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## Research Article

# Formulation Development And Evaluation Of Herbal Soap Containing *Aegle Marmelos* Fruit And *Azadirachta Indica* : Antifungal Activity

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## ABSTRACT

The utilization of natural ingredients in skincare products has gained considerable attention due to their potential therapeutic benefits and minimal adverse effects. In this study, we focused on formulating an herbal soap using neem and bael fruit extracts renowned for their antimicrobial and skin-soothing properties. The preparation involved extracting active compounds from neem leaves and bael fruit pulp, followed by their incorporation into a soap base. The formulated herbal soap underwent comprehensive physicochemical evaluation, including pH determination, microbial analysis, and stability testing. Results revealed that the neem and bael fruit herbal soap exhibited favorable characteristics, including appropriate pH levels, antimicrobial activity against common skin pathogens, and stability under varying storage conditions. Furthermore, the soap demonstrated potential efficacy in alleviating skin ailments such as fungal infections, eczema, and dermatitis, attributed to the bioactive constituents present in neem and bael fruit. Overall, the development of this herbal soap presents a promising natural solution for skincare, harnessing the therapeutic properties of neem and bael fruit to promote skin health and well-being.

## INTRODUCTION

Skin diseases pose significant public health challenges, impacting individuals and communities with pain, suffering, and reduced quality of life. The rise in skin conditions is attributed to the proliferation of harmful synthetic chemicals in skincare products. Fungal skin infections are particularly prevalent and demand

attention for both treatment and ongoing skin health maintenance. These ailments, such as acne, eczema, hives, and psoriasis, have afflicted millions over many years. Fungi typically reside in the outer layer of moist skin cells, causing minor irritation, but certain infections can lead to more severe symptoms like itching, swelling, and blistering. Overall, skin diseases present a

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considerable global health concern.(1)Fungal infections represent a significant global health concern, affecting millions of individuals annually and posing considerable challenges for healthcare providers. These infections can manifest in various forms, ranging from superficial skin conditions to life-threatening systemic diseases, depending on the causative fungal species and the host's immune status. The increasing incidence of fungal infections, coupled with the emergence of drug-resistant fungal strains, underscores the urgent need for innovative therapeutic approaches and preventive strategies .Among the diverse array of fungal infections, dermatophytosis , candidiasis, and aspergillosis stand out as common clinical entities, causing substantial morbidity and economic burden worldwide. Dermatophytosis, commonly known as “ringworm” or “athlete’s foot,” affects the skin, hair, and nails, leading to discomfort and cosmetic concerns. Candidiasis, caused primarily by *Candida* species, encompasses a spectrum of infections ranging from mucocutaneous candidiasis to invasive candidiasis, particularly in immunocompromised individuals. Aspergillosis, predominantly caused by *Aspergillus* species, poses a grave threat to individuals with underlying lung diseases or compromised immune function, often resulting in invasive pulmonary infections with high mortality rates. Conventional antifungal therapies, including azoles, polyenes, and echinocandins, have been the mainstay of treatment for fungal infections for decades. However, the emergence of antifungal resistance, along with the toxicity and limited efficacy of existing drugs, underscores the pressing need for novel therapeutic modalities.



**Fig :1 - Fungal infection of skin**

In recent years, the exploration of natural compounds and herbal remedies has garnered attention as promising alternatives for combating fungal infections. Plants have long been revered for their medicinal properties, with numerous phytochemicals exhibiting potent antifungal activity against a wide spectrum of fungal pathogens. In light of the escalating global burden of fungal infections and the limitations of existing treatment options, there is a compelling rationale for advancing research efforts aimed at harnessing the therapeutic potential of natural compounds for fungal control. This research paper aims to explore the efficacy of herbal formulations containing neem and bael fruit extracts in combating fungal infections, with a focus on their antimicrobial activity, physicochemical properties, and potential clinical applications. By elucidating the mechanisms of action and therapeutic benefits of these herbal remedies, we strive to contribute to the development of safe, effective, and affordable antifungal therapies for improved patient outcomes and public health.(2,3,4,5)



Fig No : 2 Azadirachta Indica



Fig No : 3 Aegle Marmelos

## METHODS AND PREPARATION

### Materials and Methods:

#### 1. Plant Material:

Fresh neem leaves (*Azadirachta indica*) and ripe bael fruits (*Aegle marmelos*) were collected from College Campus Of pravara Rural College of Pharmacy Loni, and authenticated by a botanist.

#### Ingredients of herbal soap

Table no 1 : ingredients of herbal soap

Sr .no	Ingredients	F1	F2	F3	Category
1	Sodium hydroxide	1.4gm	1.4gm	1.4gm	Lye Or Base
2	Distilled water	3.5 ml	3.5ml	3.5ml	
3	Propylene glycol	1.8 ml	1.8ml	1.8ml	
4	Glycerin	6.5ml	6.5ml	6.5ml	
5	Ethanol	1.7ml	1.7ml	1.7ml	
6	Sodium lauryl sulphate	0.8 gm	0.8gm	0.8gm	Herbal Soap
7	Steric acid	6.4gm	6.4gm	6.4gm	
8	Aagle marmelos extract	2.5ml	5ml	7ml	
9	Neem extract	2ml	3ml	5ml	
10	Aleo gel	q.s	qs	qs	

The plant materials were thoroughly washed with distilled water to remove any dirt or impurities, and then air-dried under shade for 7 days . Chemicals utilized in this research were sourced from the laboratory of Pravara Rural College Of Pharmacy. The following chemicals were obtained and utilized: ethanol, steric acid, sodium lauryl sulphate, propylene glycol, sodium hydroxide ,glycerine , Aloe gel , almond oil and rose water purchased from local store.

#### 2.Sonication Extraction of neem and bael :

A weighed amount of dried neem leaves and bael fruit pulp were separately ground into fine powder using a grinder. Approximately 30gm of bael fruit powdered sample was transferred to a 250 ml Of beaker and mixed with 180 ml of ethanol and 20 gm of neem powdered sample was transferred to 250 ml of beaker and mixed with 120ml of ethanol .The extraction was carried out using a sonicator operating at a frequency of 40 kHz and a power output of 100 W. The extraction was performed at room temperature for 30 minutes with continuous sonication to facilitate the release of bioactive compounds from the plant material.After sonication, the extracts were filtered through Whatman No.1 filter paper to remove any particulate matter. The filtrates were then concentrated under reduced pressure using a rotary evaporator at 40°C to obtain the crude extracts of neem and bael fruit.(6,7)

11	Almond oil	q.s	qs	qs	
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## Preparation of soap

### Preparation of soap divided into two steps

#### 1. Preparation of lye solution / soap base

Lye solution was prepared by mixing 1.4gm NaOH and 3.5ml DIL.H<sub>2</sub>O in 125ml beaker. Measure 1.8ml Propylene glycol, 6.5ml glycerine. Add 1.7ml 95% Ethanol solution, 0.8g Sodium lauryl sulfate into 250ml beaker on hot plate with stir bar. Heat mixture to 60°C.

#### 2. Preparation of Soap:-

6.4g Stearic acid and heat mixture to 68°C. When at temperature slowly add the 50:50 lye solution

and mix for 20 minutes while continuously stopping and starting stirring until mixture becomes transparent. Further required quantity of Azadirachta indica and Aegle marmelos extract was mixed to the above mixture and volume made up to 100 ml by adding remaining distilled water. Aloe gel and Almond oil was added for moisturizing property. Let soap solution cool to 62-64°C and pour into soap mould, let cool and harden. (8,9)



F1.

F2.

F3.

## EVALUATION OF HERBAL SOAP

### Test:

#### 1. Physical evaluation:

The evaluation of physical attributes, including color and appearance, was conducted via visual observation, unaided by instruments. Odor characterization was achieved through olfactory assessment. The specific attributes were documented as follows:

Parameter	Inference
Colour	The observed hue was determined to be white cream.
Odor	Descriptively categorized as pleasant.
Appearance	Subjectively assessed as satisfactory.

#### 2. pH

The pH was assessed using pH paper, revealing that it was of a basic nature. (10,11)

#### 3. Size and shape Determination:

The soap diameter of the size of 7.7 cm, with a thickness of 2 cm, which is rectangular shaped round-shaped, was chosen for the preparation of soap bars. This was chosen, as this size is ideal in regular bars usage to apply on the affected skin parts of the body

#### 4. Weight determination:

The weight was determined by digital weighing balance (12)

#### 5. Foam retention :-

Foaming ability and foam stability: Cylinder shake method was used to test for the foaming ability. 50 ml of the 1% formulated products solution was placed into a 250 ml graduated cylinder, covered with one hand and shaken for 10 times. After 1 min of shaking, the total volume of the foam content was recorded. Foam stability was valued by

recording the foam volume after 1 min and 4 min of shake test .(13)

#### 6. Foam height:

0.5 g of sample of soap was dispersed in 5 ml distilled water. Then, transferred it into 10 ml measuring cylinder. Five-eight strokes were given and allowed to stand still and the foam height above the aqueous volume measured .(14)

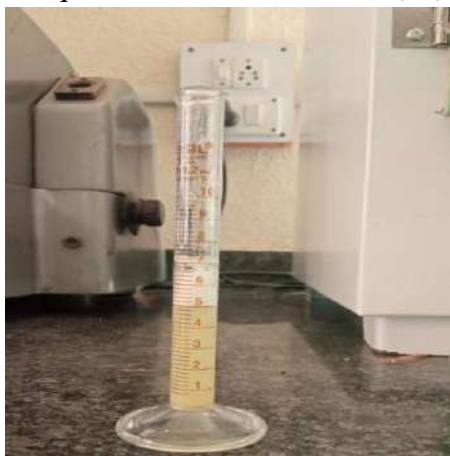


Fig no 5 : Foam height

#### 7. Moisture content

The moisture content was used to estimate the percentage of water in the soap by drying the soap to a constant weight. The soap was weighed and recorded as wet weight of sample and was dried from 100 to 115°C using a dryer . The sample was cooled and weighed to find the dry weight of sample.

The moisture content was determined using the formula.

$\% \text{ Moisture content} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Final weight}} \times 100$ (15)

#### 8. Skin Irritation Test:

The skin irritancy test on the test soap did not result in any signs of irritation for the majority of the 5 participants. Thus, the soap can be considered non-irritating based on the test results .(16)

#### 9. Alcohol Insoluble Matter

5gm of sample was taken in a conical flask. Added it to 50 ml of warm ethanol and shaken vigorously

to dissolve the solution was filtered through a tarred filter paper with 20 ml warm ethanol and dried it at 105°C for one hour. The weight of dried paper was taken.

Percentage alcohol insoluble matter =  $\frac{\text{Weight of the residue} \times 100}{\text{Weight of sample}}$ (17)

#### 10. Antifungal test

Evaluation of Antifungal Activity of Bael Fruit and Neem Soap Against Candida albicans Using the Cup Plate Method

##### METHODS:

Soap formulations containing extracts of bael fruit and neem were prepared using standard soap-making techniques. The cup plate method was employed to assess the antifungal activity of the soap formulations against Candida albicans. Agar plates were inoculated with Candida albicans and wells were created using sterile cups. The soap formulations were introduced into the wells, and the plates were incubated under appropriate conditions. Zones of inhibition around the wells were measured to determine the antifungal activity.

##### RESULTS:

Preliminary findings indicate significant antifungal activity of soap formulations containing bael fruit and neem extracts against Candida albicans. Clear zones of inhibition were observed around the wells, indicating the ability of the soap formulations to inhibit fungal growth. The size of the inhibition zones provides insights into the efficacy of the soap formulations in combating Candida albicans. Three formulations of herbal soap, designated as F1, F2, and F3, were evaluated for their antimicrobial activity against Candida albicans using the cut plate method. Among the tested formulations, F3 exhibited the highest zone of inhibition against Candida albicans, indicating superior antifungal efficacy compared to F1 and F2.(18)

**Comparative Analysis of Soap Formulations (F1, F2, and F3):****Table 2: Comparative Analysis of Soap Formulations (F1, F2, and F3)**

Sr. No	Parameters	F1	F2	F3
1.	Colour	Light Brown	Light Brown	Light Brown
2.	Oduor	Pleasant	Pleasant	Pleasant
3.	Shape	Rectangular	Rectangular	Rectangular
4.	Size	7.7cm X 2cm	7.7cm X2cm	7.7cm X2cm
5.	Weight	32 Gm	32.2 Gm	32.4gm
6.	Foam Height	2.5	2.6	2.3
7.	Foam Retention (Min)	3.0	3.0	3.0
8.	Moisture Content	18.4	18.9	19
9.	Skin Irritancy	No Skin Irritancy	No Skin Irritancy	No Skin Irritancy
10	Alcohol Insoluble Matter	4%	5%	7%

**CONCLUSION:**

The present study successfully developed and evaluated a herbal soap formulation containing neem and bael fruit extracts, demonstrating significant antifungal activity. The formulated herbal soap showed promising physical properties, including satisfactory appearance, color, pH, and hardness, making it suitable for practical application. The antifungal activity of the herbal soap was comparable to or even more effective than the standard antifungal agent, indicating the potential of neem and bael fruit extracts as natural alternatives for combating fungal infections. The safety evaluation also confirmed that the herbal soap was non-irritating and safe for topical use, highlighting its potential for commercial development as a natural antifungal soap. These findings contribute to the growing body of evidence supporting the use of herbal extracts in skincare products, particularly in the context of natural antifungal agents. Further studies are recommended to optimize the formulation, assess long-term stability, and evaluate the efficacy in clinical settings to validate the practical application of the herbal soap. In conclusion, the developed herbal soap formulation offers a promising natural alternative for antifungal skincare solutions, harnessing the

therapeutic properties of neem and bael fruit extracts.

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