World Journal of Pharmaceutical and Life Sciences

www.wjpls.org

Impact Factor: 8.21 Coden USA: WJPLA7

A REVIEW OF FORMULATION AND EVALUATION OF ANTI MICROBIAL CREAM USING DIFFERENT PLANT EXTRACT

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How to cite this Article: Dr. Alinda Thomaseena*[1], A. Yamuna[2], M. Ramya[3], M. Suresh[4]. (2026). A Review of Formulation and Evaluation Of Anti Microbial Cream Using Different Plant Extract. World Journal of Pharmaceutical and Life Sciences, 12(8), 32–44.

Article Received on 05/07/2026 **Article Revised on 25/07/2026** **Article Published on 01/08/2026**

ABSTRACT

Herbal antimicrobial creams have gained considerable importance in recent years due to the increasing demand for natural and safer therapeutic alternatives to synthetic drugs. Traditionally, antibiotics were primarily derived from microorganisms, whereas many chemotherapeutic agents have originated from plant sources. Herbal medicine involves the use of different parts of plants such as leaves, roots, stems, bark, seeds, and flowers for medicinal purposes. These plant materials are rich in bioactive constituents including flavonoids, alkaloids, tannins, saponins, glycosides, phenolic compounds, and terpenoids, which are known to exhibit a wide range of pharmacological activities, particularly antimicrobial effects. The increasing prevalence of antimicrobial resistance, coupled with the adverse effects associated with prolonged use of synthetic antimicrobial agents, has accelerated the interest in plant-based formulations. Topical drug delivery systems play a crucial role in the management of skin infections, as they provide direct application of therapeutic agents to the affected area. Among these systems, creams are widely used due to their semisolid nature, occlusive properties, and ability to enhance drug penetration through the skin. Cream form a protective layer over the skin, preventing moisture loss and promoting healing of infected or damaged tissues. The prolonged contact time offered by cream ensures sustained release of active ingredients, thereby improving therapeutic efficacy. Herbal antimicrobial creams are particularly beneficial in treating skin infections, wounds, burns, and dermatological disorders caused by microbial pathogens.

The formulation of herbal antimicrobial cream involves several critical steps, including selection of plant materials, extraction of active constituents, evaluation of antimicrobial activity, and incorporation into a suitable cream base. In the present study, ethanolic extraction was employed due to its efficiency in extracting a wide range of phytochemicals. The plant materials were collected, washed, shade-dried, and powdered to increase the surface area for extraction. The powdered material was subjected to cold maceration using ethanol as the solvent for a specific period, followed by filtration and concentration of the extract using evaporation techniques. The resulting extract was rich in active phytoconstituents responsible for antimicrobial activity.

To evaluate the antimicrobial potential, different combinations of plant extracts were prepared in varying ratios. The antimicrobial activity of these combinations was assessed using the agar well diffusion method, which is a widely accepted technique for screening antimicrobial agents. In this method, wells are created in agar plates inoculated with test microorganisms, and the extracts are introduced into the wells. After incubation, the zones of inhibition are measured to determine the effectiveness of the extracts. The microorganisms used in the study included common pathogens such as *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella* species, which are frequently associated with skin infections.

The results indicated that the antimicrobial activity varied depending on the ratio of the extracts used. Certain combinations exhibited enhanced activity, suggesting a synergistic interaction between the phytoconstituents present in different plant extracts. The most effective combination was selected based on the

largest zone of inhibition and further evaluated to determine its minimum inhibitory concentration (MIC). The MIC represents the lowest concentration of the extract required to inhibit visible growth of microorganisms and serves as an important parameter in assessing antimicrobial potency.

In addition to combination studies, individual plant extracts such as *Psidium guajava* leaves were evaluated for their antimicrobial activity. *Psidium guajava*, belonging to the family Myrtaceae, is a well-known medicinal plant with documented antibacterial and antifungal properties. The leaves were processed and extracted using ethanol, yielding 53.4% w/w extract. The antimicrobial activity of the extract was tested against a range of microorganisms including *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, *Candida albicans*, and *Aspergillus niger*.

The extract demonstrated significant antibacterial activity at a concentration of 3.125 mg/ml, with zones of inhibition ranging from 6 to 19 mm. It also showed antifungal activity against *Candida albicans* at higher concentrations but did not exhibit activity against *Aspergillus niger*. These results highlight the selective antimicrobial activity of the plant extract and its potential for use in topical formulations.

The formulation of herbal antimicrobial ointment was carried out using suitable cream bases. Cream bases play a critical role in determining the release and absorption of active ingredients. They are generally classified into hydrocarbon bases, absorption bases, waterremovable bases, and water-soluble bases. Hydrocarbon bases such as white soft paraffin provide excellent occlusion and are commonly used in cream formulations. Absorption bases have the ability to incorporate water, while water-removable bases are easily washable and cosmetically acceptable. Water-soluble bases are non-greasy and suitable for certain applications.

In this study, the cream base was prepared using appropriate excipients such as paraffin, wool fat, and emulsifying agents. The active extracts were incorporated into the base by trituration to ensure uniform distribution. The final formulation was smooth, homogeneous, and free from grittiness, indicating good quality.

The prepared creams were evaluated for various physicochemical properties. The pH of the formulation was maintained within the acceptable range to ensure compatibility with the skin and prevent irritation. The viscosity of the cream was measured to determine its consistency and spreadability. Adequate viscosity is essential to ensure that the cream remains at the site of application for a sufficient period. Spreadability was evaluated to assess the ease of application, which is an important factor for patient compliance. The formulations showed good homogeneity and were free from phase separation, indicating stability.

Stability studies were conducted under different conditions to evaluate the shelf life of the creams. The formulations were stored at various temperatures and humidity conditions, and their physical and chemical properties were monitored over time. The creams remained stable for a period of three months, with no significant changes in color, odor, or consistency.

The antimicrobial activity of the formulated creams was evaluated using agar diffusion techniques. The results showed that the creams exhibited effective antimicrobial activity against bacterial strains and moderate activity against fungal strains. However, the activity was slightly lower compared to crude extracts, which may be due to the slower release of active constituents from the ointment base.

Further studies involving *Azadirachta indica* and *Aloe vera* extracts demonstrated significant antimicrobial potential. Neem extract showed strong activity against Gram-positive bacteria, while Aloe vera exhibited notable antifungal activity. The combination of these extracts resulted in enhanced antimicrobial activity, indicating a synergistic effect. The cream containing equal proportions of neem and aloe vera extracts showed the best results among the formulations.

The antimicrobial mechanism of herbal creams is attributed to the presence of phytoconstituents that act through multiple pathways. These include disruption of microbial cell membranes, inhibition of protein synthesis, interference with nucleic acid synthesis, and inhibition of metabolic pathways. The complex composition of plant extracts reduces the likelihood of resistance development, making herbal formulations a promising alternative to synthetic drugs.

Despite their advantages, herbal antimicrobial creams face certain challenges such as variability in plant composition, lack of standardization, and stability issues. The concentration of active constituents may vary depending on factors such as geographical location, harvesting time, and extraction method. Therefore, standardization of herbal extracts is essential to ensure consistent quality and efficacy.

Future research in this field should focus on the development of advanced formulations incorporating nanotechnology and novel drug delivery systems to enhance the bioavailability and therapeutic effectiveness of herbal creams. Techniques such as nanoemulsions, liposomes, and solid lipid nanoparticles may improve the penetration of active constituents through the skin and provide controlled release.

In conclusion, herbal antimicrobial creams represent a promising and effective approach for the treatment of

skin infections. The use of plant-based extracts such as *Psidium guajava*, *Azadirachta indica*, and *Aloe vera* has demonstrated significant antimicrobial activity and potential for formulation into stable creams. These formulations offer advantages such as reduced side effects, improved safety, and lower risk of antimicrobial resistance. With further research and development, herbal antimicrobial creams can play a significant role in modern dermatological therapy and provide a sustainable alternative to conventional treatments.

1. INTRODUCTION

The skin is the largest organ of the human body and acts as a protective barrier against environmental pollutants, pathogens, ultraviolet radiation, and chemical substances.[1] Due to constant exposure to microorganisms, the skin is highly susceptible to infections caused by bacteria, fungi, and viruses.[2] Common skin infections include acne, boils, dermatitis, fungal infections, wounds, burns, and eczema.[3] The increasing prevalence of antimicrobial resistance and side effects associated with synthetic drugs has created a growing interest in herbal medicines and plant-based topical formulations.[4-6]

Medicinal plants have been used since ancient times in traditional systems of medicine such as Ayurveda, Siddha, Unani, and Traditional Chinese Medicine for the treatment of various diseases.[7] Plants contain numerous bioactive constituents including alkaloids, flavonoids, tannins, terpenoids, glycosides, saponins, and phenolic compounds, which exhibit antimicrobial, anti-inflammatory, antioxidant, and wound healing properties.[8-10] Herbal formulations are generally considered safer, economical, eco-friendly, and more acceptable to patients compared to synthetic formulations.[11]

Among various topical dosage forms, creams are widely used because of their ease of application, patient compliance, spreadability, and ability to deliver active ingredients directly to the site of infection.[12] Antimicrobial creams prepared from medicinal plant extracts are increasingly gaining importance due to their therapeutic effectiveness and reduced adverse effects.[13] Herbal creams can provide localized treatment, minimize systemic absorption, and improve skin hydration and healing.[14]

Different medicinal plant varieties possess varying degrees of antimicrobial activity depending on their phytochemical composition. Plants such as Azadirachta indica, Aloe vera, Curcuma longa, Ocimum sanctum, and Calendula officinalis are well known for their antimicrobial and wound-healing properties. These plants are rich in active phytoconstituents capable of inhibiting the growth of pathogenic microorganisms such as Staphylococcus aureus, Escherichia coli infection, Pseudomonas aeruginosa infection, and Candida albicans[15] infection.

The formulation of antimicrobial herbal cream involves the incorporation of plant extracts into a suitable cream base containing excipients such as emulsifying agents, preservatives, humectants, and stabilizers. The selection of appropriate excipients plays a crucial role in ensuring the stability, consistency, spreadability, and therapeutic efficacy of the cream. Evaluation parameters such as pH, viscosity, spreadability, homogeneity, washability, extrudability, stability, and antimicrobial activity are essential to determine the quality and effectiveness of the formulation.[16]

The present study focuses on the formulation and evaluation of antimicrobial creams prepared from different medicinal plant varieties. The study aims to compare the antimicrobial potential of various plant extracts and identify the most effective formulation for topical application. Such herbal creams may serve as promising alternatives to synthetic antimicrobial agents and contribute to the development of safer and more effective dermatological preparations.

1.1 BACKGROUND OF HERBAL MEDICINE

Herbal medicine refers to the use of plants and plant-derived materials for therapeutic purposes. Since ancient times, medicinal plants have played a vital role in healthcare systems worldwide. According to the World Health Organization, nearly 80% of the global population depends on traditional herbal medicines for primary healthcare needs.[17]

The therapeutic potential of medicinal plants is mainly due to the presence of secondary metabolites such as:

- Alkaloids
- Flavonoids
- Tannins
- Terpenoids
- Glycosides
- Phenolic compounds
- Essential oils

These compounds possess antimicrobial, antioxidant, anti-inflammatory, antifungal, antiviral, and wound-healing activities.[18]

The emergence of multidrug-resistant microorganisms has increased the need for alternative antimicrobial agents. Herbal medicines are considered advantageous because they:

- Have fewer side effects
- Are biodegradable
- Are easily available
- Are cost effective
- Exhibit broad-spectrum activity

1.2 Types of Skin Infection

The skin acts as a physical and immunological barrier protecting the body from external agents. Skin infections occur when pathogenic microorganisms invade the skin tissue and cause various diseases.[19]

Bacterial Infections
- Impetigo
- Cellulitis
- Acne
- Folliculitis

Fungal Infections
- Ringworm
- Athlete's foot
- Candidiasis

Viral Infections
- Herpes simplex
- Warts

Parasitic Infections
- Scabies

Microorganisms commonly responsible for skin infections include
- Staphylococcus aureus
- Escherichia coli
- Pseudomonas aeruginosa
- Candida albicans.[20]

Antimicrobial creams are effective in treating such infections by directly acting on the infected area.

1.3 Herbal Creams
Creams are semisolid dosage forms intended for external application on the skin or mucous membranes. They may be oil-in-water (O/W) or water-in-oil (W/O) emulsions. and are widely used for topical drug delivery.[21]

Advantages of Creams
- Easy application
- Better patient compliance
- Good spreadability
- Rapid absorption
- Non-greasy nature
- Enhanced therapeutic effect

Advantages of Herbal Creams
- Reduced toxicity
- Natural healing action
- Skin nourishment
- Fewer allergic reactions
- Suitable for long-term use.[22]

Herbal antimicrobial creams are widely used for
- Wound healing
- Burns
- Acne treatment
- Fungal infections
- Skin irritation
- Inflammation

1.4 Medicinal Plants Used in Antimicrobial Creams
Medicinal plants such as neem, aloe vera, turmeric, and tulsi are widely used in herbal formulations due to their antimicrobial, anti-inflammatory, and wound-healing properties.[23]

Neem (Azadirachta)
Neem possesses strong antibacterial, antifungal, antiviral, and anti-inflammatory activities.[24] Active constituents include:
- Nimbidin
- Azadirachtin
- Quercetin

Neem extract is effective against Staphylococcus aureus and fungal pathogens.

Aloe vera
Aloe vera contains
- Aloin
- Aloe-emodin
- Vitamins
- Enzymes

It exhibits antimicrobial, moisturizing, anti-inflammatory, and wound-healing properties.

Turmeric (Curcuma longa)
Turmeric contains curcumin, a powerful antioxidant and antimicrobial agent. It helps:
- Reduce inflammation
- Prevent microbial growth
- Accelerate wound healing

Tulsi (Ocimum sanctum)
Tulsi contains
- Eugenol
- Ursolic acid
- Rosmarinic acid

It possesses antibacterial and antifungal properties.

1.5 Antimicrobial Activity of Plant Extracts
Plant extracts inhibit microbial growth through different mechanisms:
- Disruption of cell wall
- Inhibition of protein synthesis
- Damage to microbial DNA
- Alteration of membrane permeability.[25]

The antimicrobial activity depends upon
- Type of plant
- Extraction solvent
- Concentration of extract
- Nature of microorganisms

The agar well diffusion method is commonly used to evaluate antimicrobial activity.

1.6 Formulation of Herbal Antimicrobial Cream
The formulation process involves:
1. Preparation of plant extract
2. Selection of cream base
3. Mixing of oil and aqueous phases
4. Incorporation of extract

5. Homogenization.[26]

Table 1: Ingredients Used in Cream Formulation.

Ingredient	Function
Stearic acid	Emulsifying agent
Cetyl alcohol	Thickening agent
Beeswax	Stiffening agent
Liquid paraffin	Emollient
Glycerin	Humectant
Triethanolamine	Emulsifier
Methyl paraben	Preservative
Water	Vehicle

1.7 Evaluation of Antimicrobial Cream

Evaluation ensures quality, stability, safety, and effectiveness.

Physical Evaluation

- Color
- Odor
- Texture
- Appearance
- Homogeneity pH **Determination**

Ideal pH for skin preparations ranges between 5.5 and 7.[27]

Spreadability

$$S = \frac{M \times L}{T}$$

Where:

- S = Spreadability
- M = Weight applied
- L = Length moved
- T = Time taken

Viscosity

Determined using Brookfield viscometer.[27]

Extrudability

Measures ease of removal from tube.

Washability

Determines ease of washing from skin.

Stability Studies

Performed under different temperature conditions.[27]

1.8 Antimicrobial Evaluation

The antimicrobial activity is evaluated using:

- Agar well diffusion method
- Disc diffusion method
- Minimum inhibitory concentration (MIC)

The zone of inhibition indicates antimicrobial effectiveness.

1.9 Significance of the Study

This study is significant because:

- Herbal products are safer alternatives to synthetic drugs.
- Medicinal plants possess broad-spectrum antimicrobial activity.
- Herbal creams may reduce antibiotic resistance problems.
- Plant-based formulations are economical and eco-friendly.[28-29]

The research contributes to the development of effective herbal dermatological products.

1.10 Aim of the Study

To formulate and evaluate antimicrobial cream using extracts from different medicinal plant varieties.

1.11 Objectives of the Study

1. To prepare plant extracts.
2. To formulate antimicrobial cream.
3. To evaluate physicochemical properties.
4. To study antimicrobial activity.
5. To compare different formulations.[30]

Therapy with herbal drugs is an old tradition al medicine. Plants have been used over the years for the treatment of numerous health problems including infectious and noninfectious skin disorders. The antimicrobial effects of some plants were attributed to the number of phytochemical constituents like flavonoids, triterpenes and tannins1.

The use of conventional medications is often unsatisfactory for many patients with chronic skin disorders because of adverse effects and loss of effectiveness on long term uses2. Moreover, the development of drug resistance in human pathogens against commonly used antibiotics has necessitated a search for new antimicrobial substances from other sources.

Therefore, it has become necessary to search for an alternative safe, effective medicinal with little side effects. Ziziphus spina Crist leaves (ZSCL) family Rhamnaceae) is a well-known medicinal plant (Sidr), with leaves, roots, and bark being exploited in traditional medicine in Africa a, India and UAE 3. The leaves of ZSC are used in traditional medicine treating chest and stomach problems, hair and skin care4, 5. Moreover, The Quran mentioned the tree twice (LIII: 13–18; LVI: 28–32); In addition to Sunnah and is highly respected by the Muslims through the Middle East6. The lote tree is commonly identified as Z. spina-christi6. The antimicrobial properties of ZSCL have been previously investigated against E.Coli and P. aeroginosa7.

The plant is known to be active against wide spectrum of bacteria due to presence of flavonoids, saponins and phenolic compounds8. Several reports are available on the antimicrobial activity of plant extracts on human pathogenic bacteria9. use are being imposed11 and the search for natural antimicrobial as safe alternatives is

becoming critical. Skin problems are common among children12, and the development of new natural & safe therapeutic antimicrobial topical preparation is the plan of our study. The aim of the present study was to investigate antibacterial activity of aqueous extract of ZSCL, to formulate a natural, safe antibacterial cream and to evaluate its physicochemical properties and stability.

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Medias Nutrient agar was purchased from DEFCO Labodratories, USA, Peptone bacteriological from BDH Chemicals Ltd., England, Sabauraud dextrose agar and sheep red blood from OXOID Ltd., England, Staphylococcus aureus and Escherichia coli are the main pathogens that cause skin infections9.

Development of microbial resistance to antibacterial is a global concern. However, human and animal studies supported the toxic effect of synthetic chemicals10. Therefore, restriction on theirplant extracts on human pathogenic bacteria9. use is being imposed11 and the search for natural antimicrobial as safe alternatives is becoming critical.

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Whole plant of Aloe vera syn. Aloe barbadensis Mill., (Fam. Xanthorrhoeaceae), also known as Barbados or Curaçao Aloe, has been used in traditional and folk medicines for thousands of years to treat and cure a variety of diseases.

Although the plant is native to northern parts of Africa, it has rapidly spread across the world because its cultivation is easy. Aloe vera is the most biologically active of the Aloe species. More than 75 potentially active constituents have been identified in the plant.

Formulation of these extracts with antimicrobial

activities into semi solid dosage forms with suitable excipients is desirable in order to improve its stability, drug release, cosmetically acceptability among others for skin application.

The herbal cream formulation can be employed in the treatment of susceptible skin diseases. Various studies have been carried out on the phytochemical and medicinal uses of Azadirachta indica leaves and Aloe vera gel but there are limited studies on the formulation of a combination of these two extracts in varying concentrations as semi solid dosage forms.

The aim of this study is to evaluate the antimicrobial properties of ethanolic extract of dried fresh leaves of Azadirachta indica and Aloe vera gel and to formulate an effective antimicrobial cream using the ethanolic extract of both plants.

Creams that are used for medical purposes are usually semi solid or very viscous liquid emulsions that contain medicaments dissolved or dispersed in the emulsion and are meant to be used externally[31-32] [Barry, 1999; Okorie and Ofoefule, 2002].[31-32]

Medicated creams are preferred to ointments because they are usually less greasy, spread quickly and the inflamed tissues are soothed due to evaporation of water [Barry, 1999; Okorie and Ofoefule, 2002].

The incorporated medicament could be synthetic, semi synthetic or netural product. Natural products are predominantly obtained from plants, although animals and soil materials may also be used.

Plants contain wide range of chemical constituents that are of therapeutic importance. They contain a lot of secondary metabolites, and one plant may contain enormous spectrum of biologically salient active compounds[33] [Koteshwasr, 2017].

Infectious diseases despite the discovery of new antimicrobial agents still pose a great threat to humans with regards to morbidity and mortality, especially in developing countries[34] [Shehu et al., 2016].

This may be due to poor access to drugs in developing countries, limited spectrum of activity, side effects, irrational use of these antibiotics and the emergence of multidrug resistant strains of bacteria, virus, and fungi[35] [Ofokansi et al., 2013].

This has led to the search for new, safe, alternative and more effective antimicrobial agents especially from natural sources[34] [Shehu et al., 2016].

Medicinal plants have been identified and used throughout human history and have recently found its way as a drug source or lead in modern medicine since they are termed to act by stimulating and supplementing the body's healing forces.

Vast arrays of antimicrobial substances are present in plants and have remained, hitherto unexplored. Antimicrobials of plant origin have enormous therapeutic potential.

They are effective in the treatment of infectious diseases as well as ameliorating some of the untoward effects that are often associated with synthetic antimicrobials [Ofokansi et al., 2013; Hossain et al., 2014; Chen et al., 2016; Shehu et al., 2016; Ordu et al., 2018].

These active substances from plants are isolated as crude extracts, purified and incorporated into the desired dosage forms. Vernonia ambigua Kotschy and Peyr is called Orungo by the Yorubas and Tabtaba/Tattaba by the Hausas in Nigeria.

It is used traditionally as remedies for cough and fever. It belongs to the family Asteraceae. It is an annual herb that grows up to 65 cm high, occurring throughout the drier parts of tropical West Africa.

It has a green erect stem that is very hairy (long and dense). It grows as a weed in Nigeria, and it is of no economic importance[36] [Kunle and Egharevba, 2009].

The antimalarial potential of the plant has been evaluated [Builders et al, 2011].

A study conducted using decoction from the whole plant showed that it contains alkaloids, flavonoids, tannins, saponins, sterols, phenols and reducing sugars and a moderate antioxidant activity[36-37] [Builders et al, 2011; Kunle et al, 2010].

Man has utilized medicinal plants as remedies for several human diseases for centuries. Herbal medicines are used as antibacterial, anticonvulsant, antifungal, antioxidant, antidiabetic, antiulcer, anti-inflammatory and antimicrobials. In traditional medicine, one plant can be used to treat several diseases.

Psidium guajava has been used in the treatment of various ailments including treatment of diabetes, treatment of plague, treatment of acne, oral care.

Its anti-cancer activity, anti-microbial activity, anti-amoebic and anti-malarial effects, as well as antioxidant activities have been documented.

Psidium guajava L is a medicinal plant that belongs to the family Mytaceace. It is also known as guava., It is an ever-green shrub like tree which reaches to the height of 6-25 feet.

It is widely distributed in tropical and warm temperature regions of the world. The plant parts include leaves, flowers, fruit, seeds, bark.21 The antimicrobial uses of

Psidium guajava have been studied by many researchers.19-24 Creams are semi-solid dosage forms.

The results of the phytochemical screening and antibacterial activities of Vernonia ambigua, Vernonia blumeoides and Vernonia oocephala (Astraceae) showed the presence of steroids/terpenes, saponins, flavonoids, alkaloids, tannins and glycosides.

The antibacterial activity was concluded to probably be due to the presence of flavonoids, saponins or sesquiterpene lactones[38] [Aliyu et al., 2011]

The use of plant materials for medical purposes, such as seeds, berries, roots, leaves, bark, or flowers, is known as herbal medicine, sometimes known as botanical medicine or phytochemical.

To live a healthy life free from illness and as reliable sources of medication in the conventional healthcare system, medicinal plants are nature's gift to humans.

Nearly a quarter of all medications contain plant components. Long before recorded history, the plants were employed for medical purposes, and traditional medicine is still used widely today.

According to archaeological evidence, people have been using medicinal herbs at least since the Paleolithic, around 60,000 years ago.

Traditional herbal remedies, which have been used to treat illnesses all throughout the world, are made from naturally derived plant materials that have undergone technological processing.

The pharmaceutical term Emulsion is defined as a thermodynamic-ally unstable system consisting of at least two immiscible liquids, one dispersed as fine spheres, known as the dispersed or internal phase, and the other phase known as the continuous or external phase.

The system is stabilized by adding a third substance known as an emulsifier, which stabilizes the emulsion by forming a thin layer around the disperse phase and by increasing the viscosity of continuous phase.

Stable emulsions are excellent and interesting vehicles for the delivery of active substances from natural and synthetic sources and offer promising applications in various fields due to the complete protection of the active substance in the internal phase.

The cosmetic and toiletry formulation market is growing based on herbs globally. Apart from traditionally documented applications, some modern trials have also established the utility of herbs in personal care products.

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 “Herbal Cosmetics”.

The demand of herbal medicines is increasing rapidly due to their lack of side effects (Gediya et al., 2011). World Health Organization (WHO) notes that 74% of the plant derived medicines are used in modern medicine, in such a way that their modern application directly correlates with their traditional use as herbal medicines by native cultures (Kumar et al., 2003). The natural content in the herbs does not have any side effects on the human body; instead enrich the body with nutrients and other useful minerals.[39-40]

The plants possess a vast and complex arsenal of active ingredients (photochemical) not only able to calm or smooth the skin, but also actively restore, heal and protect the skin as it is obvious by scientific literatures[41] (Patel et al., 2013).

There are large numbers of medicinal plants which are widely used in the treatment of skin diseases and possessed antimicrobial activity.

However, plants are very complex in their compositions, and their therapeutic activity depends on their major active chemical constituents.

Also, improper authentication of herbs, adu lterations by microorganism, and pesticide residue, has made standardization of herbal drug of primary importance.

Thus, before using these medicinal herbs in any formulation, their authentication is necessary.

This study was made to develop herbal skin care for mulation for antimicrobial action against various selected microorganisms like Staphylococcus aureus which are associated with localized skin infection, Escherichia coli, Bacillus subtilis, Aspergillus niger and Penicillium chrysogenum.

The skin care formulation consists of Azadirachta indica leaves, Glycyrrhiza glabra roots and Piper betle leaves and these herbs have been selected based on a traditional system and scientific justification with modern uses.

This study was expanded by obtaining ethanolic extracts of selected herbs, to test these plants for their main active constituents and then to incorporate these extracts into cosmetic formulations for skin care.

The formulations were also checked for their antimicrobial activities. Endeavors were also made to determine the physicochemical stabilities of formulations by assessing their organoleptic characteristics over time, thereby verifying the antimicrobial efficacy of these extracts against selected microbial strains.

This herbal skin care formulation (semisolid cosmetic cream) can give effective protection to skin and free from any toxicity (paraben free, alcohol free) or toxic residue or any irritation when regularly used and should also be cosmetically acceptable.

Herbal medicine, also called botanical medicine or phytomedicine, refers to the use of any plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes.

Long practiced outside of conventional medicine, herbalism is becoming more mainstream as up-to-date analysis and research show their value in the treatment and prevention of disease.

Recently, the World Health Organization estimated that 80% of people worldwide rely on herbal medicines for some aspect of their primary healthcare.

Plant drugs are frequently considered to be less toxic and freer from side effects than the synthetic ones. Along with other dosage forms, herbal drugs are also formulated in the form of ointment and creams. Medicated ointments contain a medicament dissolved, suspended or emulsified in the base.

Ointments are used topically for several purposes, example, as protectants, antiseptics, emollients, antipruritic, keratolytics and astringents.

Ointment bases are almost always anhydrous and generally contain one or more medicaments in suspension or solution or dispersion. Ointment bases may be hydrocarbon (oleaginous), absorption, water removable and water-soluble type.

The delivery of drugs through the skin has long been a promising concept because of the ease of access, large surface area, vast exposure to the circulatory and lymphatic networks and noninvasive nature of the treatment.

Mangifera indica (MI), also known as mango, has been an important herb in the Ayurvedic and indigenous medical systems for over 4000 years.

MI *Linn* (L.) belongs to the family Anacardiaceae; the tree is a native of tropical Asia and is indigenous to the Indian subcontinent, though it is now completely naturalized in many parts of the tropics and subtropics.

According to Ayurveda, varied medicinal properties are attributed to different parts of the mango tree. The presence of phytoconstituents in the leaf and seed extracts may be responsible for the antibacterial activity of the plant.

There are scanty reports on the activity of MI in the form of herbal ointment preparation to the best of the authors' knowledge.

The objective of the study was to formulate and evaluate the antimicrobial herbal ointment and cream from extracts of the seeds of mango (MI L.).

A medicinal plant is any plant, which one or more of its organs are contains substances that can be used for therapeutic purposes, or which are precursors for chemo pharmaceutical semi synthesis.

When a plant is designated as medicinal, it is implied that the plant is useful as a drug or therapeutic agent or as an active ingredient of a medicinal preparation.

The plant product or natural products show an important role in diseases prevention and treatment through the enhancement of antioxidant activity, inhibition of bacterial growth, and modulation of genetic pathways.

The therapeutics role of number of plants in diseases, management is still being enthusiastically researched due to their less side effect and affordable properties.

It has been accepted that drugs based on allopathy are expensive and exhibit toxic effect on normal tissues and on various biological activities. It is a largely accepted fact that numerous pharmacologically active drugs are derived from natural resources including medicinal plants.

Plants have been used in medicines since time immemorial. India has a rich heritage of using medicinal plants in traditional medicines, as in the Ayurveda, siddha and Unani systems besides folklore practices.

The plant kingdom is a virtual goldmine of biologically active compounds, and it is estimated that only 10-15% of existing species of higher plants have been surveyed.

Many plants have been successfully used in the treatment of various diseases. The ancient record is evidencing their use by Indian, Chinese, Egyptian, Greek, Roman, and Syrian dates to about 5000 years.

History of Argemone Mexicana plant and it Availability Meaning of the name Argemone -argots means white spot, eye cataract, which the plant was believed to cure; mexicana -from Mexico.

The Papaveraceae family consists of annual or perennial herbaceous plants; they can grow in sunny and open environments. This group of plants is composed of approximately 45 genera with more than 400 species commonly distributed in different points of the Northern Hemisphere.

Papaveraceae family is included phylogenetically in a group known as "psychoactive families" because of it includes representative plants like Papaver somniferum

L., "adormidera"; alkaloids such as morphine and heroin have been extracted from them, on the other hand these plants can be cultivated as ornamental plants.

Argemone is a genus of flowering plants in the family Papaveraceae. It contains 30-32 species, commonly known as "Prickly Poppies" all with prickly stems, leaves and capsules.

Antibacterial activity is the ability of a substance to inhibit or kill bacterial cells. Different types of antibiotics and chemotherapeutic agents are being used in the treatment of one form of disease or the other.

Most of these antibiotics were originally derived from micro-organisms while the chemotherapeutic agents are from plants. However, nowadays these antibiotics and chemotherapeutic agents are obtained by various synthetic processes (Reiner, 1984). Nepal is richly blessed with forests containing arrays of different herbs, shrubs and trees.

The leaves, stems, bark and roots of these plants are being used by the local populace and people with thin income for incurring different types of ailments because of the inadequate medical facilities across the country[42] (Sule and Agbabiaka, 2008).

Herbal medicine, also called botanical medicine or phytomedicine, refers to the use of any plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Long practiced outside of conventional medicine, herbalism is becoming more mainstream as up-to-date analysis and research show their value in the treatment and prevention of disease.

Plants had been used for medicinal purposes long before recorded history. Indigenous cultures (African and Native American) used herbs in their healing rituals, while others developed traditional medical systems (Ayurveda and Traditional Chinese Medicine) in which herbal therapies were used systematically.

Scientists found that people in different parts of the globe intended to use the same or similar plants for the same purposes. Recently, the World Health Organization estimated that 80% of people worldwide rely on herbal medicines for some aspect of their primary healthcare.

For most herbs, the specific ingredient that causes a therapeutic effect is not known. Whole herbs contain many ingredients, and it is likely that they work together to produce the desired medicinal effect. Herbalists prefer using whole plants rather than extracting single components from them.

Whole plant extracts have many components. These components work together to produce therapeutic effects and to lessen the chances of side effects from any one component. Several herbs are often used together to enhance effectiveness and synergistic actions and to reduce toxicity[43] (Hawkins and Ehrlich, 2007).

Traditional medicine is an important source of potentially useful new compounds for the development of chemotherapeutic agents. The first step towards this goal is the screening of plants used in popular medicine.

Thus, antimicrobial research is geared towards the discovery and development of novel antibacterial and antifungal agents. Plant drugs are frequently considered to be less toxic and freer from side effects than the synthetic ones (Momin, 1987). Along with other dosage forms, herbal drugs are also formulated in the form of ointment.[44]

An ointment is a viscous semisolid preparation used topically on a variety of body surfaces. These include the skin and the mucus membranes of the eye, vagina, anus, and nose. An ointment may or may not be medicated.

Medicated ointments contain a medicament dissolved, suspended or emulsified in the base. Ointments are used topically for several purposes, e.g. as protectants, antiseptics, emollients, antipruritic, keratolytics and astringents.

Ointment bases are almost always anhydrous and generally contain one or more medicaments in suspension or solution or dispersion. Ointment bases may be hydrocarbon (oligeanous), absorption, water removable and water-soluble type.

Based on their level of action, they are classified as: epidermatic, endodermatic and diadermatic (Carter, 1987). An antiseptic ointment is aimed to destroy or inhibit the growth of bacteria.[45]

In an earlier study, medicinal plants have been reported to be very beneficial in wound care, promoting the rate of wound healing with minimal pain, discomfort, and scarring to the patient (Odimegwu et al., 2008). The objective of the study was to formulate and evaluate the antimicrobial herbal ointment from the local medicinal[46]

The increasing prevalence of microbial infections and the growing resistance of pathogenic microorganisms to conventional antibiotics have become major global health concerns. Infectious diseases caused by bacteria, fungi, and other microorganisms continue to affect millions of people worldwide, leading to significant morbidity and mortality.

The misuse and overuse of synthetic antimicrobial drugs have contributed to the emergence of multidrug-resistant microbial strains, thereby reducing the effectiveness of existing therapeutic agents. As a result, there is an urgent need to explore alternative and safer antimicrobial agents derived from natural sources. Medicinal plants have gained considerable attention in recent years because of

their therapeutic potential, easy availability, lower side effects, and cost-effectiveness.

Traditional systems of medicine such as Ayurveda, Siddha, and Unani have long utilized plant-based preparations for the treatment of skin infections, wounds, burns, and inflammatory conditions. Plant extracts contain a wide range of bioactive compounds including alkaloids, flavonoids, tannins, terpenoids, glycosides, phenols, and essential oils that possess significant antimicrobial activity against various pathogenic microorganisms.

Topical drug delivery systems such as creams are widely used in the treatment of skin infections because they provide localized action, reduce systemic side effects, and improve patient compliance. Antimicrobial creams are semisolid formulations designed to deliver active ingredients directly onto the skin for the prevention or treatment of microbial infections.

Cream formulations offer several advantages including ease of application, rapid absorption, soothing effect, and enhanced spreadability. In recent years, herbal creams containing plant extracts have become increasingly popular due to consumer preference for natural and herbal products.

Herbal antimicrobial creams are considered safer alternatives to synthetic formulations because they are generally non-toxic, biodegradable, and less likely to produce adverse reactions. The incorporation of medicinal plant extracts into cream bases not only enhances therapeutic efficacy but also improves the stability and cosmetic acceptability of the formulation.

Different plant varieties possess varying degrees of antimicrobial activity depending on their phytochemical composition, geographical distribution, environmental conditions, and extraction methods. Many medicinal plants such as neem, turmeric, aloe vera, tulsi, tea tree, and eucalyptus have been extensively studied for their antimicrobial properties.

Neem (*Azadirachta indica*) is known for its broad-spectrum antibacterial and antifungal activities due to the presence of compounds like nimbidin and azadirachtin.

Turmeric (*Curcuma longa*) contains curcumin, a potent bioactive constituent with antimicrobial, anti-inflammatory, and antioxidant properties. Aloe vera is widely used for its wound healing and soothing effects, while tulsi (*Ocimum sanctum*) possesses strong antibacterial and antifungal activities attributed to eugenol and other phenolic compounds. The combination of different plant extracts in a cream formulation may produce synergistic effects, thereby enhancing antimicrobial efficacy against pathogenic microorganisms.

The present study focuses on the formulation and evaluation of antimicrobial cream using extracts obtained from different plant varieties. The study aims to investigate the antimicrobial potential of selected medicinal plants and to develop an effective topical cream formulation with desirable physicochemical properties and enhanced antimicrobial activity.

By comparing different plant varieties, the research also seeks to identify the most effective plant source for the preparation of herbal antimicrobial cream. The findings of the study may contribute to the development of safe, effective, and economical herbal formulations for the management of microbial skin infections and related disorders.

2. FINDINGS AND DISCUSSION

The present review, based on the collection and analysis of multiple published research studies, demonstrates that herbal antimicrobial ointments possess significant therapeutic potential in the treatment of skin infections. The compiled data clearly indicate that a wide variety of medicinal plants exhibit notable antimicrobial activity against common skin pathogens.

Among the studied plants, Psidium guajava, Azadirachta indica, Aloe vera, and other medicinal species showed strong inhibitory effects against both Gram-positive and Gram-negative bacteria. It was consistently observed that Gram-positive bacteria, particularly Staphylococcus aureus, were more susceptible to plant extracts compared to Gram-negative organisms. This difference in susceptibility may be attributed to the structural complexity of the outer membrane in Gram-negative bacteria, which acts as a barrier to many phytochemicals.

The antimicrobial activity of plant extracts is mainly due to the presence of bioactive phytoconstituents such as flavonoids, tannins, alkaloids, phenolic compounds, and terpenoids. These compounds exert their effects through multiple mechanisms, including disruption of microbial cell membranes, inhibition of enzyme activity, interference with protein synthesis, and damage to nucleic acids. The presence of multiple active compounds in a single plant extract contributes to its broad-spectrum antimicrobial activity and reduces the likelihood of resistance development.

Extraction methods were found to play a crucial role in determining the effectiveness of plant extracts. Ethanolic extraction yielded higher concentrations of active constituents and demonstrated superior antimicrobial activity compared to aqueous extraction. The polarity of ethanol allows it to dissolve a wide range of phytochemicals, thereby enhancing the overall efficacy of the extract.

Another important finding from the collected studies is the synergistic effect observed when different plant

extracts are combined. Combinations of extracts, such as Azadirachta indica and Aloe vera, showed enhanced antimicrobial activity compared to individual extracts. This suggests that the interaction between different phytoconstituents can lead to improved therapeutic outcomes.

The formulation of herbal antimicrobial ointments was found to significantly influence the delivery and effectiveness of the active compounds. Ointment bases such as hydrocarbon and absorption bases provided good occlusion and increased the residence time of the formulation on the skin. This prolonged contact enhances drug absorption and improves therapeutic efficacy. However, it was also observed that the release of active compounds from the ointment base is slower compared to crude extracts, which may slightly reduce the observed antimicrobial activity in vitro.

Physicochemical evaluation of the formulated ointments revealed that most formulations exhibited acceptable properties, including appropriate pH, viscosity, spreadability, and homogeneity. These parameters are essential for ensuring patient compliance and effective topical application. Stability studies indicated that the formulations remained stable under different storage conditions, with no significant changes in color, odor, or consistency.

Microbiological evaluation using agar well diffusion and minimum inhibitory concentration methods confirmed that the formulated ointments retained antimicrobial activity against selected microorganisms. The zones of inhibition observed for the formulations were slightly lower than those of crude extracts, which can be attributed to the controlled release of active ingredients from the base.

Fungal pathogens such as Candida albicans showed moderate sensitivity to herbal extracts, whereas Aspergillus niger was generally more resistant. This suggests that herbal formulations may be more effective against bacterial infections than certain fungal infections, although further optimization may improve antifungal efficacy.

Despite the promising results, several challenges were identified. Variability in plant composition due to environmental factors, geographical location, and harvesting conditions may affect the consistency of the extracts. Additionally, the lack of standardization in extraction and formulation methods makes it difficult to compare results across different studies.

Overall, the findings from this review strongly support the potential of herbal antimicrobial ointments as effective topical therapeutic agents. The combination of traditional knowledge and modern pharmaceutical techniques provides a promising approach for developing safe, effective, and affordable treatments for skin infections.

3. CONCLUSION

In conclusion, this review of collected research studies demonstrates that herbal antimicrobial ointments are promising alternatives to conventional synthetic formulations for the treatment of skin infections. Medicinal plants such as *Psidium guajava*, *Azadirachta indica*, and *Aloe vera* possess significant antimicrobial properties due to their rich phytochemical composition.
The findings indicate that herbal extracts exhibit effective activity against a wide range of pathogenic microorganisms, and their incorporation into ointment bases results in stable, safe, and patient-friendly formulations. The use of combination extracts further enhances antimicrobial efficacy through synergistic interactions.

Herbal antimicrobial ointments offer several advantages including reduced side effects, lower risk of resistance development, cost-effectiveness, and eco-friendliness.

However, challenges such as variability in plant composition, lack of standardization, and formulation limitations need to be addressed through further research.

Future studies should focus on standardization of plant extracts, optimization of formulation techniques, and incorporation of advanced drug delivery systems to improve bioavailability and therapeutic effectiveness. Clinical studies are also required to validate the efficacy and safety of these formulations in human subjects.

Overall, the integration of herbal medicine with modern pharmaceutical science provides a valuable opportunity for the development of novel, safe, and effective antimicrobial therapies for dermatological applications.

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