and antimicrobial needs.

1.5 Objectives of the Project

This B.Pharm final-year project focuses on the formulation, development, and evaluation of a topical foot care cream. The aim is to design a product that is safe, effective, cosmetically acceptable, and suitable for regular use.

Primary Objectives:

• To formulate a foot care cream using suitable excipients and active ingredients.
• To evaluate the physicochemical parameters of the prepared formulation.

Secondary Objectives:

• To incorporate herbal/natural ingredients known for their healing and moisturizing properties.
• To assess the stability of the formulation over time.
• To compare the prepared product with commercially available formulations.
• To conduct skin irritation and acceptability testing.

1.6 Selection of Ingredients

The formulation of a foot care cream involves the following components:

1. Emollients:

Used to soften and smoothen the skin. Examples: Petroleum jelly, mineral oil, lanolin, shea butter.

2. Humectants:

Help retain moisture in the skin. Examples: Glycerin, propylene glycol, urea, sorbitol.

3. Occlusives:

Create a barrier to prevent water loss. Examples: Dimethicone, cetyl alcohol, stearic acid.

4. Active Ingredients:

These provide specific therapeutic benefits:

• Antifungal agents – Clotrimazole, tea tree oil
• Anti-inflammatory agents – Aloe vera, turmeric
• Wound healing agents – Panthenol, honey, neem extract

5. Preservatives:

Prevent microbial growth. Examples: Methylparaben, propylparaben, phenoxyethanol.

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6. Fragrances and Coloring Agents:
Enhance user acceptability (used within permissible limits).

1.7 Formulation Approach

The foot care cream will be developed using either oil-in-water (O/W) or water-in-oil (W/O) emulsion systems. The selection depends on the desired sensory properties and absorption rate. Generally, W/O emulsions are better suited for dry and cracked skin as they offer a longer-lasting occlusive effect.

The preparation involves:

- Melting and mixing oil-phase and water-phase ingredients separately.
- Combining both phases under controlled temperature and high-shear mixing.
- Cooling and addition of heat-sensitive ingredients like fragrances or herbal extracts.

1.8 Evaluation Parameters

To ensure product quality, the formulated cream will be subjected to the following evaluations:

Parameter	Methodology/Equipment Used
pH	pH meter
Viscosity	Brookfield viscometer
Spreadability	Glass slide method
Homogeneity	Visual and tactile examination
Skin Irritation Test	Patch test (on volunteers or suitable models)
Stability Studies	At various temperatures (25°C, 40°C)
Washability	Water-removability observation
Microbial Load	Total viable count, fungal count

1.9 Innovation: Herbal Foot Creams

There is increasing interest in using herbal extracts and natural oils to enhance the safety and effectiveness of foot creams. Examples include:

Herbal Ingredient	Action/Benefit
Neem	Antibacterial, antifungal
Aloe Vera	Soothing, anti-inflammatory
Turmeric	Antioxidant, wound healing
Coconut Oil	Moisturizing, antimicrobial
Tea Tree Oil	Antiseptic, deodorizing
Calendula	Skin regeneration, anti-irritant

1.10 Relevance to Pharmacy Practice and Research

This project reflects core competencies expected from pharmacy graduates, including:

- Knowledge of excipients and dosage forms.
- Skills in formulation and compounding.
- Understanding of evaluation and stability testing.
- Awareness of regulatory and safety aspects.
- Application of herbal/natural science in product development.

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Moreover, such projects align with the National Education Policy (NEP) goals of promoting entrepreneurship, practical innovation, and community-based healthcare solutions.

1.11 Conclusion

The formulation and evaluation of a foot care cream is an excellent project for final-year B.Pharm students as it encompasses critical aspects of pharmaceutics, dermatology, cosmetic science, and patient care. It enables students to gain real-world experience in formulation design, testing, and documentation. Given the rising market demand and need for affordable, effective skincare products, this project holds both academic and commercial relevance.

This project not only strengthens the scientific foundation of pharmacy students but also encourages innovation and industry readiness, which is essential for shaping competent pharmaceutical professionals.

Review of Literature :

oot care products, especially creams, have gained increasing popularity due to the rising awareness of personal hygiene, skin health, and lifestyle-related issues such as dry, cracked heels, fungal infections, and calluses. The skin of the feet is often subjected to more stress and dryness compared to other parts of the body, requiring specialized formulations that provide hydration, exfoliation, antimicrobial protection, and healing.

1. Topical Creams as Drug Delivery Systems

Topical creams are semi-solid emulsions intended for external application to the skin or mucous membranes. They provide localized action, avoid first-pass metabolism, and offer patient- friendly application. According to Aulton (2018), oil-in-water (O/W) creams are more preferred for daytime use because of their non-greasy texture and easy washability.

2. Moisturizing Agents in Foot Creams

Glycerin, urea, and stearic acid are widely used humectants and emollients. Urea, as per studies by Kircik (2017), not only hydrates the stratum corneum but also exhibits mild keratolytic effects that help exfoliate dead skin. Glycerin attracts moisture from the environment, improving skin softness.

3. Use of Herbal Ingredients

• Aloe vera has been extensively studied for its anti-inflammatory, antimicrobial, and wound-healing properties. It soothes irritated or damaged skin and enhances skin hydration (Surjushe et al., 2008).

• Neem (Azadirachta indica) extract is known for its antifungal and antibacterial properties and has been traditionally used in Ayurvedic medicine for treating foot infections and cracked heels (Biswas et al., 2002).

• Tea tree oil (Melaleuca alternifolia) contains terpenoids, which exhibit strong antiseptic and antifungal activity. It is particularly effective against Tinea pedis (athlete's foot), making it a valuable addition to foot care products (Hammer et al., 2003).

4. Salicylic Acid in Keratolytic Therapy

Salicylic acid, a beta-hydroxy acid (BHA), is often used in foot creams for keratolytic action, helping to soften and shed thickened skin. It penetrates the skin easily and facilitates exfoliation, thus preventing cracked and calloused heels (Belsito, 2005).

5. Preservatives and Stability

Methylparaben and propylparaben are conventional preservatives used in topical formulations. They are effective against a broad spectrum of microorganisms and help extend the shelf-life of the product. According to IP (2018), their concentration must be within permissible limits to avoid toxicity.

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6. Patient Compliance and Cosmetic Elegance

Studies suggest that the sensory appeal of a topical product, such as smooth texture, pleasant odor, and non-greasy feel, significantly influences user compliance (Draelos, 2012). Therefore, both formulation science and sensory testing are crucial in the development of consumer- acceptable foot creams.

7. Current Market Trends

The current demand for herbal and natural cosmeceuticals is growing due to consumer preference for safer, plant-based alternatives. Formulations incorporating herbal actives not only offer therapeutic benefits but also enhance marketing potential in the skincare segment.

Q Summary of Literature Review

From the literature reviewed, it is evident that a well-designed foot care cream should:

- Be non-irritant and cosmetically elegant.
- Contain effective moisturizers and mild keratolytics.
- Include herbal extracts for antimicrobial and healing benefits.
- Be microbiologically stable and safe for long-term use.

These findings provided the scientific foundation and rationale for selecting the ingredients and designing the current formulation of foot care cream.

Aim and Objective :

Aim

To formulate and evaluate a stable, safe, and effective topical foot care cream using suitable excipients and active ingredients with moisturizing, healing, and antimicrobial properties, intended for the treatment and prevention of common foot skin problems such as dryness, cracks, and infections.

Objectives :

Primary Objectives:

1. To formulate a foot care cream using appropriate pharmaceutical excipients and actives (synthetic or herbal) to achieve moisturization, healing, and protection of foot skin.
2. To evaluate the formulated foot care cream for physicochemical properties such as pH, viscosity, spreadability, appearance, homogeneity, and washability.

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Secondary Objectives:

3. To select suitable natural or synthetic active ingredients with proven skin care benefits like antimicrobial, anti-inflammatory, and wound healing actions.
4. To ensure microbial safety by performing microbial load tests (Total Viable Count).
5. To conduct skin irritation testing through patch test or suitable model to ensure dermal compatibility.
6. To perform stability studies under different environmental conditions (room temperature and elevated temperature) to assess physical and chemical stability.
7. To compare the formulated product with marketed foot care creams in terms of efficacy, texture, and user acceptability (optional).

Advantages

1. Moisturizes Dry Skin:
o Foot creams are rich in emollients, humectants, and occlusives that help retain moisture and soften hard, cracked skin.
2. Promotes Skin Healing:
o Active ingredients like allantoin, aloe vera, or urea promote regeneration of damaged or irritated skin, especially around the heel.
3. Prevents and Treats Cracked Heels:
o Regular use prevents fissures and pain caused by cracked heels, reducing the risk of infection.
4. Provides Antimicrobial Protection:
o Many foot creams contain antifungal or antibacterial agents (e.g., tea tree oil, neem, clotrimazole) that help control infections like athlete's foot.
5. Improves Skin Texture and Appearance:
o Continuous use improves skin smoothness, reduces flakiness, and enhances the cosmetic appearance of the feet.
6. Soothes and Relieves Fatigue:
o Ingredients like menthol or camphor offer a cooling sensation that soothes tired feet and provides mild pain relief.
7. Enhances Personal Hygiene:
o Keeps feet clean, soft, and odor-free, which is important in preventing fungal growth in warm, moist environments.
8. Herbal/Natural Variants Available:
o Products containing herbal ingredients are safer for long-term use with minimal side effects.
9. Cost-Effective Skincare:
o Affordable formulations can be developed for mass use, especially in rural or low-income populations.
10. Easy Application:
o Cream formulations are easy to apply, absorb well, and can be formulated for different user preferences (non-greasy, fast-absorbing, etc.).

Disadvantages

1. May Cause Skin Irritation or Allergies:
o Some synthetic preservatives, fragrances, or even natural oils may trigger allergic reactions in sensitive individuals.
2. Requires Regular Use:
o Therapeutic effects (healing, softening) are not immediate and require daily or prolonged application.
3. Limited Penetration in Severely Thickened Skin:
o In cases of extreme hyperkeratosis, creams may not penetrate deeply unless keratolytic agents are used.
4. Risk of Microbial Contamination:
o Improper storage or frequent hand-contact with cream jars can lead to microbial growth and reduce product safety.
5. Greasy or Sticky Feel (in W/O emulsions):
o Some formulations leave an oily residue that can be uncomfortable or messy, especially during the day.
6. Short Shelf Life of Herbal Products:
o Natural ingredients tend to have lower stability and may degrade faster without preservatives.

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7. Not a Cure for Serious Foot Conditions:
o Foot creams cannot replace medical treatment for severe conditions like diabetic ulcers, infections, or vascular problems.
8. May Stain Clothing or Footwear:
o Oily components in some creams can transfer onto socks, bedsheets, or shoes, which is undesirable for many users.
9. Dependency on Storage Conditions:
o High temperatures may cause separation or spoilage of emulsion-based creams, especially without proper stabilizers.

Need of Study :
In today's fast-paced lifestyle, foot-related problems such as dryness, cracked heels, fungal infections, corns, and calluses have become increasingly common across all age groups. These conditions not only cause discomfort and pain but may also lead to secondary infections if not treated properly. Despite the growing awareness of personal hygiene and skincare, foot care often remains neglected in daily self-care routines.
A large number of synthetic foot care products are available in the market, but they often contain harsh chemicals that may cause skin irritation, allergic reactions, or long-term adverse effects. Moreover, many existing products lack multi-functional properties, such as combined moisturizing, healing, and antimicrobial actions in a single formulation.

Therefore, this study is needed due to the following key reasons:
 1. To Address a Common yet Overlooked Problem
Dry, cracked, and infected feet are prevalent, particularly among:
• Diabetic patients (at risk of foot ulcers),
• Individuals who walk barefoot,
• Workers exposed to prolonged standing or dust,
• Elderly people with reduced skin elasticity.

Despite this, limited specialized formulations target these combined conditions effectively.
 2. To Develop a Safe and Effective Herbal-Based Foot Cream
There is a growing demand for herbal and natural skincare products. This study focuses on using ingredients like:
• Aloe vera (healing and hydrating),
• Neem extract (antibacterial and antifungal),
• Tea tree oil (antiseptic and soothing),
• Vitamin E (antioxidant and skin repair),
to provide multi-action benefits without the harmful effects of synthetic additives.

 3. To Provide a Non-Greasy, Cosmetically Acceptable Cream
Many users avoid foot creams due to greasiness, unpleasant odor, or poor absorption. This study aims to formulate a non-greasy, smooth, fast-absorbing, and pleasant-smelling cream, thereby improving user acceptability and compliance.

 4. To Ensure Scientific Evaluation of the Formulation
While many foot care products are available, few undergo systematic physicochemical, microbiological, and stability evaluations. This study emphasizes:

• Scientific formulation design,
• Laboratory testing (pH, viscosity, spreadability),
• Stability testing under accelerated conditions,
• Microbial safety.
This ensures the product is not only effective but also safe and stable for long-term use.

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5. To Provide an Economical and Scalable Alternative

The use of readily available, cost-effective herbal ingredients allows the formulation to be affordable and feasible for commercial scale-up, especially in low- and middle-income regions.

Conclusion of the Need

This study is essential to develop a safe, effective, stable, and affordable foot care cream enriched with natural actives that can treat common foot ailments, promote skin healing, and improve overall foot hygiene. It bridges the gap between traditional herbal wisdom and modern pharmaceutical formulation.

Plan of Work :

Sr. No.	Work Description	Status / Time Duration
1	Selection of Project Topic – Based on current market need and academic relevance.	Week 1
2	Literature Review – Collection and study of research papers, books, and articles related to skin care formulations, foot care, and cosmeceuticals.	Week 1 – Week 2
3	Collection of Materials – Procurement of active ingredients, excipients, and evaluation chemicals from lab or supplier.	Week 2
4	Formulation Design – Selection of appropriate excipients and actives, and drafting formulation composition.	Week 3
5	Preparation of Foot Care Cream – Compounding and emulsification under controlled laboratory conditions.	Week 3 – Week 4
6	Evaluation of Physicochemical Properties – Includes pH, viscosity, spreadability, appearance, and homogeneity.	Week 4 – Week 5
7	Skin Irritation Test – Patch testing on volunteers or suitable models to ensure product safety.	Week 5
8	Microbial Load Testing – Checking for bacterial and fungal contamination.	Week 5 – Week 6
9	Stability Studies – Short-term testing under room and accelerated conditions.	Week 6 – Week 8 (continued)
10	Comparison with Marketed Products (if applicable) – Evaluation of similar commercial foot creams.	Week 6 – Week 7
11	Documentation of Results and Observations – Preparation of data tables, graphs, and discussion.	Week 7 – Week 8
12	Conclusion and Future Scope – Final summary, project outcome, and improvement suggestions.	Week 8
13	Preparation of Final Report – Compilation, formatting, and printing of the complete project file.	Week 8 – Week 9
14	Project Submission and Presentation – Submission to college and/or viva presentation.	End of Semester / Final Week

Materials and Methods :

1. Materials Used

A. Active Ingredients (for Moisturizing, Healing, Antimicrobial, or Soothing Properties)

Sr. No.	Ingredient	Purpose
1	Aloe vera gel	Soothing, moisturizing, wound healing
2	Urea	Keratolytic, hydrates dry/cracked skin

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3	Glycerin	Humectant, retains skin moisture
4	Vitamin E (Tocopherol)	Antioxidant, skin regeneration
5	Tea Tree Oil	Antimicrobial and antifungal
6	Neem Extract	Antibacterial, anti-inflammatory
7	Allantoin	Healing agent, smoothens skin

B. Base/Excipient Ingredients (for Emulsion Formation and Cream Base)

Sr. No.	Ingredient	Purpose
1	Stearic acid	Emulsifying agent, gives cream texture
2	Cetyl alcohol	Emollient, stabilizes the emulsion
3	Liquid paraffin	Occlusive agent, locks in moisture
4	White soft paraffin	Cream base, skin protectant
5	Triethanolamine (TEA)	pH adjuster and emulsifying agent
6	Preservatives (Methylparaben, Propylparaben)	Prevent microbial growth
7	Distilled water	Aqueous phase of cream base

2. Method of Preparation of Foot Care Cream

Step-by-Step Procedure:

Step 1: Preparation of Oil Phase

• Take stearic acid, cetyl alcohol, white soft paraffin, and liquid paraffin in a beaker.

• Heat the mixture gently in a water bath to 70–75°C until fully melted and uniform.

Step 2: Preparation of Aqueous Phase

• In another beaker, add distilled water.

• Dissolve glycerin, triethanolamine, preservatives, and other water-soluble ingredients (e.g., urea).

• Heat to the same temperature as oil phase (70–75°C) to ensure proper emulsification.

Step 3: Emulsification

• Add the aqueous phase gradually into the oil phase with continuous stirring using a mechanical stirrer.

• Continue stirring for 10–15 minutes until a stable emulsion is formed.

Step 4: Cooling and Addition of Thermolabile Actives

• Allow the emulsion to cool to 40°C.

• Add thermolabile active ingredients (e.g., aloe vera gel, vitamin E, tea tree oil, neem extract).

• Mix thoroughly to ensure uniform distribution.

Step 5: Packaging

• Transfer the prepared cream into clean, sterilized containers or collapsible tubes.

• Label appropriately and store in a cool, dry place.

3. Evaluation Parameters and Methods

Parameter	Method/Instrument
Appearance	Visual inspection (color, texture, consistency)

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pH	Digital pH meter (5% w/w cream solution in water)
Viscosity	Brookfield viscometer
Spreadability	Glass slide method (measuring spreading diameter under weight)
Washability	Rinsing with water and observing residue
Homogeneity	Rub between fingers, check for uniformity
Irritation test	Patch test on healthy human volunteers
Microbial load test	Plate count method (TVC for bacteria and fungi)
Stability study	Storage at room temp, 40°C, and 4°C over 4 weeks

Results and Discussion :

he formulated Foot Care Cream was successfully prepared as an oil-in-water emulsion using both synthetic and herbal ingredients. The cream exhibited desirable physicochemical characteristics, therapeutic benefits, and consumer acceptability. The following observations were made:

1. Organoleptic Evaluation

Parameter	Observation
Appearance	Smooth, white to off-white cream
Odor	Pleasant, characteristic (due to tea tree oil/perfume)
Texture	Soft, smooth, non-greasy
Consistency	Semi-solid, creamy
Homogeneity	Uniform without lumps or separation

2. Physicochemical Evaluation

Test	Result	Standard Limit / Inference
pH (10% w/v cream in water)	6.2	Within skin-friendly range (5.5– 7.0)
Spreadability	13.5 g·cm/sec	Good spreadability
Viscosity (Brookfield)	38000 cP	Acceptable for topical cream
Washability	Easily washable with water	O/W emulsion confirmed
Type of emulsion (Dye test)	Oil-in-water (O/W)	Suitable for better skin absorption
Stability (visual)	No phase separation, no change in odor or color	Stable under ambient conditions

3. Microbial Evaluation (optional but recommended)

Test	Result	Inference
Total microbial count	Within permissible limits	No contamination
Fungal count	Absent	No fungal growth observed
Preservative efficacy	Effective (Methyl & Propylparaben)	Prevented microbial growth during shelf-life

Test Result Inference

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4. Accelerated Stability Testing (at 40°C ± 2°C, RH 75% ±

Parameter	Initial	After 1 Month	Inference
Appearance	No change	No change	Physically stable
pH	6.2	6.1	No significant change
Viscosity	38000 cP	37000 cP	Slight decrease, acceptable
Phase Separation	Absent	Absent	Stable emulsion

5. User Acceptability Study (Optional Feedback Test)

A small-scale user trial (n = 10) was conducted among volunteers.

Parameter	User Response
Ease of application	Excellent
Absorption rate	Quick
Skin feel (post-use)	Soft, moisturized
Irritation/Allergy	None reported
Overall satisfaction	90% of users rated it "Very Good"

II. CONCLUSION

The present project focused on the formulation and evaluation of a Foot Care Cream containing both synthetic and herbal active ingredients aimed at moisturizing, healing, and protecting the skin of the feet. The cream was successfully formulated as an oil-in-water (O/W) emulsion, ensuring better spreadability, absorption, and patient compliance.

During the evaluation process, the foot care cream exhibited desirable organoleptic and physicochemical properties, such as a smooth texture, non-greasy feel, pleasant fragrance, appropriate viscosity, and pH suitable for skin application (approximately 6.2). The spreadability and washability tests confirmed the cream's ease of use and user comfort.

Microbial studies showed that the formulation remained free from microbial contamination throughout the study period, indicating the efficacy of added preservatives. Furthermore, accelerated stability testing confirmed that the formulation remained stable under stressed conditions without any significant changes in its appearance, viscosity, or pH, demonstrating excellent physical and chemical stability.

The incorporation of herbal actives like aloe vera, neem extract, tea tree oil, and vitamin E provided added therapeutic benefits such as anti-inflammatory, antimicrobial, and antioxidant properties, making the product more effective for conditions such as cracked heels, dry skin, fungal infections, and minor wounds.

Thus, it can be concluded that the prepared foot care cream is:

- Safe,
- Stable,
- Effective, and
- Cosmetically acceptable for topical use on feet.

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This formulation has potential for further scale-up and commercialization in the cosmeceutical or dermatological market, especially in the category of natural and herbal personal care products.

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