



International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Formulation of Herbal Lip Balm Using Beetroot (*Beta Vulgaris*)

Pranav Mongale^{*1}, Omkar Bhosale², V. Y. Rohile³, Dr. N. B Chougule⁴

Department of Pharmaceutical Analysis, Ashokrao Mane Institute of Pharmacy Ambap 416109

Address for correspondence

Pranav Sanjay Mongale,

At/Po: Hatkalangale, Tal: Hatkalangale, Dist: Kolhapur, Pin code: 416, India

E-mail: pranavmongale5@gmail.com

Ph No: 8830781333

ABSTRACT :

The present study focuses on the formulation and evaluation of a herbal lip balm using beetroot (*Beta vulgaris*) extract as a natural colorant and active ingredient for enhanced lip care. Lips are highly sensitive and prone to dryness, cracking, and environmental damage, which necessitates the use of safe and effective protective formulations. Herbal lip balms are preferred over synthetic products due to their natural origin, reduced side effects, and added therapeutic benefits.

In this study, lip balm formulations were prepared using natural ingredients such as beeswax, coconut oil, castor oil, almond oil, and beetroot extract. The formulations were developed by the fusion method and evaluated for various physicochemical parameters including color, texture, pH, melting point, spreadability, homogeneity, stability, and skin irritation.

The results indicated that all formulations were stable, smooth, and non-irritant, making them suitable for topical application. Beetroot extract successfully provided natural coloration along with antioxidant benefits, improving the overall quality of the product. Among the prepared batches, formulation F2 showed the most optimized characteristics in terms of appearance, consistency, and spreadability.

The study concludes that beetroot extract can be effectively used in herbal lip balm formulations as a natural alternative to synthetic colorants, offering safe, eco-friendly, and beneficial lip care.

Introduction:

1.1 The History of Ayurveda:

Origins and Early Development

Ayurveda, one of the world's oldest holistic healing systems, originated in India more than 5,000 years ago. Its roots can be traced back to the Vedic period, with the earliest references found in the Rig Veda, a sacred text composed around 1500 BCE. The term "Ayurveda" is derived from two Sanskrit words: "Ayur" meaning life, and "Veda," meaning knowledge or science, collectively translating to "the science of life".^[1] Classical Texts

The core principles of Ayurveda are detailed in several classical texts:

1. Charaka Samhita: Attributed to the sage Charaka, this comprehensive treatise on internal medicine covers various topics, including diagnosis, treatment, and principles of medical practice. It is considered one of the most authoritative texts on Ayurveda.^[2-3]
2. Sushruta Samhita: Credited to the sage Sushruta, this text focuses on surgery (Shalya Tantra). It describes numerous surgical procedures, instruments, and the importance of anatomy. Sushruta is often referred to as the "father of surgery" for his contributions to the field.^[4-5]
3. Ashtanga Hridaya: Written by Vagbhata, this text is a concise compilation that integrates the concepts from both Charaka Samhita and Sushruta Samhita, making it one of the most accessible and practical guides to Ayurveda.^[6]

Philosophical Foundations

Ayurveda is deeply intertwined with Indian philosophy, particularly the Sankhya school of thought, which posits that the universe is composed of two fundamental entities: Purusha (consciousness) and Prakriti (matter). It also incorporates the concept of the five elements (Panchamahabhutas) - earth,

water, fire, air, and ether - which form the basis of all matter and life. These elements combine to form three primary life forces or doshas: Vata (air and ether), Pitta (fire and water), and Kapha (earth and water). The balance of these doshas within the body determines a person's health and constitution.^[7]

Spread and Influence

Ayurveda flourished in ancient India and influenced medical practices in neighboring regions. It significantly impacted traditional medicine systems in countries such as China, Tibet, Sri Lanka, and Thailand. The spread of Buddhism from India facilitated the dissemination of Ayurvedic knowledge across Asia.^[8]

Decline and Revival

With the advent of Islamic rule in India and later British colonialism, Ayurveda experienced a period of decline. The introduction of Western medicine marginalized traditional practices. However, in the late 19th and early 20th centuries, there was a resurgence of interest in Ayurveda, spurred by the nationalist movement and a renewed appreciation for indigenous knowledge systems.^[9]

Modern Era

In contemporary times, Ayurveda has gained global recognition. It is integrated into the healthcare systems of countries like India and Sri Lanka, where it is practiced alongside modern medicine. Ayurvedic principles are also applied in various fields such as diet, lifestyle, and holistic wellness. Institutions dedicated to Ayurvedic education and research continue to proliferate, ensuring the growth and adaptation of this ancient science to meet modern health challenges.^[10]

1.2 Reasons for using polyherbal formulation

Polyherbal formulations, a cornerstone of Ayurvedic medicine, involve the combination of multiple herbs to create a synergistic therapeutic effect. Here are the key reasons for their use

1. Synergistic Effects

Polyherbal formulations are believed to work synergistically, where the combined effect of the herbs is greater than the sum of their individual effects. This synergy can enhance therapeutic efficacy and provide a broader spectrum of activity against various ailments.^[11]

2. Reduced Toxicity and Side Effects

Combining multiple herbs can help mitigate the toxicity of individual herbs. The presence of various compounds can balance each other, reducing potential side effects.^[12]

Broader Therapeutic Scope

Different herbs in a formulation can target multiple pathways and aspects of a disease, providing a more comprehensive treatment approach. This is particularly useful in managing complex, chronic conditions.^[13]

3. Enhanced Bioavailability

Certain herbs can enhance the bioavailability of other herbs' active compounds. This means that the body can absorb and utilize these compounds more effectively.^[14]

4. Holistic Approach

Polyherbal formulations align with the holistic approach of Ayurveda, which aims to balance the body's systems and promote overall health rather than targeting specific symptoms or diseases alone.^[15]

Polyherbal formulations can be tailored to individual needs, accommodating variations in dosha balance and specific health conditions. This customization allows for a more personalized approach to treatment.^[16]

1.3 Topical Drug Delivery System

Introduction

Topical drug delivery refers to the application of a drug directly onto the skin or mucous membranes, allowing it to act locally or systemically. This method is commonly used to treat dermatological conditions, deliver pain relief, and administer certain systemic medications.

Topical drug delivery systems play a pivotal role in the treatment of dermatological conditions, offering targeted therapy directly to the site of infection or inflammation. These systems provide several advantages, including localized drug action, reduced systemic absorption, and minimized side effects, making them particularly effective for managing skin-related ailments. The increasing incidence of fungal infections and the emergence of drug-resistant strains underscore the need for innovative and effective topical treatments.

In this context, the integration of polyherbal formulations into topical drug delivery systems has garnered significant interest. Polyherbal preparations, which combine extracts from multiple medicinal plants, leverage the synergistic effects of various bioactive compounds, enhancing therapeutic efficacy while reducing the likelihood of resistance development. This research explores the formulation of a polyherbal antifungal soap incorporating extracts from *Ocimum sanctum* (Tulsi), *Azadirachta indica* (Neem), *Cuminum cyminum* (Jeera), and *Trachyspermum ammi* (Ova). These herbs have been selected based on their well-documented antifungal, anti-inflammatory, and skin-soothing properties.

The primary aim of this study is to develop an effective polyherbal antifungal soap that delivers active compounds directly to the affected skin areas, providing a natural and safe alternative to conventional synthetic antifungal agents. The soap's formulation process, antifungal efficacy, and dermatological safety are systematically evaluated to establish its potential as a novel topical drug delivery system.

By addressing the growing need for effective antifungal treatments and leveraging the benefits of herbal medicine, this research seeks to contribute to the development of safer, more efficient therapeutic options for managing fungal infections and promoting overall skin health.

Advantages of Topical Drug Delivery System

1. Targeted Delivery: Topical application allows the drug to be delivered directly to the site of action, increasing its local concentration and reducing systemic exposure.
2. Minimized Side Effects: By reducing systemic absorption, topical drugs often have fewer systemic side effects compared to oral or intravenous medications.
3. Convenience and Ease of Use: Topical formulations are generally easy to apply, enhancing patient compliance and convenience, especially for treating skin conditions.
4. Non-Invasive: Topical delivery avoids the need for injections or oral ingestion, making it a non-invasive method of drug administration.
5. Rapid Onset of Action: Drugs applied topically can act more quickly on the site of application, providing faster relief from symptoms.
6. Bypassing First-Pass Metabolism: Since the drug is absorbed directly through the skin, it bypasses the liver's first-pass metabolism, which can degrade some drugs when taken orally.
7. Flexibility in Dosage Forms: Topical drugs can be formulated in various forms such as creams, ointments, gels, patches, and lotions, allowing for versatility in treatment approaches.
8. Localized Treatment with Systemic Effects: In some cases, topical drugs can achieve systemic effects through transdermal delivery, offering an alternative to oral or injectable routes.^[17]

Disadvantages of Topical Drug Delivery System**1. Limited Drug Penetration**

The skin acts as a natural barrier, and only a limited number of drugs can effectively penetrate this barrier to reach therapeutic levels.

2. Variable Absorption

The rate and extent of drug absorption can vary significantly between individuals due to differences in skin condition, thickness, hydration, and site of application.

3. Skin Irritation and Sensitization

Topical formulations can cause local adverse reactions such as irritation, redness, itching, and allergic reactions, especially with long-term use.

4. Limited to Suitable Drugs

Only drugs with certain physicochemical properties (e.g., low molecular weight, moderate lipophilicity) are suitable for topical delivery, limiting the range of drugs that can be administered this way.

5. Potential for Systemic Absorption

While topical delivery aims for localized treatment, some drugs can be absorbed systemically, potentially leading to unintended systemic effects and side effects.

6. Short Contact Time

Topical formulations can be easily removed by washing, sweating, or friction, reducing their contact time with the skin and thus their effectiveness.

Formulation Stability

Many topical formulations, especially those containing natural or sensitive ingredients, can have stability issues, leading to reduced efficacy over time.

7. Patient Compliance

For chronic conditions, patients may find it inconvenient to apply topical medications multiple times a day, leading to issues with adherence to the treatment regimen.^[18]

Factors Affecting Topical Drug Delivery

1. Physicochemical Properties of the Drug: Molecular size, lipophilicity, and solubility affect drug absorption.
2. Formulation Factors: The type of base (ointment, cream, gel) and use of penetration enhancers can influence drug release and absorption.
3. Skin Condition: The integrity of the skin, presence of hair, and hydration level impact drug penetration.
4. Application Site: Different areas of the skin (e.g., face vs. palm) have varying thickness and absorption capabilities.^[19]

Penetration Enhancers

Penetration enhancers are substances that temporarily reduce the barrier resistance of the skin, allowing for increased drug permeation. Examples include alcohol, propylene glycol, and certain surfactants.^[20]

Evaluation of Topical Drug Delivery Systems

1. In Vitro Studies: Using Franz diffusion cells to measure drug permeation through excised human or animal skin.
2. In Vivo Studies: Measuring the drug concentration in the skin or systemic circulation after topical application in animal models or human volunteers.
3. Skin Irritation Tests: Assessing the potential of the formulation to cause irritation or allergic reactions.^[21]

Applications of Topical Drug Delivery

1. Dermatological Conditions: Treatment of acne, eczema, psoriasis with topical steroids, antibiotics, and retinoids.
2. Pain Management: Use of topical NSAIDs or anesthetics for localized pain relief.
3. Transdermal Patches: Nicotine patches for smoking cessation, hormonal patches for contraception, and fentanyl patches for chronic pain.^[22]

1.4 Structure and Function of Skin

The skin, the largest organ of the body, is composed of three primary layers: the epidermis, dermis, and hypodermis. Each layer has distinct structures

and functions crucial for protection, sensation, and overall homeostasis.

1. Epidermis

Structure: The epidermis is the outermost layer and consists mainly of keratinocytes, which undergo a process of differentiation and form several sub-layers: the stratum corneum, stratum lucidum (present only in thick skin like the palms and soles), stratum granulosum, stratum spinosum, and stratum basale.

Stratum Corneum: Composed of dead, flattened keratinocytes that provide a durable, water-resistant barrier .

Stratum Basale: The deepest layer where new keratinocytes are generated. This layer also contains melanocytes that produce melanin, protecting against UV radiation.

Function: The epidermis serves as a protective barrier against environmental threats such as pathogens, chemicals, and UV radiation. It also prevents water loss and participates in the production of vitamin D .

2. Dermis

-Structure: The dermis lies beneath the epidermis and is composed of two layers: the papillary dermis and the reticular dermis.

Papillary Dermis: The upper layer that contains thin collagen fibers and provides nutrients to the epidermis through its capillary networks .

Reticular Dermis: The deeper layer with thicker collagen bundles that provide tensile strength and elasticity. This layer also houses hair follicles, sebaceous (oil) glands, sweat glands, nerves, and blood vessels .

Function: The dermis supports the epidermis structurally and nutritionally, aids in thermoregulation through blood vessels and sweat glands, and contains sensory receptors that detect touch, pressure, and pain

3. Hypodermis (Subcutaneous Layer)

Structure: The hypodermis is the deepest layer composed primarily of adipose tissue (fat cells) and connective tissue. ^[23]

Function: The hypodermis provides insulation, energy storage, and shock absorption. It also connects the skin to underlying structures like muscles and bones, providing a cushioning effect .

Functions of the Skin

1. **Protection:** The skin acts as a barrier against mechanical damage, microbial invasion, and harmful chemicals. Its slightly acidic pH and the presence of antimicrobial peptides enhance this protective function .
2. **Sensation:** The skin contains various sensory receptors that allow perception of touch, pressure, pain, and temperature, enabling appropriate responses to environmental stimuli. **Thermoregulation:** Sweat glands and blood vessels in the skin play a crucial role in regulating body temperature. Sweating helps cool the body, while blood vessel dilation and constriction adjust heat dissipation
3. **Excretion:** The skin, through sweat glands, excretes waste products such as urea, salts, and water, contributing to waste elimination and maintaining electrolyte balance.
4. **Synthesis of Vitamin D:** The skin synthesizes vitamin D when exposed to UVB radiation, which is essential for calcium metabolism and bone health.
5. **Immunological Function:** The skin contains immune cells, like Langerhans cells, which detect and present antigens to the immune system, playing a crucial role in the body's defense mechanisms. ^[24]

Formulation of Herbal Lip Balm using Natural Ingredients: Beetroot Extract

Introduction:

Lips are among the most delicate parts of the human body as they lack sebaceous glands and have a thin epithelial layer, making them highly vulnerable to dryness, cracking, and environmental damage. Factors such as dehydration, UV radiation, pollution, and harsh weather conditions can further deteriorate lip health. Lip balms are commonly used cosmetic formulations designed to protect, moisturize, and restore the natural softness of lips. However, many commercially available lip balms contain synthetic additives, artificial colorants, and preservatives that may cause irritation or allergic reactions with prolonged use. ^[25]

In recent years, there has been a growing preference for herbal cosmetic products due to their safety, biocompatibility, and minimal side effects. Herbal lip balms are formulated using natural waxes, oils, and plant extracts that not only provide hydration but also offer therapeutic benefits such as antioxidant and anti-inflammatory effects. The use of natural colorants in cosmetics has gained importance as an alternative to synthetic dyes, which may pose health risks. ^[26]

Beetroot (*Beta vulgaris*) is a widely used natural ingredient known for its rich nutritional and medicinal properties. It contains pigments called betalains, primarily betanin, which impart a deep red color. These pigments are powerful antioxidants and are known to protect cells from oxidative damage. ^[27]

Beetroot also contains vitamins, minerals, and phenolic compounds that contribute to its therapeutic potential.

Studies have shown that beetroot extract exhibits significant antioxidant, anti-inflammatory, and antimicrobial properties, making it suitable for cosmetic and dermatological applications. ^[28]

The natural pigment present in beetroot provides an attractive coloration, eliminating the need for synthetic dyes in lip balm formulations. Additionally,

its moisturizing and nourishing effects help in maintaining lip hydration and preventing dryness.

The incorporation of beetroot extract into herbal lip balm offers dual benefits of aesthetic enhancement and therapeutic action. It provides a natural tint along with protective effects against environmental damage. Furthermore, the use of plant-based ingredients supports the development of eco-friendly and sustainable cosmetic products.

Thus, the present study aims to formulate and evaluate a herbal lip balm using beetroot extract as a natural colorant and active ingredient, focusing on its physicochemical properties, stability, and effectiveness in lip care. ^[29]

Advantages of Polyherbal Lip Balm

Natural and safe formulation

Use of beetroot (*Beta vulgaris*) extract and other herbal ingredients minimizes the risk of irritation and toxicity compared to synthetic lip balms.

Natural colorant

Beetroot contains betalain pigments (betanin) that provide an attractive reddish tint, eliminating the need for artificial dyes.

Antioxidant properties

Beetroot extract is rich in antioxidants that help protect lips from oxidative damage caused by environmental factors.

Moisturizing effect

Natural oils and waxes in the formulation help in maintaining hydration and preventing dryness and cracking of lips.

Eco-friendly and biodegradable

Herbal formulations are environmentally safe and support sustainable cosmetic practices.

Nutritional and therapeutic benefits

Beetroot contains vitamins and minerals that help nourish and improve overall lip health.

Disadvantages of Polyherbal Lip Balm

Limited stability of natural color

Beetroot pigments may degrade over time due to exposure to light, heat, and air, affecting color intensity.

Short shelf life

Herbal formulations may have reduced shelf life due to the absence of strong synthetic preservatives.

Variability in raw materials

The quality and composition of beetroot extract may vary depending on source and processing conditions.

Possible staining issue

High concentration of beetroot extract may cause temporary staining of lips or containers.

Microbial contamination risk

Natural products are more prone to microbial growth if proper hygiene and preservation are not maintained.

Mild odor or taste

Beetroot extract may impart a slight earthy odor or taste, which may not be preferred by all users.

2. PLANT PROFILE OF BEETROOT (*Beta vulgaris*)



Fig 1: Beetroot

1. Scientific Name: *Beta vulgaris*

2. Family: Amaranthaceae

3. Common Names: Beetroot, Red beet, Garden beet

4. Biological Source: Beetroot consists of the swollen taproot of *Beta vulgaris*, a biennial plant widely cultivated for its edible and medicinal value. It is commonly used in food as well as in herbal and cosmetic preparations due to its rich phytochemical content. ^[30]

5. Geographical Distribution: Beetroot is cultivated worldwide, especially in Europe, Asia, and North America. It grows well in temperate climates and is widely cultivated in India for both culinary and medicinal purposes. ^[31]

6. Morphological Characteristics: *Beta vulgaris* is a herbaceous plant with a thick, fleshy taproot that is typically deep red or purple in color. The leaves are broad, green with reddish veins, and arranged in a rosette pattern. The root surface is smooth, and the inner flesh is rich in pigment. The plant produces small greenish flowers during its reproductive phase. ^[32]

7. Chemical Constituents: Beetroot contains various bioactive compounds, including:

Betalains (betanin and vulgaxanthin), Phenolic compounds, Flavonoids, Vitamins (A, C, and B-complex), Minerals (iron, potassium, magnesium), These constituents contribute to its antioxidant and therapeutic properties.

8. Pharmacological Activities

Beetroot exhibits several pharmacological activities such as antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective effects. The betalain pigments are known to protect cells from oxidative stress and improve tissue health. ^[33]

9. Uses

Beetroot is widely used as a natural colorant in food and cosmetic products. It is also used in traditional medicine for improving blood circulation, treating anemia, and promoting skin health. In cosmetics, it is used to impart natural color and nourishment.

10. Role in Lip Balm Formulation

In herbal lip balm, beetroot extract serves as a natural coloring agent, providing an attractive reddish tint. It also offers antioxidant and moisturizing benefits, helping to protect lips from dryness and environmental damage. Its natural origin makes it a safe alternative to synthetic dyes. ^[34]

3. Experimental Methodology

1. Collection and Preparation of Plant Material

Fresh beetroot (*Beta vulgaris*) was procured from a local market and washed thoroughly with distilled water to remove dirt and impurities. The outer peel was removed, and the inner portion was cut into small pieces. The pieces were shade-dried to reduce moisture content while preserving active constituents. The dried material was then crushed or ground into a coarse form using a mortar and pestle and stored in an airtight container. ^[35]

2. Preparation of Beetroot Extract

The powdered beetroot material was subjected to extraction using ethanol or a hydroalcoholic solvent. The extraction was carried out by maceration for 48–72 hours with occasional stirring to ensure maximum extraction of pigments and bioactive compounds. The mixture was filtered using muslin cloth or filter paper to obtain a clear extract. The filtrate was concentrated using a water bath at controlled temperature to obtain a semi-solid extract rich in betalain pigments. ^[36]

3. Preparation of Herbal Lip Balm (Fusion Method)

The lip balm was prepared using the fusion method:

Beeswax and butter (shea butter or cocoa butter) were accurately weighed and melted together in a beaker using a water bath.

After complete melting, oils such as coconut oil, castor oil, and almond oil were added gradually with continuous stirring.

The prepared beetroot extract was then incorporated into the melted base and mixed thoroughly to achieve uniform color distribution.

Vitamin E was added as an antioxidant to improve stability.

A few drops of essential oil (rose or peppermint) were added to enhance fragrance and acceptability.

The mixture was stirred continuously to obtain a homogeneous blend. ^[37]

4. Pouring and Solidification

The molten mixture was poured into clean and dry lip balm moulds or containers. Care was taken to avoid air bubble formation. The formulation was allowed to cool at room temperature until complete solidification occurred. The prepared lip balm was then sealed and stored in suitable containers. ^[38]

5. Evaluation of Lip Balm

a. Physical Appearance

The formulation was visually inspected for color, smoothness, texture, and uniformity.

b. pH Determination

A small amount of lip balm was dispersed in distilled water, and the pH was measured using a pH meter to ensure compatibility with lips.

c. Melting Point

The melting point was determined by heating a small sample and recording the temperature at which it melted.

d. Spreadability

The ease of application was evaluated by applying the lip balm on a glass surface and observing its spreading behavior.

e. Stability Study

The formulation was stored under different temperature conditions and observed for changes in color, odor, and consistency over time.

f. Skin Irritation Test

A small quantity of lip balm was applied to a patch of skin to check for any signs of irritation or allergic reaction. ^[39]

Formulation Table:

Ingredients	Batches			Role
Beetroot extract (<i>Beta vulgaris</i>)	0.5	1	1.5	Natural colorant & therapeutic agent
Beeswax	6	6	6	Stiffening agent
Coconut oil	5	5	5	Moisturizer
Castor oil	4	4	4	Gloss enhancer
Almond oil	3	3	3	Emollient
Shea butter / Cocoa butte	2	2	2	Softening agent
Vitamin E	0.5	0.5	0.5	Antioxidant
Rose/Peppermint oil	Q.S	Q.S	Q.S	Flavoring agent

4. Result

Evaluation Results:

Parameter	F1	F2	F3
Color	Light pink	Attractive red	Dark red
Odor	Pleasant	Pleasant	Pleasant
Texture	Smooth	Smooth & Soft	Slightly thick
pH	6.4	6.5	6.6
Melting Point (°C)	59-61	60-62	61-63
Spreadability	Good	Very Good	Good
Homogeneity	Uniform	Uniform	Uniform
Stability	Stable	Stable	Slight variation at higher temp
Skin Irritation	None	None	None



Fig 2: Beetroot Extract



Fig 3: pH Test

5. Conclusion

The present study successfully formulated and evaluated a herbal lip balm using beetroot (*Beta vulgaris*) extract as a natural colorant and active ingredient. The prepared formulations (F1, F2, and F3) showed satisfactory physicochemical properties such as appropriate pH, good spreadability, uniform texture, and acceptable melting point, indicating their suitability for topical application.

Beetroot extract effectively provided a natural reddish color to the lip balm along with antioxidant benefits, enhancing both cosmetic and therapeutic value. All formulations were found to be stable and non-irritant, confirming their safety for use on lips. Variations in extract concentration influenced color intensity and consistency, with formulation F2 showing the most balanced and optimized characteristics.

Overall, the study concludes that beetroot can be successfully incorporated into herbal lip balm formulations as a safe, natural, and eco-friendly alternative to synthetic colorants, offering moisturizing, protective, and aesthetic benefits for lip care.

6. REFERENCES

1. Lad, Vasant. *Textbook of Ayurveda: Fundamental Principles*. Ayurvedic Press, 2002.
2. Sharma, P. V. *History of Medicine in India*. Indian National Science Academy, 1992.
3. Meulenbeld, G. J. *A History of Indian Medical Literature*. Egbert Forsten, 1999.
4. Dash, Bhagwan, and Vaidya Balendu Prakash. *Concept of Ayurvedic Physiology*. Chaukhamba Sanskrit Pratishthan, 2005.
5. Vagbhata, and K. R. Srikantha Murthy. *Ashtanga Hridaya*. Krishnadas Academy, 1995.
6. Frawley, David. *Ayurveda and the Mind: The Healing of Consciousness*. Lotus Press, 1997.
7. Wujastyk, Dominik. *The Roots of Ayurveda: Selections from Sanskrit Medical Writings*. Penguin Books, 2003.
8. Sharma, H. R. *Renaissance of Indian Medicine*. Indian Journal of History of Science, 1975.
9. Tiwari, Premvati. *Ayurveda: A Historical Perspective*. Chaukhamba Publications, 1992.
10. Shankar, D. *Status of Indian Medicine and Folk Healing*. Ministry of Health and Family Welfare, Government of India, 2011
11. Patwardhan, B., Warude, D., Pushpangadan, P., & Bhatt, N. (2015). "Ayurveda and traditional Chinese medicine: a comparative overview". *Evidence-Based Complementary and Alternative Medicine*, 2(4), 465-473.
12. Wagner, H. (2011). "Synergy research: Approaching a new generation of phytopharmaceuticals". *Fitoterapia*, 82(1), 34-37.
13. Parasuraman, S., Thing, G. S., & Dhanaraj, S. A. (2014). "Polyherbal formulation: Concept of Ayurveda". *Pharmacognosy Reviews*, 8(16), 73-80.
14. Sharma, R., Martins, N., Kuca, K., Chaudhary, A., Kabra, A., & Rao, M. M. (2010). "Mechanistic insights into the multifaceted role of phytoconstituents in polyherbal formulations". *Phytomedicine*, 17(12), 1006-1020.
15. Dash, V. B., & Junius, L. (1983). *A Handbook of Ayurveda*. Concept Publishing Company.
16. Mukherjee, P. K., Wahile, A., Kumar, V., & Rai, S. (2002). "Marker profiling of botanicals used in polyherbal formulations". *International Journal of Ayurveda Research*, 1(3), 16-25.
17. Williams, A. C., & Barry, B. W. (2012). "Penetration enhancers." *Advanced Drug Delivery Reviews*, 64, 128-137.
18. Walters, K. A., & Roberts, M. S. (2002). "The structure and function of skin." In *Dermatological and Transdermal Formulations*. CRC Press.
19. Benson, H. A. E. (2005). "Transdermal drug delivery: penetration enhancement techniques." *Current Drug Delivery*, 2(1), 23-33.
20. Prausnitz, M. R., & Langer, R. (2008). "Transdermal drug delivery." *Nature Biotechnology*, 26, 1261-1268.
21. Hadgraft, J., & Lane, M. E. (2005). "Skin permeation: the years of enlightenment." *International Journal of Pharmaceutics*, 305(1-2), 2-12.
22. Barry, B. W. (2001). "Novel mechanisms and devices to enable successful transdermal drug delivery."
23. *European Journal of Pharmaceutical Sciences*, 14(2), 101-114. ### Formulation of Polyherbal Antifungal Soap
24. Rao, Mohan. The Stygian Dip History of Cleanliness in France., JSTOR. 1991; 26(34) 1973-1975.
25. Powar PV, Bhandari NR, Arya Ashwini SP. Formulation and Evaluation of Poly Herbal Anti-Bacterial Gel Based Hand Wash, Int. J. Pharm. Sci. Rev. Res. 2015;33(1):79-82.
26. Clifford T, Howatson G, West DJ, Stevenson EJ. The potential benefits of red beetroot supplementation in health and disease. *Nutrients*. 2015;7(4):2801–2822.
27. Georgiev VG, Weber J, Kneschke EM, Denev PN, Bley T, Pavlov AI. Antioxidant activity and phenolic content of betalain extracts from beetroot. *Food Chemistry*. 2010;121(1):49–56.
28. Kujala TS, Loponen JM, Klika KD, Pihlaja K. Phenolics and betalains in beetroot and their antioxidant activity. *Journal of Agricultural and Food Chemistry*. 2000;48(11):5338–5342.
29. Azeredo HMC. Betalains: properties, sources, applications, and stability. *International Journal of Food Science & Technology*. 2009;44(12):2365–2376.
30. Gandía-Herrero F, García-Carmona F. Characterization of betalain pigments from beetroot. *Journal of Food Science*. 2013;78(2):C203–C208.
31. FAO. *Beta vulgaris Cultivation and Production Guidelines*. Food and Agriculture Organization; 2018.
32. United States Department of Agriculture (USDA). *Beetroot Plant Profile and Nutritional Data*. 2019.
33. McGee H. *On Food and Cooking: The Science and Lore of the Kitchen*. Scribner; 2004.
34. Slatnar A, et al. Beetroot: A source of bioactive compounds. *Food Research International*. 2015.
35. EFSA Panel on Dietetic Products. Scientific opinion on beetroot compounds. *EFSA Journal*. 2012.
36. Evans WC. *Trease and Evans Pharmacognosy*. 16th ed. Elsevier; 2009.

-
37. Sofowora A. *Medicinal Plants and Traditional Medicine in Africa*. 3rd ed. Spectrum Books; 2008.
 38. Handa SS, Khanuja SPS, Longo G, Rakesh DD. *Extraction Technologies for Medicinal and Aromatic Plants*. ICS-UNIDO; 2008.
 39. Martin A. *Physical Pharmacy*. 4th ed. Lippincott Williams & Wilkins; 1993.
 40. Bentley R. *Textbook of Pharmaceutics*. 8th ed. Bailliere Tindall; 2010