



Formulation, Development and Antimicrobial Evaluation of Polyherbal Soap

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ABSTRACT

A herbal soap was formulated using the leaf and bark extract of *Azadirachta indica*, *Mangifera indica*, *Ocimum sanctum* and *Malvastrum coromandelianum* powder. Bacterial skin infections are the most common among people, necessitating prompt treatment as well as continuing care to maintain healthy skin. The natural material in the herbs does not have any side effect on the human body as the herbal cosmetics are also known as Ayurvedic cosmetics. The majority of herbal supplements are focused on many botanical ingredients with a long traditional or folk medicine history of use. Among the variety of botanical ingredients on the market today. Numerous toxins from chemical compounds Cosmetics alone are inadequate to care for skin and body parts because microorganisms in the air can cause chemical infection and damage. Due to its wide range of medicinal properties, neem leaves and their constituents have been shown to exhibit anti-inflammatory, anti-hyperglycemic, anti-ulcer antimalarial, antifungal, antibacterial, anti-mutagenic and anti-carcinogenic properties, the Neem (*Azadirachta indica*) tree has attracted worldwide prominence. Reetha, neem, shikekai and tulsi were used in herbal soap ingredients, in which neem leaf and seed were found to be effective against some dermatophytes. Shikekai and Reetha serve as a detergent and show antiviral activity with washing and foaming activity and Tulsi is useful due to its antifungal properties.

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INTRODUCTION

The skin, also known as the cutaneous membrane, protects the body's external surface. In terms of surface area and weight, it is the body's largest organ [1]. Body temperature control, blood storage, protection from the external environment, cutaneous stimuli, excretion and absorption, and vitamin D synthesis are all functions of the skin. The skin is the most vulnerable part of the body to the sun, pollutants, and pathogens while still offering some protection. Eczema, warts, acne, rashes, psoriasis, asthma, etc. are the most common skin disorders. *Staphylococcus aureus* (*S. aureus*) is a Gram-positive bacterium that can live on the skin and in the nose and throat as a commensal organism. *S. aureus* asymptotically colonises

about 30 percent of healthy people [2]. A variety of diseases, from mild skin infections to abscesses, endocarditis, and sepsis, are caused by *S. Aureus*. *S. aureus* is also a leading cause of nosocomial infections and is a significant cause of food poisoning caused by heat resistant enterotoxin A. Hand hygiene is critical in preventing contagious diseases by protecting the skin from infectious microorganisms and their spread.

Many chemical antiseptics are also available as alcohol-based sanitizers, Chlorohexidine products, and other products. This polyherbal soap or solution aims to minimise healthcare-associated infectious disease transmission more

efficiently, but it has certain disadvantages or side effects.

As a traditional medicine, plants with medicinal properties have been used from time immemorial. Medicinal plant extracts from the leaves, stems, and roots have been used as a natural remedy for a number of ailments and diseases. Since prehistoric times, herbal remedies, plant products and extracts have been imitated for their use. Plants with pharmacological active properties have been used as functional foods, drugs, cosmetics, dyes as well as in the prevention, cure and treatment of various diseases since the life of humankind. The extract produced with medicinal properties from roots, stems, leaves, flowers acts as a natural remedy for the disease or ailment [3-4]. The use of herbal medicines has been recouped since the introduction of synthetic medicines. Yet synthetic medications have not yet met with the requirements of natural medicines in pursuit of their safety and efficacy.

In recent years, there has been a significant rise in the use of herbal medicines. It is estimated that herbal plant extracts are used in the medicines of around 80% of the world's population in both developed and developing countries. It is considered to be one of the key health care initiatives for the treatment of different ailments, especially in developing countries.

This drastic increase in the use of the herbal plant and its extracts culminated in the birth of a new field of medicine known as 'Herbal Medicinal Goods.' These can be described as a plant or part of a plant that is used as a whole or as an extract for the treatment, prevention, or management of disease or ailment in health care.

Antimicrobial, anti-inflammatory, antihelminthic, anti-diabetic, antioxidant, and other properties are all imparted by these herbal medicinal items. As a consequence, herbal medication with different properties is used in various pharmaceutical formulations such as soaps, ointments, gels, and creams for the treatment of various skin disorders as well as for cosmetic purposes. The growing rise in the pursuit of herbal medicines has led to an increased demand for greater production of herbal products.

Herbal medicinal products are in greater demand than the synthetic ones because of many reasons:

- Lesser Side effects
- Better safety and efficacy
- Easily available
- Better compatibility with additives
- Potent therapeutic effect
- Cost-friendly
- Greater are for selection
- No requirement of animal testing
- Better compatibility with all types of skin.

Skin is the most revealed part of the body that is susceptible to numerous foreign particles that can lead to different skin-related disorders. As a result, in order to protect the skin from various disorders, it is important to maintain proper cleanliness and hygiene for the most exposed part of the body and to protect it from widespread microorganism spread in the environment, thus preventing various skin disorders. The use of soaps is the easier and more convenient way to eliminate all the foreign particles. The use of soap, along with its anti-microbial properties, helps to cleanse the skin [5]. The causative agents for various skin infections include various micro-organisms such as *Staphylococcus aureus*, *Pseudomonas spp.*, *Klebsiella pneumonia* and *Proteus vulgaris*.

The antimicrobial property of the human body contributes to the prevention of both diseases and skin infections. Antibacterial property is known as the property of bacteria's growth inhibition. Soaps are cleaning agents—solid, liquid, and semisolid powders—that assist in the removal of dust, dirt, microorganisms, and stains, as well as the maintenance of health and beauty. When reacted by the saponification process with an alkaline base, the free fatty acids consist of soap. Fatty acids such as lauric acid, palmitic acid and stearic acid help to provide soaps with washing properties. The soap industry is valued at around US\$ 186 billion. In terms of natural ingredients, the latest trends have also increased enormously. The basic soap's origins can be traced back to the Egyptians, when an alkaline plant was combined with animal fats to produce crude soaps. In recent years, herbal soaps have become important, including extracts from different plant extracts that are integrated into the basic soap reaction [6]. Herbal antimicrobial soaps have been documented to have around 60-80% of the ability to inhibit the growth of microorganisms. Natural as well as handmade soaps production has been a total creative work

involving different variables such as ability, materials, imagination and thoughts that seem to produce quality soap.

Other factors affecting the quality of soaps are:

- Ability of lather producing
- Colour of the soap
- Fragrance of the soap
- Moisturizing ability
- Compatibility of the skin
- Storage Stability.

Herbal soaps are made up of fatty acids and alkali salts derived from vegetable or plant sources, as well as natural fragrances and organic ingredients. There are two types of preparation: hot process and cold process, both of which require the presence of a base such as potassium hydroxide or sodium hydroxide, as well as fatty acids, to form soap. The cold process is typically the artisans' preferred process. The consistency of the soaps depends on different variables, such as the form of alkali used, its hardness, the height of the foam, solubility, etc.

Olive oil, Castor oil, Sunflower oil, Palm oil, Rice bran oil, soybean oil, and other oils are used depending on the properties they have. In the herbal soap bar, additives provide anti-oxidants that help to inhibit the oxidation of fatty acids. For example: extracts from rosemary, tomatoes, fruits, etc. There's also a scent and a colouring agent. While several plant-based products have been replaced by synthetic chemicals, they have not been able to match the protection and efficacy of ayurvedic products [7].

In contrast to chemical products, herbal medicines have the advantage of being affordable, readily available, and having fewer side effects. As a result, research has accelerated in the direction of producing natural products that are higher in quality, less costly, and have no harmful side effects when compared to chemical products. However, if these compounds are separated from herbs, it can become easier to systematically use them as herbal soap alone or in combination. Opportunistic microorganisms primarily cause nosocomial infections, and nosocomial infections are generally implicated in multidrug-resistant pathogens. Infectious diseases of bacterial and fungal origin that are multidrug resistant are leading killers and account for around 25 percent of global deaths and are difficult to treat. The alarming pace at

which human pathogens such as *Staphylococcus aureus* (methicillin & multi-antibiotic resistant), *Escherichia coli*, *Pseudomonas aeruginosa*, *Candida albicans* and *Cryptococcus neoformans* evolve as multi-drug resistant 'superbugs' towards newly generated groups of antibiotics, requirements for biodiversity exploration of new chemical sources and the creation of therapy. The most exposed portion of our body's skin needs protection from skin pathogens. Soaps have a long tradition, dating back over 6,000 years, and are used in our everyday lives. By combining animal fats with wood ash and water, which was later known as "soap," the ancient Babylonians found a cleaning product. Saponification, in which the reaction of fats/oil with base/lye takes place, is the fundamental process of soap production. Soaps are commonly solid and liquid of two forms, NaOH is used as the foundation in solid soaps, while KOH is used to obtain liquid soaps [8].

Medicinal soaps vary slightly from regular soaps, where synthetic or natural bioactive ingredients are applied to the basic medium of the soap to give the final product a range of biological activities. The use of toxic synthetic chemicals from medicinal soap products is chosen because of the undesirable or harmful effects of synthetic substances. Natural products based on plants have become an enticing alternative to synthetic substances in recent years, enhancing the essential biological characteristics of medicinal soaps. Many of the side effects associated with medicinal soaps containing synthetic ingredients were alleviated by replacing synthetic foaming agents such as sodium lauryl sulphate with saponins, synthetic antibacterial agents such as Triclosan with natural antibacterial agents, and synthetic antioxidants such as BHT with natural phenolic compounds. Some of the most widely used ingredients such as medicinal soaps in skin care items are coconut oil, neem oil, olive oil, turmeric, venivel, sandalwood, jasmine, and lemon essence.

Herbal soap preparation is a medication or medicines containing antibacterial and antifungal agents that primarily use parts of plants such as leaves, stem, roots & fruits to treat or achieve good health for an injury or illness. This antimicrobial preparation is applied topically and comes in a number of ways, including creams, lotions, gels, soaps, solvent extracts, and ointments. Different skin conditions have been treated with a combination of creams

& soap properties. In general, fungi live in moist areas of the body in the dead and upper layers of skin cells and cause only mild irritation. Other fungal infections may be more severe. They can penetrate and cause scratching, swelling, blistering and scaling in the cells. As a result, skin cancer is a big issue all over the world. The majority of commercial soaps on the market today contain chemical agents with antimicrobial activity and possible depilatory properties on skin pathogens. Detergents and soaps are considered to be disinfectants needed for hygiene in everyday practise. Soaps are cleaning agents that can be liquid, solid, powdery or semi-solid. In order to preserve hygiene, appearance, and eliminate bad odour from the body or inanimate items, including clothing, they are used to remove dirt, including dust, microorganisms, stains and bad smells.

Commercial soap commonly consists of poisonous arsenic, aluminium, barium, bisphenol, plastics and other contaminants that are absorbed through solvent vaporisation and skin absorption into the body through the internal lungs with harmful side effects. The problem now is that most individuals are unaware of the long-term effects of using industrial soaps. This is because there are chemicals in these consumer goods that are deemed harmful and could harm the body in the future. Health experts recently questioned the bacterial killing effect of medicated soap, and the United States Food and Drug Administration (U.S. FDA) queried that there is no convincing evidence that medicated antimicrobial soap offers additional protection. (FDA of the United States, 2016). This is due to their assumption that the bulk of the soap is misleading. They are overhyped, but they have little additional defence. However, antimicrobial soap is recommended in situations where a person's immunity is poor and their skin is unable to care for itself, according to Dr. Ihuma Ogbonnaya, a consultant physician in Abuja, Nigeria.

In addition, commercial antibacterial soap is a form of soap containing chemical ingredients that often include triclosan, chloroxynol, and triclocarbon. Study findings have disputed that these chemicals are no more effective than any other form of soap or detergent in deactivating viruses (U.S. FDA, 2016). People are now more likely to use natural formulas due to the disadvantages of industrial soap [9].

Commercial soap issues have been stated to be effectively solved on a regular basis by using just what 'mother nature' has to give to help nourish your skin. As opposed to the contents of consumer products, herbal soaps do not contain artificial colours, flavours, or fluoride. Antimicrobial activity against skin pathogens is reported to be demonstrated by the antimicrobial activities of the selected plants to be used in this project work. Due to their high medicinal value, cost-effectiveness, availability, and compatibility, herbs are widely used in the treatment of almost all diseases and skin problems. It can also be used as a soap base. The soap attribute includes skin gentleness, rich lather, protection against skin disorders (including rashes, eczema, scabies), treatment of skin infections (such as ringworm), protection against even skin tone and smoothness of the skin.

The *Azadirachta indica* (Neem) tree contains a variety of natural substances in its various sections, including leaves, seeds, and bark, and has a variety of biological activities against disease-causing species. It also contains approximately 140 chemical compounds. The active ingredient in Neem tree leaves and seeds is azadiractrin (AZ) ($C_{35}H_{44}O_{16}$), which has the potential to destroy disease-causing fungi, viruses, and parasites. Neem extract, which causes ringworm disease, is very active against skin fungi.

The AZ content of neem oil has been closely associated with its bioactivity toward insect research. A marked difference was recorded in the yield of AZ from neem seeds of different geographical origins, and in the same geographical area in different seasons. Two new tetranortriterpenoids have recently been isolated from neem seeds: 11-epiazadirachtin H and AZ-K. Although the bark, heartwood, leaves, berries, and seeds of neem have all been chemically studied for their main biocidal components, the renewable parts (seeds and leaves) have gotten the most attention. Thanks to its insecticidal and fungicidal importance in entomological activities, neem oil is environmentally friendly and significant essential oil. It is possible to take neem oil at 5% concentration as a lethal dose to control white rot fungus in the Wood Plastic Particle Board. Fungi, *staphylococcus aureus* and *streptococcus* species are mainly responsible for skin infections [10].

Ethnomedicinally, the juice and extract from the plants' leaves are used topically as antimicrobial and anti-inflammatory agents in the treatment of skin diseases such as eczemas, ringworm, and pruritus. The succulent gel type is used for psoriasis disorders. Crude soapy plant preparation can soften the skin epidermis, improve greater acne penetration and cleaning, and also facilitate healing and resolution rapidly over time. In this article, neem, tulsi, shikekai and reetha containing herbal soap as natural plant ingredients and this material gives or demonstrates antibacterial action. The key compound in this soap is neem, which has medicinal properties. Immunomodulatory, anti-inflammatory, anti-ulcer, anti-malarial, antifungal, antibacterial, antioxidant, and anticarcinogenic properties are all present in neem leaf and extract.

Tulsi is the most medicinal of the plants. Tulsi is beneficial for diabetics because it reduces blood glucose levels. Tulsi is also used in the treatment of serious acute respiratory syndrome. Leaf juice provides relief from cold fever, bronchitis, and cough. Tulsi is used as the main compound in this herbal soap because it decreases tension, increases strength, relieves inflammation, and has antifungal properties. Tulsi's primary antifungal function is useful in the formulation of soap such as scabies and often used as a property for anti-wrinkles [11-12].

MATERIALS AND METHODS

Chemicals

These include stearic acid, soft paraffin, ethanol, orange oil.

Collection, Identification and Processing of Plant

The leaves of *Azadirachta indica*, *Mangifera indica*, *Ocimum sanctum*, and *Malvastrum coromandelianum* were collected from different matured plant. The leaves were dried in hot air oven, pulverized and stored in airtight bottles for the studies.

Extraction

The *Azadirachta indica*, *Ocimum sanctum*, *Mangifera indica* and *Malvastrum coromandelianum* powder was extracted with water by decoction process. 9 gm of above stated powder was taken in conical flask and extracted with water for four hours with occasional agitation then filtered.

Formulation of Herbal Soap

To obtain extract of *Azadirachta indica*, *Mangifera indica*, *Ocimum sanctum*, and *Malvastrum coromandelianum* was incorporated into a soap formulated with basic glycerin soap and which contain 1 gm stearic acid, 0.70 gm soft paraffin. Weighed 1gm of stearic acid, 0.70 gm soft paraffin, 5mL ethanol was taken. Glycerin basic soap was melted first and to it 1gm stearic acid, 0.70 gm soft paraffin, 5mL ethanol were added. Extract was incorporated into melted solution with continuous agitation for 30 minutes until molten mixture became homogeneous. The semisolid mixture was poured into a mould and allowed to solidify.

Evaluations

The herbal soap formulated was evaluated for the following:

1. Organoleptic Evaluation:

- i. Colour: brown
- ii. Odour: orange
- iii. Appearance: Good

2. Physical Evaluation

The herbal soap formulated was evaluated for the following properties:

a) pH:

The pH was determined by using pH paper. The pH was found to be basic in nature.

b) Foam Retention:

The cylinder was hand-covered and shaken 10 times with 25 mL of one percent soap solution into a 100 mL graduated measuring cylinder. For 4 minutes, the amount of foam was assessed at 1 minute intervals. It was discovered that the time was 5 minutes.

c) Foam Height: 10 cm

d) Antimicrobial Testing of the Prepared Formulations:

Preliminary screening tests for antimicrobial sensitivity are shown in the table below. The formulation of the antibacterial polyherbal soap proved beneficial and had excellent efficacy against all species tested. A important result was found to be 7 mm, 9 mm, 3 mm and 4 mm against *Staphylococcus aureus*, *Escherichia coli*, *Aspergillus flavus* and *Aspergillus niger* respectively.

Table 1: Formulation of herbal soaps

Sr. No.	Ingredients	Quantity	Use
1	Soft Paraffin	0.70 gm	Hardening
2	Stearic Acid	1 gm	Hardening
3	Ethanol	5 mL	Solvent
4	Neem Powder	2 gm	Antibacterial
5	<i>Malvastrum coromandelianum</i> powder	2 gm	Antibacterial
6	Reetha	3 gm	Surfactant
7	Shikekai	2 gm	Cleanser
8	Tulsi	1 gm	Antiviral
9	Orange oil	q.s	Perfume

Table 2: Antimicrobial Testing on Herbal Soap

Sr. No.	Sample Code	Microorganism			
		<i>E.coli</i>	<i>S. aureus</i>	<i>A. flavus</i>	<i>A. niger</i>
1	Distilled water (Negative Control)	-	-	-	-
2	Soap solution (1 %)	7	9	3	4

CONCLUSION

The plants *Azadirachta indica*, *Ocimum sanctum*, *Mangifera indica*, and *Malvastrum coromandelianum* were extracted with water and placed through various evaluation tests based on previous research on Neem's antimicrobial activity. When tested for various tests, the prepared formulation yielded good results. It does not offer any skin irritation that has been decided by few volunteers using these soaps, so it is proven that soap does not give skin irritation. In addition, the prepared soap was standardised by testing different physical chemical properties such as the odour of the pH appearance in which the satisfactory effect was exhibited.

The results showed that the majority of the 1% soap solution had an antibacterial effect and had maximum activity with zones of inhibition of 07 and 09 mm on *Staphylococcus aureus* and *Escherichia coli*, respectively. When tested for antibacterial activity, the prepared formulations showed 06 and 09 mm inhibition zones that were much stronger than the inhibition zones of individual extracts.

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