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Review Article

Herbal Cream Formulation: A Review of Therapeutic Potential

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ABSTRACT

The growing interest in plant-based topical preparations has encouraged the development of polyherbal formulations in which botanicals with different phytochemical profiles are incorporated into a single pharmaceutical or cosmetic system. The present review examines the formulation and evaluation of a polyherbal cream prepared from Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Aloe vera (*Aloe vera*), and Turmeric (*Curcuma longa*). Each of these medicinal plants has been investigated for biological properties that may be relevant to topical use. Neem and Tulsi have been associated with antimicrobial, antioxidant and anti-inflammatory effects, whereas Aloe vera is widely investigated for its moisturizing, soothing and skin-supportive characteristics. Turmeric, particularly its curcuminoid fraction, has received considerable research attention because of its antioxidant, anti-inflammatory and antimicrobial potential. The literature further indicates that the nature of a plant extract is strongly influenced by the extraction solvent, plant material, processing conditions, extraction duration and concentration of the resulting extract. Reported methods for the selected botanicals include aqueous and alcoholic extraction, maceration, Soxhlet extraction, methanolic extraction and mechanical recovery of Aloe vera gel. A formulation study specifically involving Neem, Tulsi, Aloe vera and Turmeric describes their incorporation into a semisolid cream containing liquid paraffin, beeswax, borax, methylparaben and distilled water. However, the individual quantities of the four herbal extracts in the final cream were not clearly stated in the available formulation report; therefore, these amounts should be established experimentally rather than inferred.

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Appropriate evaluation of the finished product may include assessment of appearance, colour, odour, homogeneity, pH, viscosity, spreadability, emulsion type, after-feel, washability, centrifugation behaviour, spectrophotometric characteristics, stability and microbial quality. Overall, the available literature supports further investigation of this four-herb topical system, while also emphasizing the need for controlled extraction, extract standardization, reproducible formulation procedures and systematic quality evaluation.

INTRODUCTION

Skin is not simply a covering of the human body; it is a dynamic biological organ that performs several protective and physiological roles. It forms the first line of defence against physical damage, chemical exposure and microorganisms while also helping to restrict excessive loss of water and electrolytes. In addition, the skin contributes to thermal regulation, sensory perception, immune defence and several metabolic functions. Among its structural components, the stratum corneum has a particularly important role in maintaining cutaneous barrier integrity. It is principally formed by corneocytes surrounded by an organized lipid arrangement, and this architecture contributes substantially to hydration and protection from environmental exposure. These characteristics must therefore be considered when developing preparations intended for application to the skin. [1,2]

The performance of a topical formulation is influenced not only by the active substance but also by the vehicle in which that substance is incorporated. When a semisolid preparation is placed on the skin, the formulation and its components come into contact with a living biological barrier. Consequently, factors such as vehicle composition, tolerability, spreading behaviour, cosmetic acceptability, processing characteristics and physicochemical stability are important during formulation development. Semisolid dosage forms continue to represent important systems for delivering substances to the skin. [3]

Creams are commonly prepared as semisolid emulsified systems containing aqueous and oily components. According to the phase that forms the continuous medium, they are generally described as oil-in-water (O/W) or water-in-oil (W/O) emulsions. This structural difference can influence several practical characteristics of the product, including its sensory properties, ease of washing, degree of greasiness, moisturization and spreadability. O/W preparations are commonly perceived as comparatively less greasy and easier to remove with water, whereas W/O systems may provide a more occlusive effect. Nevertheless, these characteristics cannot be attributed to emulsion type alone because the behaviour of a cream is determined by the formulation as a whole. [3,4]

The barrier function of the stratum corneum is closely associated with its lipid composition. Ceramides, cholesterol and free fatty acids are arranged within the intercellular region and contribute to maintaining barrier integrity and limiting water loss. Because topical excipients can interact with these lipid structures, their selection requires consideration of skin compatibility in addition to the physical stability of the formulation. Research involving non-ionic emulsifiers has shown that different emulsifier systems may influence skin lipid organization differently. Therefore, a successful topical formulation should be designed with attention to both its pharmaceutical properties and its interaction with the skin barrier. [2]

Medicinal plants provide a chemically diverse source of materials for pharmaceutical and cosmetic development. Depending upon the botanical source, extracts may contain phenolic substances, flavonoids, terpenoids, alkaloids, polysaccharides, volatile compounds and numerous other secondary metabolites. However, the composition of an extract cannot be assumed to remain constant. Plant species, plant part, geographical conditions, harvesting practices, drying procedure, extraction solvent, temperature, extraction period and post-extraction processing can all influence the final composition. For this reason, the term “herbal extract” by itself does not necessarily indicate a standardized chemical preparation.

The present review considers four medicinal plants selected for development of a polyherbal topical cream: Neem (*Azadirachta indica*), Tulsi (*Ocimum sanctum*), Aloe vera (*Aloe vera*) and Turmeric (*Curcuma longa*). Although each plant has a distinct phytochemical profile, their reported properties provide a potentially complementary basis for topical formulation. Neem has been widely investigated in relation to

antimicrobial and dermatological applications. Tulsi has demonstrated antimicrobial and antioxidant potential. Aloe vera provides a polysaccharide-rich gel associated particularly with moisturizing and soothing characteristics, whereas Turmeric contains curcuminoids and other constituents investigated for antioxidant, anti-inflammatory and antimicrobial effects.

Combining these four botanicals creates the possibility of incorporating several types of plant-derived constituents within one semisolid dosage form. A formulation study directly relevant to this combination has reported the preparation of a cream containing Neem, Aloe vera, Turmeric and Tulsi extracts. [5] In addition, studies involving Neem–Tulsi and other herbal cream systems provide useful information concerning extraction, cream preparation and evaluation procedures that can guide development of the four-herb formulation. [6]

The purpose of this review is to examine the botanical and phytochemical characteristics of the four selected plants, discuss the extraction techniques reported for their preparation, describe the available method for producing the polyherbal cream, and summarize the formulation and quality-control considerations relevant to evaluation of the final topical product.

2. SKIN AS A TARGET FOR TOPICAL HERBAL FORMULATIONS

2.1 Structure and Functions of Skin

The skin is a structurally complex organ consisting mainly of the epidermis and dermis together with associated structures such as hair follicles, sebaceous glands, eccrine glands and apocrine glands. The epidermis forms the external cellular layer and contains predominantly keratinocytes. Its most superficial region, the stratum corneum, forms a major component of the body's protective barrier.

Located beneath the epidermis, the dermis contains connective tissue, collagen, elastic fibres, blood vessels, nerves and various cutaneous appendages. Sebaceous glands release sebum, which assists lubrication and has reported antimicrobial characteristics. Sweat glands participate in regulation of body temperature, while melanocytes synthesize melanin, contributing to protection against ultraviolet radiation. Skin also contains immune components and therefore participates in both innate and adaptive immune responses. [1]

These features are important from a formulation standpoint because the skin cannot be regarded as a passive surface. A cream applied externally interacts with a living, chemically active and structurally organized tissue. The composition and behaviour of the formulation may consequently influence its interaction with the skin barrier.

2.2 Stratum Corneum and Topical Formulation

The stratum corneum consists of flattened corneocytes surrounded by an organized extracellular lipid matrix. Ceramides, cholesterol and free fatty acids constitute important components of this lipid environment and contribute to maintaining barrier function, water retention and resistance to penetration by external substances. [2]

Consequently, ingredients present in topical preparations may influence the behaviour of this barrier. Formulation components such as emulsifiers can interact with skin lipids, and their effects may vary according to their chemical nature. Formulation development should therefore seek an appropriate balance between desirable physical characteristics, stability during storage and compatibility with the skin. [2]

3. SEMISOLID TOPICAL DOSAGE FORMS AND HERBAL CREAMS

Semisolid preparations have an established role in topical drug delivery. Their performance depends upon the combined behaviour of the active material, formulation vehicle and skin. Important characteristics include release of the incorporated substance, penetration behaviour, viscosity, spreadability, skin tolerance, physical stability and user acceptability. [3]

Cream formulations are especially useful for herbal preparations because an emulsion can accommodate constituents having different physicochemical characteristics. Selection of the oil phase, aqueous phase, emulsifying agents, consistency-improving materials, preservatives and other excipients determines the characteristics ultimately displayed by the cream.

From a practical perspective, an acceptable topical cream should have appropriate consistency, satisfactory spreading behaviour, an acceptable colour and odour, adequate physical stability and good skin compatibility. Depending upon the intended use, ease of washing may also be desirable. Herbal extracts should remain reasonably distributed throughout the formulation without producing marked aggregation or undesirable phase separation.

Introducing several botanical extracts into the same formulation increases the formulation challenge. Individual extracts may differ in polarity, solubility, colour, odour, viscosity and stability. The development of a polyherbal cream therefore requires assessment of the properties of each extract as well as the behaviour produced when all extracts are incorporated together.

4. DRUG PROFILE

A. HERBAL INGREDIENTS

4.1 Aloe vera

Botanical information

Botanical name: *Aloe vera* (L.) Burm. f. **Common synonym:** *Aloe barbadensis* Mill. **Family:** Asphodelaceae **Part used:** Inner leaf gel

Aloe vera is a perennial succulent belonging to the family Asphodelaceae. Its fleshy leaves can be differentiated into three principal regions: an external rind, an intermediate latex-containing portion and an internal mucilaginous gel. The inner gel contains a high proportion of water along with polysaccharides, amino acids, minerals, enzymes, vitamins, sterols and other constituents. [7,8]

Phytochemical composition

The chemical constituents reported from Aloe vera include glucomannans, acemannan and other polysaccharides, together with amino acids, vitamins, minerals, enzymes, phenolic compounds, sterols, fatty acids and saponins. Anthraquinone compounds such as aloin are associated primarily with the latex portion rather than the purified inner gel. [7–9]

This distinction between inner gel, latex and whole-leaf preparations is particularly important because the three materials do not possess identical chemical compositions. Consequently, when Aloe vera is incorporated into a polyherbal cream, the exact Aloe-derived material being used should be clearly identified.

Biological relevance

Aloe vera has been investigated for several properties of potential topical relevance, including moisturizing, emollient, soothing, antioxidant, antimicrobial and anti-inflammatory effects, as well as possible roles in supporting skin repair. Particular attention has been directed towards polysaccharides such as acemannan and glucomannans in relation to hydration and tissue-repair processes. [7–10]

A systematic review of clinical studies examined Aloe vera preparations in the context of wound prevention and healing. Although potential benefits were identified in certain applications, the available clinical findings were not completely consistent. Aloe vera should therefore be regarded as a promising topical material rather than assuming that every Aloe preparation will produce the same clinical outcome. [10]

Importance of Aloe vera in the cream

Within the proposed formulation, Aloe vera has a functional role that differs from the more prominently antimicrobial-oriented botanical ingredients. Its gel is particularly relevant to the moisturizing and soothing characteristics expected from a topical preparation. Thus, its incorporation may contribute to the skin-conditioning characteristics of the final cream while the other botanicals contribute their respective phytochemical components.

4.2 Neem

Botanical information

Botanical name: *Azadirachta indica* A. Juss. **Common name:** Neem or Indian lilac **Family:** Meliaceae **Part used:** Leaves

Neem is an evergreen medicinal tree belonging to the family Meliaceae. Leaves, bark, seeds, fruits, flowers and oil have all been used traditionally. Among these materials, the leaves are particularly relevant to topical formulation research because of their reported antimicrobial and dermatological applications. [11]

Phytochemical composition

Neem possesses a chemically diverse phytochemical profile. Its constituents include limonoids, triterpenes, flavonoids, phenolic substances, tannins, saponins, steroids and other secondary metabolites. Compounds frequently associated with Neem include azadirachtin, nimbin, nimbolide, nimbidin and related limonoids. The actual composition of an extract may, however, change according to the plant part and extraction conditions used. [11–14]

Biological relevance

Research on Neem has investigated antibacterial, antifungal, antioxidant and anti-inflammatory activities. Its traditional use has also included preparations intended for various dermatological and microbial conditions. [12,13]

Ali et al. examined an ethanolic extract of Neem leaves and reported antibacterial activity against multidrug-resistant bacterial pathogens associated with poultry. MIC and MBC values differed between the organisms examined. Although these findings demonstrate activity of the tested ethanolic leaf extract, the experiment was not performed on human skin and therefore should not be interpreted as direct evidence of clinical topical efficacy. [14]

Neem leaf preparations have additionally been examined in relation to melanogenesis. Songtavisin et al. reported that aqueous Neem leaf extract reduced melanin production and intracellular tyrosinase activity in B16F10 melanoma cells under their experimental conditions. These observations provide a basis for further research but do not by themselves establish clinical skin-lightening effectiveness. [15]

Importance of Neem in the cream

Neem is relevant to the proposed polyherbal preparation because its reported antimicrobial and anti-inflammatory characteristics may complement the properties contributed by the other botanical ingredients. Neem leaf extract can therefore serve as an important component when the formulation is being investigated for antimicrobial or general skin-care applications.

4.3 Turmeric

Botanical information

Botanical name: *Curcuma longa* L. **Common name:** Turmeric or Haldi **Family:** Zingiberaceae **Part used:** Rhizome

Turmeric is a rhizomatous plant belonging to the Zingiberaceae family. Its rhizome is the principal medicinal portion and has long been utilized in traditional medicine as well as food and cosmetic preparations. [16]

Phytochemical composition

Curcuminoids represent the principal characteristic constituents of Turmeric. These include curcumin, demethoxycurcumin and bisdemethoxycurcumin. The rhizome also contains volatile constituents and other compounds that contribute to its characteristic biological and physicochemical properties. [16,17]

Biological relevance

Turmeric and its major constituent curcumin have been widely investigated for antioxidant, anti-inflammatory, antibacterial and antifungal properties. These findings have stimulated research into their incorporation into topical and cosmetic preparations. [17,18]

Pondini et al. reviewed research concerning Turmeric rhizome extracts in cosmetic creams and lotions and identified investigations involving anti-aging, anti-acne and wound-related applications. Such findings indicate areas of research interest and should not be interpreted as establishing universal clinical effectiveness. [18]

Formulation relevance

A significant formulation difficulty associated with Turmeric is the limited aqueous solubility of curcumin. This physicochemical property can affect both the extraction procedure and subsequent incorporation and release of curcuminoids from a topical vehicle. Curcumin stability and its susceptibility to photodegradation are additional considerations. [17]

For these reasons, the extraction procedure and method used to introduce Turmeric into the cream require careful control.

4.4 Tulsi

Botanical information

Botanical name: *Ocimum sanctum* L. **Synonym:** *Ocimum tenuiflorum* **Common name:** Tulsi or Holy basil **Family:** Lamiaceae **Part used:** Leaves and aerial parts

Tulsi is an aromatic medicinal plant belonging to the Lamiaceae family and has a long history of use in Ayurveda. Its leaves and aerial portions contain both volatile and non-volatile phytochemical constituents. [19,20]

Phytochemical composition

Reported Tulsi constituents include eugenol, ursolic acid, rosmarinic acid, linalool, flavonoids, phenolic compounds and components of the essential oil. Their concentrations may vary depending on the plant variety, botanical part, geographical conditions and extraction technique employed. [19–21]

Biological relevance

Tulsi has been investigated for antimicrobial, antifungal, antioxidant and anti-inflammatory activities. A systematic review of in-vitro investigations reported anticandidal activity for *O. sanctum* preparations and discussed constituents including eugenol and linalool in relation to the observed effects. [21]

Importance in the cream

Tulsi contributes another botanical source of antimicrobial and antioxidant constituents to the proposed formulation. Its combination with Neem is particularly relevant because these two botanicals have already been investigated together in a polyherbal skin-care cream, providing a useful formulation precedent for development of the present four-herb system. [22]

5. COMPARATIVE CHARACTERISTICS OF THE FOUR HERBS

Sr. No.	Herb	Botanical source	Main part used	Major constituents	Important reported properties	Main reported relevance
1	Neem	*Azadirachta indica*	Leaves	Limonoids, nimbin, nimbolide, flavonoids, phenolics	Antibacterial, antifungal, antioxidant, anti-inflammatory	Antimicrobial, antioxidant, anti-inflammatory
2	Tulsi	*Ocimum sanctum*	Leaves/aerial parts	Eugenol, rosmarinic acid, ursolic acid, flavonoids, volatile compounds	Antimicrobial, antioxidant, anti-inflammatory	Antimicrobial, antioxidant, anti-inflammatory
3	Aloe vera	*Aloe vera*	Inner leaf gel	Glucomannan, acemannan, polysaccharides, amino acids	Moisturizing, soothing, antioxidant, anti-inflammatory	Moisturizing, soothing, skin-supportive
4	Turmeric	*Curcuma longa*	Rhizome	Curcumin, demethoxycurcumin, bisdemethoxycurcumin, volatile compounds	Antioxidant, anti-inflammatory, antimicrobial	Antioxidant, anti-inflammatory, antimicrobial

The comparison indicates that the four botanicals do not simply duplicate one another. Neem and Tulsi are especially associated with antimicrobial activity, Aloe vera contributes a water-rich polysaccharide-containing gel with moisturizing and soothing relevance, while Turmeric provides curcuminoids and other constituents investigated mainly for antioxidant and anti-inflammatory effects. Their differing profiles provide the underlying rationale for investigating them together in a single topical preparation.

6. EXTRACTION OF HERBAL MATERIALS

Extraction is a decisive stage in herbal formulation because the extraction procedure determines which plant constituents enter the preparation. Variables such as solvent polarity, quantity of solvent relative to plant material, particle size, extraction temperature, duration and extraction technique can all influence the resulting extract.

6.1 Aloe vera extraction

Aloe vera can be processed using approaches that are fundamentally different from conventional solvent extraction.

Muñoz et al. described mechanical recovery of fresh Aloe vera gel. The leaves were washed, the marginal spines and outer cortex were removed, and the internal filets were separated. After washing, the gel was recovered through pressing. A high recovery of gel from the leaf filet was reported in the study. [8]

Saha et al. investigated methanolic extraction of dried Aloe vera gel. After separating the gel, it was dried at 60°C and converted into powder. The powdered material was subsequently soaked in methanol for seven days while being protected from light. Following filtration, the extract was concentrated with a rotary evaporator. [9]

Dasalkar et al. examined several approaches for obtaining extract from Aloe mucilage powder. The investigated procedures included general extraction, hot-water extraction, cold-water extraction, ultrasonic extraction, overnight extraction and ethanol extraction. Under the conditions reported, hot-water extraction produced the greatest quantity of powder. [23]

These procedures should not be regarded as equivalent because each produces a different type of Aloe-derived preparation.

6.2 Neem extraction

Neem leaves can be subjected to extraction using several solvent systems, including water, ethanol, methanol, ethyl acetate, petroleum ether and hexane. Selection of the solvent depends largely on the type of constituents intended to be recovered. [13]

Kannan et al. reviewed different Neem extraction approaches, including Soxhlet extraction, immersion and shake-flask techniques. Alcoholic solvents such as ethanol and methanol are commonly used when broader groups of constituents are targeted, whereas less-polar solvents are more appropriate for lipid-rich fractions. [13]

Ali et al. reported an ethanolic Soxhlet procedure in which 500 g of Neem leaves were dried at 35–40°C, pulverized and extracted using 3000 mL of 96% ethanol. Extraction was performed at approximately 78°C for 18 h, after which the extract was concentrated using a rotary evaporator. [14]

A different procedure was used by Chandrasekar and Sivagami in their Neem–Tulsi cream study. Neem leaves were shade dried for four days and powdered, followed by defatting with petroleum ether 60–40. Ethanolic extraction was subsequently performed in a Soxhlet apparatus for three hours. [22]

These examples demonstrate that Neem extraction conditions can vary considerably depending on the intended purpose and formulation.

6.3 Turmeric extraction

Dadas et al. described an ethanolic procedure for obtaining Turmeric extract for preparation of a skin cream. Five grams of raw Turmeric were combined with 100 mL ethanol and maintained for five days before the extract was used in the formulation. [24]

This represents a comparatively simple alcoholic extraction method suitable for preparation of a crude Turmeric extract. However, the method does not demonstrate that the resulting material contains a predetermined concentration of curcumin. If reproducible pharmaceutical development is intended, chemical marker-based standardization would therefore be desirable.

6.4 Tulsi extraction

Different procedures have been described for obtaining Tulsi extracts.

Chandrasekar and Sivagami first defatted Tulsi material with petroleum ether and subsequently performed Soxhlet extraction using ethanol. In their procedure, 100 g of plant material were extracted with 500 mL ethanol for three hours. [22]

Patil and Mahajan described Soxhlet extraction using 50 g dried Tulsi powder and 500 mL ethanol for approximately 6–8 h to obtain an extract intended for incorporation into a nanogel. [25]

Sahu et al. investigated solvent extraction of fresh Tulsi leaves for preparation of Tulsi oil intended for use in a topical emulgel. [26]

The variation among these procedures illustrates why the expression "Tulsi extract" alone is insufficient to describe the chemical characteristics of the material.

7. COMPARISON OF EXTRACTION METHODS

Herb	Reported method	Important conditions	Intended material
Aloe vera Aloe mucilage	Mechanical separation	Gel separated from leaf filets by pressing	Fresh gel
	Solvent extraction	Dried gel soaked 7 days	Solvent extract
	Hot-water extraction	Investigated by Dasalkar et al.	Mucilage powder
Neem	Soxhlet	3 h in Neem–Tulsi cream study	Leaf extract
Neem	Soxhlet	18 h at approximately 78°C	Ethanolic leaf extract
Neem	Maceration	4–5 days in four-herb cream source	Leaf extract
Turmeric	Maceration	5 g/100 mL; 5 days	Crude extract
Tulsi	Soxhlet	3 h after defatting	Leaf extract
Tulsi	Soxhlet	6–8 h	Leaf extract
Tulsi	Solvent extraction	Fresh leaves	Oil-containing preparation

The comparison makes clear that extraction technique should be selected according to the desired plant fraction and the characteristics required in the final dosage form. A greater extraction yield should not automatically be interpreted as better extract quality, since the same process may also recover unwanted constituents.

8. EXTRACTION AND PREPARATION OF THE POLYHERBAL CREAM

8.1 Collection and preprocessing

Before extraction begins, the selected botanical materials should be properly identified and authenticated. Neem and Tulsi leaves are washed, dried and pulverized, whereas Turmeric rhizomes are cleaned, dried and powdered. Aloe vera leaves are obtained from healthy mature plants and processed to recover the inner gel. [5,6]

Moisture control is especially important when working with leafy materials because excessive residual moisture can encourage microbial growth and may also alter extraction behaviour. In the Neem–Tulsi cream study, shade drying was used for Neem and Tulsi leaves. [22]

After drying, the botanical material should be reduced to an appropriate particle size to improve contact between the plant material and extraction medium.

9. EXTRACTION PROCEDURES USED FOR THE POLYHERBAL CREAM

9.1 Neem

The directly relevant formulation source describes maceration of 10 g Neem powder with 100 mL ethanol for 4–5 days. Another herbal cream study used 5 g Neem powder with DMSO followed by heating at 80–100°C and filtration. [5,6]

Because these procedures differ in both solvent and extraction principle, they cannot be expected to produce identical extracts. The extraction method selected for an experimental batch should therefore be documented precisely.

9.2 Aloe vera

Fresh Aloe vera gel can be prepared by removing the external portion of the leaf, collecting the internal gel and filtering the material to remove fibrous matter. [6]

The directly relevant four-herb formulation source, however, reports treatment of 10 g Aloe vera powder with 10 mL ethanol for 4–5 days. [5]

These procedures begin with different Aloe materials and employ different extraction principles; consequently, they should not be treated as interchangeable.

9.3 Turmeric

The four-herb formulation source describes preparation of a Turmeric decoction using 10 g powdered Turmeric with 100 mL distilled water, maintained at approximately 80–90°C. [5]

In contrast, the Turmeric cream study reported use of 5 g Turmeric with 100 mL ethanol for five days. [24]

For experimental development, one selected extraction procedure should be consistently followed from batch to batch.

9.4 Tulsi

Tulsi leaves are cleaned, dried and pulverized before extraction. One herbal cream source describes use of 1 g Tulsi powder with 10 mL DMSO followed by heating at 80–100°C and filtration. [6]

The directly relevant four-herb formulation instead reports 10 g Tulsi powder with 100 mL ethanol, followed by heating and filtration. [5]

10. PREPARATION OF POLYHERBAL CREAM

The formulation directly relevant to the four selected herbs employs separate oil and aqueous phases. For the oil phase, 2 mL liquid paraffin and 2 g beeswax are heated to approximately 75°C. The aqueous phase contains 1 g borax and 2 g methylparaben dissolved in distilled water and is likewise maintained at approximately 75°C.

The heated aqueous portion is then introduced gradually into the oil phase while continuous stirring is maintained. Once the cream base has formed, the prepared extracts of Aloe vera, Neem, Tulsi and Turmeric are incorporated under continuous stirring until a uniform preparation is obtained. [5]

The overall sequence can be represented as:

Selection of herbal materials → cleaning → drying → size reduction → extraction → filtration/concentration → preparation of oil phase → preparation of aqueous phase → controlled heating → combination of phases → incorporation of herbal extracts → continuous stirring/homogenization → cooling → final cream

An important limitation of the reported method is that the available source does not clearly specify the individual amounts of the four herbal extracts incorporated into the final cream. These quantities should therefore be established experimentally rather than reconstructed from assumption.

11. QUALITY CONTROL AND EVALUATION

Evaluation of a polyherbal cream is required to determine whether the finished product possesses acceptable physical uniformity, application characteristics and stability. The Neem–Tulsi polyherbal cream study provides a useful experimental reference for evaluating herbal topical preparations. [22]

11.1 Organoleptic evaluation

The finished cream should be visually and manually examined for characteristics such as colour, odour, texture, smoothness and the presence or absence of visible particles. An acceptable preparation should have a reasonably uniform appearance and should not contain obvious lumps or foreign matter.

Changes in colour or odour during storage can provide an early indication of physical or chemical instability. This consideration is particularly relevant for herbal formulations because botanical extracts may contain naturally coloured substances and volatile components.

11.2 Homogeneity

Homogeneity can be examined visually and by touch. The formulation should demonstrate reasonably uniform distribution of the incorporated herbal materials and other components, without obvious aggregates or visible separation of phases.

11.3 pH

For pH determination, approximately 0.5 g of cream may be dispersed in 50 mL distilled water and measured using a calibrated digital pH meter. [22]

Monitoring pH is important because considerable alteration during storage may indicate instability. The measured value should also be appropriate for the intended topical application.

11.4 Viscosity

Viscosity can be determined with a Brookfield viscometer. Chandrasekar and Sivagami reported the use of spindle number 64 in their evaluation. [22]

The viscosity of a cream affects several practical properties, including its consistency, flow behaviour, spreading characteristics, ease of application and resistance to physical instability.

11.5 Spreadability

Spreadability describes how readily a cream can be distributed over a surface and is therefore an important practical characteristic of a topical preparation.

The reported glass-slide method uses the equation:

S = M × L / T

Where:

- **S** = spreadability
- **M** = weight attached to the upper slide
- **L** = length of the slide
- **T** = time required for separation of the slides

Under the specified experimental conditions, a greater spreadability value generally indicates easier distribution of the preparation.

11.6 Determination of emulsion type

The continuous phase of the cream can be identified to establish whether the formulation is O/W or W/O. A dye-based test may be used for this purpose.

Determining the emulsion type helps establish the physical organization of the cream and confirms whether the preparation corresponds to the intended emulsion system.

11.7 After-feel

After-feel evaluation considers the sensation remaining on the skin after application. Parameters such as emolliency, slipperiness, smoothness and residual material can be considered.

A formulation intended for regular topical use should ideally leave an acceptable skin sensation without producing an unnecessarily greasy or excessive residual film.

11.8 Type of smear

The character of the film left after spreading the formulation can be examined. The smear may be assessed for smoothness, greasiness, stickiness or other undesirable characteristics.

11.9 Ease of removal

Washability can be examined by applying the cream to the skin and subsequently attempting to remove it using water.

Although O/W preparations are commonly easier to wash than highly occlusive W/O systems, the actual washability of a product is dependent upon the complete composition of the formulation.

11.10 Centrifugation test

Approximately 5 g of cream may be subjected to centrifugation at 3000 rpm for 30 min at room temperature. The formulation is subsequently inspected for evidence of phase separation. [22]

If no separation is observed following this stress condition, it provides evidence that the formulation possesses satisfactory resistance to centrifugation-induced instability.

11.11 Spectrophotometric examination

In the Neem–Tulsi cream study, the formulation was diluted at 1:100 w/v using ultrapure water and examined spectrophotometrically at 245 nm. [22]

For the proposed four-herb formulation, a similar procedure may provide a comparative analytical profile. However, any absorbance observed should be interpreted in relation to the constituents actually present in the combined formulation rather than assigning the signal to a particular compound without appropriate analytical confirmation.

11.12 Accelerated stability

The cream should be monitored under room-temperature and elevated-temperature conditions for changes in:

- colour;
- odour;
- appearance;
- homogeneity;
- pH;
- viscosity; and
- phase separation.

Chandrasekar and Sivagami evaluated stability for 20 days under room-temperature and elevated-temperature conditions. [22]

11.13 Microbial stability

Microbiological assessment is particularly important for herbal creams because the presence of water and plant-derived materials can provide conditions that may support microbial contamination.

The Neem–Tulsi study examined microbial growth including *E. coli* and yeast and reported no growth under the conditions employed in that study. [22]

This finding should be interpreted specifically for the tested formulation and experimental conditions and should not automatically be generalized to every herbal cream.

12. QUALITY-CONTROL PARAMETERS AND THEIR SIGNIFICANCE

Parameter	Purpose
Colour	Helps identify physical changes and contributes to product acceptability
Odour	May reveal changes in volatile constituents or formulation stability
Appearance	Provides an overall indication of physical quality
Homogeneity	Confirms reasonably uniform distribution of formulation components
pH	Provides information relevant to topical compatibility and formulation stability
Viscosity	Indicates consistency and flow behaviour
Spreadability	Indicates ease with which the cream can be applied
Emulsion type	Establishes whether the system is O/W or W/O
After-feel	Provides information regarding the sensation following application
Smear	Characterizes the residual film produced on application
Washability	Determines how readily the formulation can be removed
Centrifugation	Provides information regarding resistance to phase separation
Spectrophotometry	Provides a comparative analytical profile
Stability	Helps identify changes occurring during storage
Microbial evaluation	Assesses microbiological quality

13. REPORTED EVALUATION OF NEEM–TULSI POLYHERBAL CREAM

The work of Chandrasekar and Sivagami represents an important precedent for evaluation of a topical cream containing medicinal plant extracts. Their Neem–Tulsi formulation showed pH values ranging approximately from 5.9 to 6.9, while the reported viscosity values were approximately 40,900–50,910 cps. The formulation was described as homogeneous and identified as an oil-in-water cream. The selected formulation showed satisfactory spreading behaviour and could be removed readily using water. [22]

The investigators also reported that the preparation did not undergo phase separation after centrifugation or during the accelerated stability study. Microbiological examination did not demonstrate growth of *E. coli* or yeast under the conditions employed. These observations are useful as methodological guidance for evaluating the proposed four-herb cream; however, the results should not be represented as experimental results obtained from the Neem–Tulsi–Aloe vera–Turmeric formulation.

14. COMPARISON OF REPORTED HERBAL TOPICAL FORMULATIONS

Formulation	Herbal components	Dosage form	Main evaluation
Neem–Tulsi cream	Neem + Tulsi	O/W cream	pH, viscosity, spreadability, stability, microbial quality
Four-herb cream	Neem + Aloe + Turmeric + Tulsi	Cream	Formulation and topical evaluation
Turmeric formulation	Turmeric	Cream	Physical properties, pH, viscosity, spreadability
Aloe + Turmeric	Aloe + Turmeric	Gel	pH, viscosity, spreadability, stability
Tulsi + Neem	Tulsi + Neem oils	Emulgel	pH, viscosity, spreadability, washability

Formulation	Herbal components	Dosage form	Main evaluation
Tulsi extract	Tulsi	Nanogel	pH, viscosity, spreadability, antimicrobial testing

Taken together, the available studies indicate that the four selected botanicals have been investigated both individually and in various combinations across different topical dosage forms. Nevertheless, formulations containing Neem, Tulsi, Aloe vera and Turmeric together as a single cream have received comparatively less detailed characterization. This makes controlled extraction, standardization and systematic evaluation especially important.

15. RATIONALE FOR COMBINING NEEM, TULSI, ALOE VERA AND TURMERIC

The proposed combination can be justified on the basis of the different characteristics reported for the four botanicals.

Neem contributes limonoids, phenolic substances and other constituents that have been investigated in relation to antimicrobial and anti-inflammatory activity.

Tulsi contributes volatile and phenolic constituents, including eugenol and rosmarinic acid, that have been associated with antimicrobial and antioxidant effects.

Aloe vera contributes polysaccharides and gel-associated components that have been investigated for moisturizing, soothing and skin-supportive properties.

Turmeric contributes curcuminoids, particularly curcumin, which have been extensively investigated in relation to antioxidant and anti-inflammatory effects, along with reported antimicrobial potential.

Consequently, the formulation brings together botanicals with different phytochemical characteristics rather than combining four plants that possess exactly the same reported activity.

Nevertheless, the word **"synergistic"** should be used carefully. The available studies demonstrate biological activities of the individual botanicals and selected combinations, but they do not establish pharmacological synergy for the exact four-herb cream. The formulation should therefore be described as **potentially complementary** unless an experimental study specifically demonstrates synergy.

16. IMPORTANT FORMULATION CONSIDERATIONS

16.1 Extract standardization

Variability in herbal extract composition represents one of the major challenges associated with polyherbal formulation development. The same botanical can yield extracts with different chemical profiles when solvent, temperature, extraction time or starting material changes.

Consequently, the following factors should be recorded and controlled wherever possible:

- botanical authentication;
- plant part;
- drying procedure;
- particle size;
- extraction solvent;
- plant-to-solvent ratio;
- extraction duration;
- extraction temperature;
- extract yield;
- physical characteristics; and
- appropriate phytochemical markers.

Such information improves reproducibility and makes comparison between different batches more meaningful.

16.2 Solubility

Turmeric requires particular attention during formulation because curcumin has poor aqueous solubility. The method selected for extraction and subsequent incorporation should therefore take the physicochemical behaviour of Turmeric constituents into account.

16.3 Aloe vera stability

Fresh Aloe vera gel contains a large proportion of water and may therefore be vulnerable to physical and microbiological deterioration. Appropriate processing and storage conditions are consequently important

when Aloe material is incorporated into a topical formulation.

16.4 Colour and odour

The natural characteristics of the selected plants may influence the sensory properties of the final product. Turmeric can impart a pronounced colour, while Neem and Tulsi may contribute characteristic herbal odours. Such changes may affect acceptability and should therefore form part of organoleptic assessment.

16.5 Preservative considerations

The presence of an aqueous phase together with plant-derived materials makes microbial control an important consideration. Although methylparaben is included in the reported formulation, the effectiveness of the preservative system should be established experimentally for the final product rather than assumed simply because a preservative is present.

17. LIMITATIONS OF THE AVAILABLE LITERATURE

Several limitations become apparent when the available studies are considered collectively.

A major issue is the substantial variation in extraction methodology. Extracts produced using different solvents and processing conditions cannot automatically be regarded as chemically equivalent.

In addition, a considerable proportion of the reported biological evidence originates from in-vitro experiments or experimental models. Such findings are valuable for establishing biological potential, but they cannot by themselves be considered evidence of clinical effectiveness in humans.

Another important limitation concerns the directly relevant four-herb cream formulation. The available source does not clearly report the individual quantities of Neem, Tulsi, Aloe vera and Turmeric extracts incorporated into the final product. This lack of information limits exact reproduction of the formulation.

The literature also includes several different topical dosage forms, including creams, gels, emulgels and nanogels. Results obtained from one type of dosage form should therefore not automatically be transferred to another because the vehicle can substantially influence performance.

Variation in the phytochemical composition of plant materials represents another challenge. Standardization is therefore important if reproducible formulation and meaningful comparison between studies are intended.

Finally, satisfactory properties of individual herbal extracts do not necessarily ensure that their combination will remain stable, safe or effective. The final polyherbal cream must itself be evaluated for formulation compatibility, stability, microbial quality and skin irritation.

18. FUTURE PERSPECTIVES

Future development of the Neem–Tulsi–Aloe vera–Turmeric polyherbal cream should give particular attention to reproducibility and standardization. Botanical identity and authentication should be established before processing, and the drying and extraction procedures should be controlled consistently.

Marker-based standardization may be investigated using representative constituents from each botanical. Possible markers include selected Neem limonoids, phenolic or volatile Tulsi constituents, Aloe polysaccharides and Turmeric curcuminoids.

Comparative investigations of extraction procedures could also determine whether higher extraction yield is accompanied by greater phytochemical content or biological activity. Optimization of the concentration of each extract may further assist in identifying a suitable proportion of the four herbal components.

After formulation, the finished cream should undergo systematic physicochemical evaluation, stability assessment and microbial examination. Where appropriate, studies addressing skin irritation and compatibility may also be undertaken.

More advanced analytical techniques could be used to characterize both the individual extracts and the final formulation. Such characterization would help clarify the relationship between extraction conditions, phytochemical composition and formulation performance.

Future research should also maintain a clear distinction between traditional medicinal use, laboratory evidence, formulation findings and clinical evidence. Keeping

these categories separate would provide a stronger scientific basis for further development of the polyherbal cream.

19. ADVANTAGES OF THE POLYHERBAL APPROACH

A polyherbal formulation offers the possibility of bringing several botanicals with different phytochemical profiles into a single convenient dosage form. In the present case, the four selected plants possess distinct reported characteristics that may complement one another.

From a practical perspective, one cream can deliver several plant-derived ingredients in a single topical preparation. Aloe vera may contribute to moisturizing and sensory characteristics, while Neem, Tulsi and Turmeric provide additional phytochemical diversity and biological properties that have been investigated in topical research.

The polyherbal approach also provides an opportunity to study how different extraction procedures and botanical materials behave within one semisolid dosage system.

However, combining several herbs should not automatically be interpreted as evidence of superiority over individual preparations. Comparative experimental studies are required before concluding that the combined formulation provides a meaningful advantage over creams containing individual botanical ingredients.

CONCLUSION

The reviewed literature indicates that Neem, Tulsi, Aloe vera and Turmeric represent botanically and chemically diverse medicinal plants with properties of interest for topical pharmaceutical and cosmetic development. Neem and Tulsi have been investigated extensively in relation to antimicrobial and antioxidant activity, Aloe vera has attracted attention for moisturizing, soothing and skin-supportive characteristics, and Turmeric has been widely studied for antioxidant, anti-inflammatory and antimicrobial potential.

The extraction stage is particularly important in developing a formulation based on these botanicals. The literature reviewed here demonstrates considerable variation in the techniques used, ranging from mechanical recovery of Aloe vera gel and hot-water extraction of Aloe mucilage to methanolic and ethanolic extraction, Soxhlet procedures and maceration. Since these processes can yield materials with different compositions, the resulting extracts should not be considered interchangeable.

A formulation study directly relevant to the proposed combination describes incorporation of Neem, Aloe vera, Turmeric and Tulsi extracts into a semisolid cream containing liquid paraffin, beeswax, borax, methylparaben and distilled water. A significant limitation of the available formulation report is that the individual quantities of the four herbal extracts are not clearly specified. These proportions should therefore be established experimentally rather than assumed.

Systematic evaluation is essential for determining the quality of the final polyherbal cream. Parameters including organoleptic characteristics, homogeneity, pH, viscosity, spreadability, emulsion type, after-feel, smear behaviour, washability, centrifugation response, spectrophotometric characteristics, accelerated stability and microbial quality provide a useful framework for characterization.

Overall, the available literature provides a reasonable scientific and formulation basis for further investigation of a Neem–Tulsi–Aloe vera–Turmeric polyherbal cream. Nevertheless, additional research is required to establish standardized extraction procedures, optimize the concentration of individual herbal materials, improve formulation reproducibility, determine storage stability and generate stronger biological and clinical evidence. Development of the formulation should consequently follow a systematic pathway involving authenticated plant materials, controlled extraction, formulation optimization, physicochemical characterization and appropriate safety and efficacy assessment

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