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To Study Herbal Medicine - A Review

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Abstract : *Maintaining proper hand hygiene is one of the most important measures for preventing the transmission of harmful microorganisms and reducing the risk of infectious diseases. Hands frequently come into contact with contaminated surfaces, objects and individuals, which may lead to the transfer of bacteria, viruses and other microorganisms. Therefore, regular hand hygiene plays an essential role in maintaining personal hygiene and public health.*

Hand sanitizers are widely used in hospitals, healthcare centres, pharmaceutical industries, laboratories, educational institutions and everyday life. They provide a convenient method of hand cleansing, particularly when soap and water are not readily available. Alcohol-based hand sanitizers are commonly preferred because of their rapid antimicrobial action. However, repeated use of certain formulations may cause skin dryness and irritation.

In recent years, medicinal plants have received considerable attention in pharmaceutical research due to the presence of various biologically active phytochemical constituents. These natural compounds may possess antimicrobial, antioxidant, anti- inflammatory and skin-conditioning properties.

A polyherbal formulation is a preparation containing two or more medicinal plants. The combination of different plant extracts may

provide complementary biological properties and improve the overall characteristics of the formulation.

The present review focuses on the development and potential applications of polyherbal sanitizer formulations containing Neem (Azadirachta indica), Tulsi (Ocimum tenuiflorum), Aloe vera (Aloe barbadensis), Hibiscus (Hibiscus rosa-sinensis) and Clove (Syzygium aromaticum).

Keywords: Herbal medicine; Polyherbal hand sanitizer; Neem; Tulsi; Aloe vera; Antimicrobial activity

I. INTRODUCTION

Hand hygiene is considered an important practice in healthcare and everyday life. Our hands frequently come into contact with different surfaces, objects and people, which may lead to the transfer of harmful microorganisms. Proper hand hygiene helps reduce the transmission of infectious microorganisms and protects both healthcare workers and the general public.

The World Health Organization (WHO) has highlighted the importance of hand hygiene in healthcare settings. It recommends appropriate hand hygiene practices to reduce the risk of healthcare- associated infections. Alcohol-based hand rubs are particularly useful when handwashing facilities are not readily available. [1,2]

Hand sanitizers are available in different forms, such as liquid, gel and spray. Their effectiveness depends on the active ingredients, concentration, formulation and method of application. WHO has also provided recommended formulations and guidelines for the local preparation of alcohol-based hand rubs. [4]

In recent years, medicinal plants have received attention in pharmaceutical research because they contain naturally occurring compounds with different biological activities. Plant-derived compounds such as flavonoids, tannins, phenolic compounds, terpenoids and alkaloids have been investigated for their antimicrobial potential. [5]

Herbal medicine involves the use of medicinal plants and their extracts for various traditional and pharmaceutical applications. Plants contain several secondary metabolites that contribute to their biological activities.

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According to Cowan (1999), plant-derived products contain different groups of compounds, including phenolics, polyphenols, terpenoids, alkaloids and flavonoids. Many of these compounds have demonstrated antimicrobial activity under laboratory conditions. Their activity may depend on their chemical structure, concentration, extraction method and the type of microorganism tested. [5]

Medicinal plants are therefore important sources for the investigation of new pharmaceutical ingredients. However, their biological activity should be evaluated scientifically before they are used in finished pharmaceutical products.

Importance of polyherbal formulation

The main purpose of combining herbal ingredients is to investigate whether their individual properties can complement one another. For example, Neem and Tulsi are studied for their antimicrobial potential, Clove is known for its eugenol-rich essential oil, and Aloe vera is commonly used in skin-care preparations.

The selection of herbal ingredients should be based on scientific evidence, compatibility, safety and stability. The combined extracts should also be tested to determine whether they maintain their expected biological activity in the final formulation.

AIM AND SCOPE

AIM: To review select medicinal plant and discuss their possible contribution to the development of a polyherbal hand sanitizer.

Scope: This review covers the reported properties, important phytochemicals and possible formulation Roles of Neem, Tulsi, Aloe vera, Hibiscus and Clove. It also outlines formulation and testing requirements That should be addressed before a product is considered suitable for use.

OBJECTIVE

1. To study the medicinal importance and traditional uses of selected herbal plants such as Neem, Tulsi, Aloe vera, Hibiscus and Clove. [1– 9]
2. To identify the major phytochemical constituents present in the selected medicinal plants. [1,2,4–9]
3. To review the pharmacological activities of these plants, including antimicrobial, antioxidant and anti-inflammatory properties. [1–10]
4. To understand different extraction methods used for obtaining active constituents from medicinal plants. [10,12]
5. To study the pharmaceutical and healthcare applications of herbal medicines. [5–10]
6. To review the safety, possible adverse effects and limitations associated with the use of herbal medicines. [11]
7. To understand the importance of quality control, standardization and proper collection of medicinal plant materials. [12,13]
8. To explore the potential of medicinal plants in the development of safe and effective herbal formulations. [1–10]

FORMULATION CONSIDERATION

Selection of plant material: Correct identification of each plant is important. The plant part should be Selected, cleaned and dried appropriately. Raw materials should be checked for contamination and stored Under suitable conditions.

Extraction: The extraction method and solvent can change the type and amount of phytochemicals Obtained. A consistent method should be followed, and extracts should be characterised or standardised Where possible.

Compatibility: Herbal extracts may affect colour, smell, clarity, viscosity or stability. Aloe gel and Hibiscus Mucilage may alter texture, while essential oils may need suitable dispersion.

Compatibility with alcohol And other excipients must be examined.

Skin feel and safety: Ingredients intended to improve skin feel should be assessed for irritation and Sensitisation. Particular care is needed with concentrated essential oils such as Clove oil. A natural Ingredient is not automatically safe for every user.

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LITERATURE REVIEW

Cowan et al. (1999)
Reviewed plant products as antimicrobial agents and described the importance of plant secondary metabolites such as tannins, terpenoids and flavonoids. The review highlighted that many plant- derived compounds show antimicrobial activity in vitro and can be investigated as leads for antimicrobial products [5].

Hammer et al. (1999)
Evaluated 52 plant oils and extracts against several microorganisms using agar dilution and broth microdilution methods. The study showed that antimicrobial activity differed considerably among plant oils and extracts, supporting the need to select and evaluate individual plant materials under controlled conditions [9].

Biswas et al. (2002)
Reviewed the biological activities and medicinal properties of Azadirachta indica (neem). The authors discussed several pharmacological properties and the presence of biologically active constituents, supporting continued investigation of neem as a medicinal plant [6].

Burt et al. (2004)
Reviewed essential oils and their antibacterial properties. The review explained that essential oils may act through effects on microbial membranes and other cellular targets, while also emphasizing that activity depends on composition and concentration [10].

Prakash et al. (2005)
Reviewed the therapeutic uses of Ocimum sanctum (Tulsi) and discussed eugenol and other constituents associated with its pharmacological actions. The review supports the traditional and scientific interest in Tulsi as a medicinal plant [7].

Agarry et al. (2005)
Compared the antimicrobial activity of Aloe vera gel and leaf extracts against selected bacteria, fungi and yeasts. Their findings provided experimental evidence that Aloe vera preparations can show antimicrobial activity, although activity varied with the material and test organism [13].

Hammer et al. (1999) and Nazzaro et al. (2013)
Together indicate that plant extracts and essential oils can have measurable activity against microorganisms, but laboratory activity cannot automatically be translated into clinical effectiveness. Nazzaro et al. discussed several mechanisms by which essential oils may affect pathogenic bacteria and emphasized differences among oils and microorganisms [9,14].

Acharya et al. (2018)
Described a water-based herbal hand-sanitizer gel containing Azadirachta indica, Ocimum sanctum and Citrus limon extracts. The study evaluated antimicrobial activity against selected bacteria and supported further investigation of herbal ingredients in hand-hygiene formulations [15]. Kalaiyani et al. (2018)
Reported a study on the evaluation of a herbal hand sanitizer and its antibacterial activity. The work used multiple herbal materials and assessed microbial reduction, demonstrating the practical interest in plant-based hand-hygiene products [16].

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Wylie and Merrell (2022)
Reviewed the antimicrobial potential of Azadirachta indica and summarized evidence from bacteriology, mycology, virology and other fields. The review also emphasized the need for additional studies to establish specific mechanisms, clinical efficacy and safety [11].

Haro-González et al. (2021)
Reviewed clove essential oil and reported that eugenol is an important bioactive constituent associated with antimicrobial and other biological activities. The review also discussed how extraction and processing can affect the chemical composition of clove oil [17].

Pathak et al. (2026)
Recently reported a polyherbal hand-sanitizer gel containing Aloe vera, neem and Tulsi with an alcohol base and evaluated its physicochemical properties and antimicrobial activity. The study illustrates the current research interest in combining medicinal plant extracts with a conventional sanitizer base [18].

1. Neem (Azadirachta indica)

➢ According to Biswas et al. (2002), Neem possesses several biological properties, including antimicrobial, anti-inflammatory, antioxidant and other pharmacological activities. The medicinal importance of Neem is associated with its complex phytochemical composition. Wylie and Merrell (2022) also reviewed the antimicrobial potential of Neem against different groups of microorganisms, highlighting its importance as a natural source for antimicrobial research. [6,11] ➢ Various experimental studies have investigated Neem extracts against selected bacterial and fungal microorganisms. The antimicrobial activity may depend on the plant part used, extraction solvent, concentration of extract and type of microorganism tested.

➢ Potential role in polyherbal sanitizer: Neem leaf extract may be investigated as an additional herbal ingredient because of its reported antimicrobial potential. Its incorporation may provide an opportunity to study the contribution of Neem phytochemicals to the antimicrobial properties of the formulation. However, its actual effectiveness in the finished sanitizer must be established through suitable microbiological testing. ➢ Important phytochemicals: Limonoids, azadirachtin, nimbin, flavonoids and tannins.

➢ Family: Meliaceae.

2. Tulsi (Ocimum tenuiflorum)

Tulsi, commonly known as Holy Basil, is an important medicinal plant belonging to the family Lamiaceae. It has a significant position in traditional Indian medicine and is widely cultivated in India. The leaves are commonly used in traditional medicinal preparations because of their diverse phytochemical constituents.

Tulsi contains several biologically active compounds, including eugenol, ursolic acid, rosmarinic acid, carvacrol, linalool and flavonoids. The composition of these constituents may vary according to the plant variety, geographical conditions, harvesting period and extraction technique.

Prakash and Gupta (2005) reviewed the therapeutic properties and pharmacological importance of Tulsi. Their review highlighted its traditional applications and the biological activities associated with its phytochemical constituents. Eugenol, one of the important constituents of Tulsi essential oil, has also attracted research interest because of its reported antimicrobial and antioxidant properties. [7]

Tulsi extracts have been investigated in different experimental studies for their potential antibacterial, antifungal, antioxidant and anti-inflammatory activities. The biological activity of the extract depends on the concentration of active constituents and the extraction method employed.

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Potential role in polyherbal sanitizer: Tulsi leaf extract may be considered as an additional herbal component because of its reported antimicrobial potential. Its combination with Neem and other selected medicinal plant extracts provides an opportunity to investigate complementary phytochemical properties in a single formulation.
Important phytochemicals: Eugenol, ursolic acid, rosmarinic acid, flavonoids and volatile oils. Family: Lamiaceae

3. Aloe vera (Aloe barbadensis Miller)

Aloe vera is a widely used medicinal plant belonging to the family Asphodelaceae. It is commonly incorporated into pharmaceutical, cosmetic and personal-care preparations because of its moisturizing, soothing and skin-conditioning properties. The plant contains thick, fleshy leaves with a transparent inner gel and a yellowish latex layer beneath the leaf surface.
The inner gel of Aloe vera contains several naturally occurring compounds, particularly polysaccharides such as acemannan, glucomannan and other carbohydrate components. It also contains amino acids, vitamins, minerals, enzymes and phenolic compounds.
Surjushe et al. (2008) reviewed the chemical composition, mechanism of action, medicinal properties and various applications of Aloe vera. The review discussed its importance in dermatological and cosmetic preparations, particularly because of its skin-conditioning and moisturizing characteristics. [8]
Agarry et al. (2005) investigated and compared the antimicrobial activities of Aloe vera gel and leaf extracts against selected microorganisms. Their study reported differences in inhibitory activity depending on the plant preparation and microorganism examined. This indicates that the biological properties of Aloe vera may vary according to the extraction method and composition of the plant material. [13]
Aloe vera is particularly important in topical formulations because its gel may help improve skin feel and provide moisturizing properties. However, its incorporation into alcohol-based formulations requires careful evaluation of compatibility, physical stability and microbial quality.
Potential role in polyherbal sanitizer: Aloe vera gel may be used as a skin-conditioning ingredient to improve the moisturizing characteristics and overall acceptability of the sanitizer formulation. It should not be considered a replacement for the primary antimicrobial agent.
Important phytochemicals: Acemannan, glucomannan, polysaccharides, amino acids and phenolic compounds.
Family: Asphodelaceae.
Aloe vera is widely used in cosmetic and pharmaceutical preparations, particularly in skin- care products. The inner leaf gel contains polysaccharides, including acemannan, along with other naturally occurring compounds.
Surjushe et al. (2008) reviewed the properties, mechanism of action and various applications of Aloe vera. Its use in cosmetic preparations is well established, although its therapeutic effectiveness for different applications requires appropriate scientific evaluation. [8]
Agarry et al. (2005) compared the antimicrobial activities of Aloe vera gel and leaf extracts against selected microorganisms. Their study reported different inhibitory effects depending on the plant preparation and microorganism tested. [13]
In sanitizer formulations, Aloe vera may be investigated as a skin-conditioning ingredient. Its compatibility with alcohol and other formulation ingredients should be evaluated.

4. Hibiscus (Hibiscus rosa-sinensis)

Hibiscus, commonly known as China Rose, is a flowering medicinal plant belonging to the family Malvaceae. It is widely cultivated in tropical and subtropical regions and is traditionally used in various herbal and cosmetic preparations. Different parts of the plant, particularly flowers and leaves, contain several naturally occurring phytochemical constituents.

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Hibiscus contains flavonoids, anthocyanins, tannins, phenolic acids, mucilage and other secondary metabolites. Anthocyanins are responsible for the characteristic colour of many Hibiscus flowers, while flavonoids and phenolic compounds are associated with antioxidant activity.

The phytochemical composition of Hibiscus extracts may vary depending on the plant part, geographical location, environmental conditions, maturity of the plant and extraction solvent. Therefore, standardization of plant material and extraction procedures is important for obtaining reproducible results.

Different phytochemical constituents of Hibiscus have attracted scientific interest because of their potential antioxidant, anti-inflammatory and other biological properties. Phenolic compounds may contribute to the antioxidant activity by interacting with free radicals under suitable experimental conditions.

Potential role in polyherbal sanitizer: Hibiscus extract may be investigated as an additional herbal ingredient because of its phytochemical composition and potential antioxidant properties. The natural mucilage present in certain plant parts may also influence the consistency and physical characteristics of the formulation. However, its compatibility with alcohol, gelling agents and other excipients should be studied.

Important phytochemicals: Flavonoids, anthocyanins, tannins, phenolic acids and mucilage.

Family: Malvaceae.

APPLICATION

1. Antimicrobial activity: Herbal extracts such as Neem, Tulsi and Clove help provide additional antimicrobial potential.
2. Antibacterial activity: Plant extracts may help inhibit the growth of certain bacteria.
3. Antioxidant activity: Herbal ingredients help provide antioxidant properties.
4. Skin protection: Aloe vera helps soothe and moisturize the skin.
5. Skin conditioning: Herbal ingredients help improve skin feel and comfort.
6. Natural formulation: Medicinal plants can be incorporated as natural supporting ingredients in sanitizer formulations.
7. Reduction of skin dryness: Aloe vera and suitable humectants help reduce the drying sensation caused by alcohol.
8. Fragrance: Certain herbal ingredients, such as Tulsi and Clove, contribute natural aroma.
9. Personal hygiene: Herbal sanitizer formulations can be used for routine hand hygiene.

LIMITATIONS AND FUTURE SCOPE

The available information on medicinal plants includes laboratory studies, traditional uses and reviews.Results from tests on individual extracts cannot be directly applied to a finished hand sanitizer. Plant Material can vary from batch to batch, and extraction methods may produce extracts with different Compositions. More work is therefore needed to standardise the extracts, identify compatible Concentrations and study interactions among the ingredients.

Future research may focus on preparing small trial batches, checking physical and chemical stability, Measuring the alcohol content where relevant, and testing antimicrobial activity of the complete product. Appropriate skin-compatibility studies and quality-control procedures should be completed before any Product is recommended for regular use.

II. CONCLUSION

Medicinal plants such as Neem, Tulsi, Aloe vera, Hibiscus and Clove contain phytochemicals that make Them interesting candidates for pharmaceutical and personal- care research. Their possible contributions Differ: Neem and Tulsi are investigated for antimicrobial potential, Aloe vera for moisturizing and Skin-conditioning properties, Hibiscus for phenolic compounds and mucilage, and Clove for its eugenol-rich Essential oil. A polyherbal sanitizer may offer an opportunity to study these ingredients in one formulation. However, Herbal extracts should not replace the proven antimicrobial component of a hand sanitizer unless adequate Evidence supports their use. The final preparation must be

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carefully formulated and tested for antimicrobial Efficacy, stability, skin safety and overall quality. Further experimental research is required before its Effectiveness can be confirmed.

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