

A REVIEW ON FOOT CARE BALM STICK**Anusree M. S.^{1*}, Shijina Shahul², Aardhra N. A.³, Smitharaj R. S.⁴**

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Article Received on 05 Sept. 2026,
Article Revised on 25 Sept. 2026,
Article Published on 01 Oct. 2026,
<https://doi.org/10.5281/zenodo.23118231>

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How to cite this Article: Anusree M. S.^{1*}, Shijina Shahul², Aardhra N. A.³, Smitharaj R. S.⁴ (2026). A Review On Foot Care Balm Stick. World Journal of Pharmaceutical Research, 15(19), 928-943.

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ABSTRACT

Foot care is essential for maintaining healthy skin because the feet are continuously exposed to friction, pressure, dryness and environmental conditions. Foot xerosis, roughness and cracked heels are common problems that may cause discomfort and compromise the protective skin barrier. Moisturizers containing humectants, emollients and occlusive agents are commonly used to improve skin hydration and reduce dryness. Herbal ingredients have attracted increasing interest in topical preparations because of their potential antioxidant, antimicrobial, anti-inflammatory and skin-conditioning properties. A balm stick provides a convenient and localized method of applying moisturizing and herbal ingredients to dry areas of the feet. This review discusses balm-stick formulation principles, herbal ingredients, preparation methods and evaluation parameters. It also highlights the need for further

standardized studies concerning stability, safety and efficacy of herbal foot-care balm sticks.

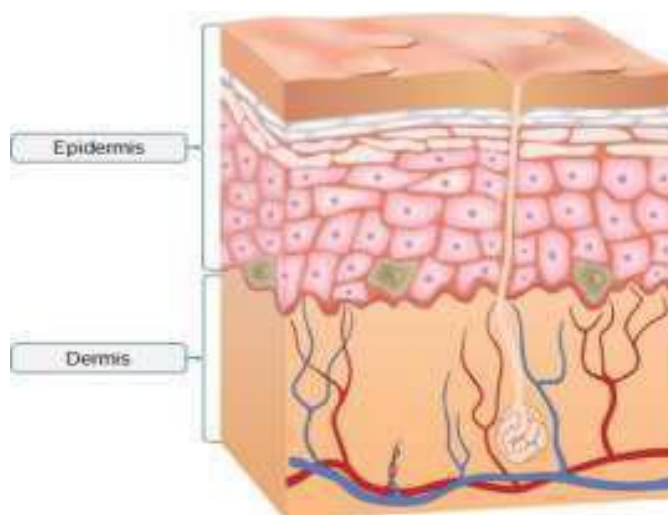
KEYWORDS: Foot care; Balm stick; Moisturizers.

INTRODUCTION

Cosmetics are defined as articles intended to be rubbed, poured, sprinkled or sprayed on, or introduced into, or otherwise applied to, the human body or any part thereof for cleansing, beautifying, promoting attractiveness or altering the appearance and includes any article intended for use as a component of cosmetic.^[4] The word 'cosmetic' is derived from a Greek

word - kosmestikos that means adornment and preparation. Cosmetics refer to all of the products used to care for and clean the human skin and make it more beautiful. The intentions of using cosmetic product is to maintain the body in a good condition, protect it from the effect of the environment and aging process, change the appearance and make the body smell nicer. Cosmetic products are widely used by every socio economic class of human beings to cleanse, perfume, protect and change the appearance of the skin.^[5] Herbal Cosmetics, referred as Products, are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are used to provide defined cosmetic benefits only, shall be called as “Herbal Cosmetics”.^[6]

FOOT SKIN



The skin of the foot is a highly specialized structure designed to support body weight and enable functions such as standing, walking and running. It is particularly thick on the plantar surface (sole) in order to resist continuous friction and pressure. The outermost layer of the foot, known as the epidermis, consists of tightly packed keratinized cells that act as a protective barrier against external damage, microorganisms and dehydration. The stratum corneum of the heel is the thickest in the entire human body and is responsible for providing mechanical strength. Beneath the epidermis lies the stratum lucidum, a layer found only in thick skin such as that of the feet and hands, which contributes to the smooth and tough structure of the sole. Unlike other areas of skin, the plantar region does not contain sebaceous glands or hair follicles, which is why dryness and cracking of heels are common. However, the area is rich in sweat glands that help maintain temperature regulation and moisture levels in the skin. Deeper to the epidermis is the dermis, which is composed of collagen and elastic fibers that give the skin strength, flexibility and durability. This layer contains blood vessels

that nourish the outer layers and assist in wound healing. It also houses numerous sensory receptors, making the foot highly sensitive to pressure, vibration and pain. These sensations help maintain balance and alert the body to potential injuries while walking. The deepest layer of the foot skin called the hypodermis or subcutaneous layer, contains thick fatty tissue that serves as a shock absorber. This padding is especially prominent in the heel region and helps protect underlying bones and joints from impact forces experienced during movement. Overall, the unique structure of foot skin ensures effective protection, cushioning and support to the body. However, because it is constantly exposed to stress and lacks natural oil secretion, it is prone to common conditions such as callus formation, fissures, blisters and fungal infections. Proper foot care, including hydration and hygiene is essential to maintain healthy skin and prevent discomfort or disease. The specialized anatomy of the foot skin highlights its vital role in mobility, stability and overall quality of life.^[7]

FOOT CARE

Foot care refers to practices that maintain the **cleanliness, hydration, protection and overall health of the feet**. Common foot problems include dryness, scaling, calluses, cracks and other skin abnormalities. Proper moisturization helps maintain the skin barrier and reduce foot xerosis.^[8] Regular foot care includes washing, drying, moisturizing, nail care, foot inspection and use of appropriate footwear.^[8]

TYPES OF FOOT CARE

1. **Hygienic foot care:** Washing and thoroughly drying the feet, particularly between the toes, to maintain cleanliness and prevent skin problems.^[4,5]
2. **Moisturizing foot care:** Application of moisturizers, emollients, creams or balms to reduce dryness and maintain skin hydration.^[7]
3. **Cracked-heel care:** Use of moisturizing preparations and protection from excessive pressure and friction to manage dry, cracked heels.^[6]
4. **Nail care:** Regular inspection and proper trimming of toenails to prevent nail-related injuries and complications.^[3]
5. **Protective foot care:** Use of properly fitting footwear and socks and avoidance of walking barefoot to reduce trauma and friction.^[4,7]
6. **Preventive foot care:** Regular inspection of the feet for cracks, wounds, redness, ulcers, calluses and other abnormalities so that problems can be identified early.^[3,5]

7. Diabetic foot care: Specialized foot care involving daily inspection, hygiene, moisturization, nail care and appropriate footwear to reduce the risk of diabetic foot complications.^[6]

PROBLEMS AFFECTING FOOT

The foot is susceptible to a variety of **dermatological, infectious, mechanical, vascular and metabolic disorders**. Common foot problems include dryness, fissures, calluses, corns, fungal infections, warts, nail disorders, ulcers and diabetic foot complications. These conditions may cause pain, itching, inflammation, impaired mobility and, in severe cases, secondary infection and tissue damage.

1. Dry skin (Xerosis)

Xerosis is characterized by dryness, scaling and reduced skin-barrier function. Severe dryness may result in skin fissures and erosions, particularly on the plantar surface.^[9]

2. Cracked heels (Heel fissures)

Excessive dryness and thickening of the heel skin can produce fissures. Deep fissures may become painful and can provide a portal for microbial infection.^[11]

3. Calluses and corns

Repeated friction and excessive plantar pressure can cause localized thickening of the skin. Callus formation is particularly important in diabetic patients because increased plantar pressure and callus can contribute to ulcer development.^[12]

4. Fungal infections

Tinea pedis (athlete's foot) and **onychomycosis (fungal nail infection)** are common fungal disorders affecting the feet. Tinea pedis may cause itching, scaling, maceration and fissuring and can occasionally be complicated by bacterial infection.^[14]

5. Plantar warts

Plantar warts are viral infections affecting the plantar surface of the foot and may cause discomfort, particularly during walking or weight bearing.^[12]

6. Bacterial Infections

Bacterial infections can occur when the protective skin barrier is damaged. Fungal infections and fissures may facilitate bacterial entry and can contribute to conditions such as cellulitis.^[11]

7. Diabetic foot ulcers

Diabetes may cause peripheral neuropathy, vascular impairment and altered wound healing. Together with pressure, callus formation and skin breakdown, these factors can contribute to diabetic foot ulceration and infection.^[10]

8. Nail disorders

Fungal nail infection and other nail abnormalities are common foot problems and may cause nail thickening, discoloration and structural changes.^[13]

DIFFERENT FORMULATIONS USED FOR FOOT CARE

1. Foot-care creams

Creams are among the commonly investigated topical formulations for foot care, particularly for **xerosis, roughness and fissuring**. They may contain humectants such as urea or ammonium lactate along with emollient and occlusive ingredients. A randomized clinical study compared a 25% urea cream with sorbolene for foot xerosis and reported improvement in the clinical signs of dryness with treatment.^[17] Urea-based creams therefore have been investigated as moisturizing preparations for maintaining hydration and improving dry foot skin.

2. Foot-care lotions

Lotions are relatively light topical preparations that can provide hydration without the heavier feel of ointments. **Ammonium lactate 12% lotion** has been clinically evaluated for mild-to-moderate foot xerosis. In a randomized double-blind study, 12% ammonium lactate lotion produced a reduction in the severity of foot xerosis after treatment.^[15] Lotions can therefore be incorporated into foot-care regimens where moisturization and ease of application are required.

3. Foot-care ointments

Ointments are semisolid, relatively occlusive preparations containing an oily or greasy base and are useful where prolonged contact with the skin is desired. A clinical trial evaluated an ointment containing **5% salicylic acid and 10% urea** for foot xerosis and compared it with 12% ammonium lactate lotion. Both treatments produced improvement in the severity of xerosis.^[15] Such preparations may be particularly useful when dryness is accompanied by **hyperkeratosis or thickened skin**.

4. Foot-care foams

Foam formulations have also been investigated for foot xerosis. A clinical study evaluated a **35% urea water-lipid-based foam containing lactic acid** in patients with mild-to-moderate foot xerosis. After four weeks, improvement was observed in redness, scaling and cracking, indicating that foam-based delivery can be used for moisturizing and softening dry foot skin.^[16]

5. Emulsion-based moisturizers

Oil-in-water and water-in-oil emulsions can combine **humectant, emollient and occlusive components** in a single topical preparation. A systematic review of moisturizers for foot xerosis identified several cream and emulsion-type preparations containing ingredients such as urea, glycerin, ammonium lactate and other moisturizing agents.^[1] Such formulations are useful for improving skin hydration and reducing the symptoms associated with xerotic foot skin.

6. Herbal foot-care formulations

Herbal formulations may contain plant extracts, fixed oils or essential oils intended to provide moisturizing, antioxidant or antimicrobial properties. Plant-based ingredients can be incorporated into creams, ointments, balms or solid preparations. Herbal approaches are particularly relevant to cosmetic foot-care products intended for **dryness, roughness and cracked heels**, although the clinical evidence varies according to the individual plant and formulation.^[1]

7. Foot-care balm

A balm is a semisolid preparation generally composed of **waxes, oils, butters and other lipophilic ingredients**. The combination of waxes and oils can produce a protective layer over the skin while providing emollient action. Balm formulations are therefore suitable for localized application to dry and rough areas such as the heels. The formulation can also accommodate herbal oils or extracts, making it relevant to herbal foot-care products.^[1]

8. Foot-care balm stick / solid stick

A **foot-care balm stick** is a solid topical formulation designed for direct and localized application to the foot. A recent formulation study developed a herbal foot-care stick containing *Cinnamomum verum* and *Juglans regia* using **beeswax, paraffin, castor oil and cetostearyl alcohol** as the principal base components. Five formulations were prepared and

evaluated for physical characteristics, pH, spreadability, melting point, antioxidant activity and antimicrobial activity.^[18] The study demonstrates the feasibility of using a solid stick dosage form for herbal foot care and provides a formulation approach relevant to products intended for dry and cracked foot skin.^[18]

9. Keratolytic foot-care preparations

Keratolytic formulations contain ingredients that help loosen and remove excessive accumulation of stratum corneum. **Urea and salicylic acid** are examples of ingredients investigated in foot-care preparations. A randomized clinical study evaluated 5% salicylic acid with 10% urea ointment against 12% ammonium lactate lotion in foot xerosis and found improvement in xerosis with both treatments.^[15] Such formulations may be useful when dryness is associated with **hyperkeratosis and rough skin**.

FOOT CARE STICK

A **foot-care stick** is a solid topical formulation designed for convenient, localized application to the skin of the feet, particularly areas affected by dryness, roughness and heel fissures. The stick formulation generally consists of a combination of **waxes, oils, fatty alcohols and active herbal ingredients**, which provide structural strength, emollient action and protective film formation. A recent study by Rahana et al. reported the formulation and evaluation of a herbal foot-care stick containing *Cinnamomum verum* and *Juglans regia*. Five formulations (F1–F5) were prepared using beeswax, paraffin, castor oil, cetostearyl alcohol and the herbal ingredients. The formulations were evaluated for physical appearance, pH, spreadability, melting point, antioxidant activity, antimicrobial activity and stability. The authors reported that the optimized formulation showed satisfactory physical characteristics, spreadability, antioxidant activity and antimicrobial activity against *Escherichia coli*.^[18] The solid-stick dosage form also offers practical advantages such as **direct and targeted application, reduced hand contact, portability and prolonged contact of the lipid/wax base with the skin**.^[18] The use of waxes and emollient oils can help form a protective layer over dry foot skin and reduce moisture loss. Therefore, the foot-care stick represents a convenient topical dosage form for incorporating herbal ingredients intended to support the care of **dry, rough and cracked heels**.^[18]



COMMON METHOD OF PREPARATION OF FOOT CARE STICK

The **hot-fusion method** is a commonly used method for preparing foot-care sticks. In this method, the waxy components are first accurately weighed and melted together on a water bath, followed by incorporation of the liquid oil phase with continuous stirring. In a published study on a herbal foot-care stick containing *Cinnamomum verum* and *Juglans regia*, beeswax and paraffin wax were melted at approximately **60–65°C** to obtain a homogeneous molten base. Castor oil was then incorporated gradually with gentle stirring. The herbal extracts were mixed separately, followed by addition of cetostearyl alcohol to facilitate dispersion, and this mixture was incorporated into the molten wax–oil base with continuous stirring. The preservative was subsequently added, and the resulting homogeneous mass was poured into suitable stick moulds at approximately **55–60°C** and allowed to cool and solidify at room temperature.^[18] Similar hot-melt procedures are used for other topical stick formulations, in which waxes and oils are melted, combined to obtain a homogeneous mass, followed by incorporation of the active ingredient and filling into moulds.^[19] Therefore, the hot-fusion method is suitable for the preparation of an **anhydrous herbal foot-care stick**, provided that heat-sensitive herbal ingredients are incorporated at an appropriately reduced temperature.^[18,19]

STEPWISE METHOD

1. **Weighing:** Accurately weigh all waxes, oils, consistency agents, herbal ingredients and other excipients.
2. **Melting of waxes:** Transfer beeswax and paraffin wax into a suitable vessel and melt on a water bath at about **60–65°C**.

3. **Addition of oils:** Add the required oil gradually to the molten wax with continuous gentle stirring.
4. **Preparation of active phase:** Mix the herbal extract/oil separately with the appropriate dispersing or consistency agent.
5. **Incorporation:** Add the active phase gradually to the molten wax–oil mixture with continuous stirring to obtain a uniform mass.
6. **Addition of heat-sensitive ingredients:** Allow the mass to cool moderately before incorporating heat-sensitive herbal constituents, antioxidants or fragrances.
7. **Moulding:** Pour the homogeneous molten formulation into clean, suitable stick containers or moulds at approximately 55–60°C.
8. **Cooling:** Allow the filled sticks to cool and solidify at room temperature.
9. **Evaluation:** The prepared sticks can be evaluated for appearance, homogeneity, spreadability, melting point, pH where applicable, stability and antioxidant/antimicrobial activity.^[18]

COMMONLY USED INGREDIENTS

MATERIALS	DESCRIPTION
1. NEEM 	NEEM – <i>Azadirachta indica</i> Family: Meliaceae. Constituents: Limonoids, triterpenoids, flavonoids and phenolic compounds. Uses: Neem is reported to possess antimicrobial, antifungal, anti-inflammatory and antioxidant activities. It is therefore used in herbal topical preparations intended for skin protection and management of foot-related microbial problems
2. CARROT 	CARROT – <i>Daucus carota</i> Family: Apiaceae. Constituents: β -carotene, α -carotene, phenolic compounds, polyacetylenes and ascorbic acid. Uses: Carrot is a source of antioxidant phytochemicals and can be incorporated into topical preparations intended to nourish and protect the skin.
3. COCONUT OIL	COCONUT OIL – <i>Cocos nucifera</i> Family: Arecaceae. Constituents: Lauric acid, caprylic acid, capric acid, myristic acid and other fatty

	acids. Uses: Coconut oil acts as an emollient and moisturizing ingredient. It helps nourish dry skin and is frequently incorporated into cracked-heel and foot-care preparations.
4. BEESWAX 	BEESWAX – Cera alba Source: Natural wax produced by honey bees. Constituents: Esters, hydrocarbons, fatty acids and other minor components. Uses: Beeswax acts as a thickening and consistency-enhancing agent. It also forms a protective layer on the skin and helps reduce moisture loss. It is particularly suitable for balm-stick formulations.
5. ALOE VERA 	ALOE VERA – Aloe barbadensis Family: Asphodelaceae. Constituents: Polysaccharides such as acemannan, vitamins, minerals, amino acids. Uses: Aloe vera is used topically for its moisturizing, soothing and wound-supporting properties and is commonly included in preparations for dry and irritated skin.
6. PETROLATUM 	PETROLATUM – Petrolatum Source: Semi-solid mixture of purified hydrocarbons derived from petroleum. Constituents: Predominantly saturated hydrocarbons. Uses: Petrolatum is an effective occlusive moisturizing agent that reduces transepidermal water loss and supports restoration of the skin barrier. It is commonly incorporated into preparations intended for dry, rough and cracked skin and can provide a protective layer over the heel. Its occlusive properties make it useful in foot-care balm formulations.

7. LANOLIN 	LANOLIN – Adeps lanae Source: Purified wax obtained from sheep's wool. Constituents: Complex mixture of sterol esters, fatty acid esters, alcohols and related lipid components. Uses: Lanolin functions primarily as an emollient and skin-conditioning material. A clinical trial specifically evaluated pure lanolin for moderate-to-severe foot xerosis, supporting its relevance to foot-care preparations. It can help soften and condition dry skin and may be incorporated into balm formulations.
8. VITAMIN E 	VITAMIN E - Tocopheryl acetate Source: Naturally occurring lipid-soluble vitamin and commonly used cosmetic antioxidant. Constituents: Tocopherols and/or tocotrienols depending on the material. Uses: Vitamin E is widely used in cosmetic and dermatological preparations as an antioxidant and skin-conditioning ingredient. It can also help protect oil-containing formulations against oxidative deterioration. Consequently, it may be incorporated into foot-care balm sticks containing vegetable oils.

EVALUATION OF A FOOT CARE BALM STICK

The prepared foot care balm stick should be evaluated to establish its physical uniformity, mechanical strength, application characteristics, safety, stability and intended foot-care performance. Since the formulation is a solid/semi-solid stick, evaluation parameters reported for foot-care gels and balm formulations can be appropriately modified for the stick dosage form.

1. Organoleptic evaluation

The formulated foot care balm stick should be examined visually for **colour, odour, appearance, texture and surface characteristics**. The product should have a uniform appearance without visible cracks, lumps, foreign particles or signs of phase separation.

2. Melting point / melting range

A small quantity of the balm should be placed in a suitable capillary tube and the melting behaviour determined using a melting-point apparatus. The temperature at which melting

begins and the temperature at which the material becomes completely liquid should be recorded.

The melting range can be reported as:

$$\text{Melting range} = T_{\text{complete melting}} - T_{\text{initial melting}}$$

3. Softening point

The softening point should be determined to establish the temperature at which the balm begins to lose its structural rigidity.

This test is useful for determining whether the formulation is likely to maintain its shape during normal storage and handling.

4. Breaking strength

Breaking strength can be used to determine the mechanical resistance of the balm stick.

The stick should be supported appropriately and an increasing force applied until the stick fractures. The force required for breakage should be recorded.

Purpose: This test determines whether the stick can withstand normal handling without breaking.

5. Spreadability / glide property

For a balm stick, conventional cream/gel spreadability testing can be modified to assess ease of application and glide.

The balm should be applied to a defined surface using a fixed number of strokes. The smoothness of movement, drag, uniformity of deposition and consistency of application should be observed.

The formulation should ideally exhibit:

- Smooth glide
- Minimal drag
- Uniform deposition
- Absence of grittiness
- No excessive stickiness.

6. Washability / removability

A suitable quantity of the formulation can be applied to the skin and its ease of removal can be evaluated using water or a mild cleansing method.

For a foot balm, complete removal is not necessarily the objective because the formulation may be designed to remain on the skin. Therefore, this parameter should be interpreted according to the intended formulation.

7. pH

For a completely anhydrous balm stick, direct pH measurement is generally not applicable because pH is an aqueous-phase property.

If your formulation contains an aqueous phase, an appropriate dispersion/extraction method may be developed and validated before measuring pH.

Therefore, do not include pH merely because it is commonly reported for creams and gels if your foot balm stick contains only oils, waxes and other non-aqueous ingredients.

8. Antimicrobial / antifungal activity

If your foot balm contains ingredients intended to provide antimicrobial or antifungal activity, the formulation can be evaluated using an appropriate validated in-vitro antimicrobial assay.

The organisms selected should correspond to the intended claim and laboratory protocol.

9. Stability study

The finished balm sticks should be stored under selected temperature and humidity conditions and periodically examined for changes in:

- Colour
- Odour
- Appearance
- Texture
- Homogeneity
- Cracking
- Softening/hardening
- Oil separation
- Melting behaviour
- Application characteristics.

10. Evaluation of cracked-heel improvement

If the balm is specifically intended for **dry or cracked heels**, its performance can be evaluated in an appropriately designed user/volunteer study following institutional ethical approval.

Possible parameters include:

- Degree of dryness
- Skin roughness
- Number/severity of fissures
- Heel appearance
- Skin softness
- Subjective discomfort
- Overall improvement.

Standardized photographs may also be used to document changes, provided appropriate consent and ethical procedures are followed.

CONCLUSION

Foot care is important for maintaining skin hydration, integrity, and overall comfort, particularly in conditions such as xerosis, roughness, and cracked heels. The balm-stick dosage form provides a convenient, portable, and localized method for delivering moisturizing ingredients to dry and rough areas of the feet. The literature reviewed indicates that suitable combinations of moisturizing agents and herbal ingredients may provide benefits in foot-care preparations. However, variations in formulation composition and evaluation methods indicate the need for standardized approaches. Further research is required to establish the stability, safety, quality, and efficacy of herbal foot-care balm sticks through appropriate physicochemical, microbiological, stability, and clinical evaluations. Overall, the balm-stick formulation represents a promising dosage form for the development of convenient foot-care products for managing dryness, roughness, and cracked heels.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to God Almighty for providing me with the strength and guidance to complete this review article entitled “A Review on Foot Care Balm.”

I sincerely thank the Principal and Management of my institution for providing the necessary facilities and support to carry out this work. I express my heartfelt gratitude to my Head of the Department for valuable guidance, encouragement, and support throughout the preparation of this review.

I am especially thankful to my guide and faculty members for their constant encouragement, constructive suggestions, and valuable assistance in completing this article. I also thank the library and laboratory staff for providing the required resources and facilities.

Finally, I extend my sincere thanks to my family, friends, and everyone who directly or indirectly supported me in the successful completion of this review article.

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