INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Article

Comparative Evaluation of Synthetic and Herbal Marketed Soaps

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ARTICLE INFO

Published: 12 Jun. 2025
Keywords:
Synthetic soaps, Herbal soaps, antimicrobial activity, Foam retention, pH, Moisture content, Soap evaluation, Zone of inhibition, Skin compatibility, Dettol, Medimix, Himalaya.
DOI:
10.5281/zenodo.15645340

ABSTRACT

The purpose of this study was to assess and contrast the physicochemical and antibacterial qualities of a few commercially available synthetic and herbal soaps. The evaluation of six widely accessible soaps Medimix, Himalaya, Patanjali (herbal), Lifebuoy, Dettol (synthetic), and Dove (natural) was conducted using criteria such pH, moisture content, foam height and retention, alcohol insoluble matter, emolliency, and microbiological efficacy. The agar well diffusion method was used to conduct the microbiological study against Bacillus subtilis, Staphylococcus aureus, and Escherichia coli. The findings showed that while herbal soaps like Himalaya and Medimix had superior foam retention and skin-friendly qualities, synthetic soaps had greater antibacterial action, with Dettol displaying the biggest zone of inhibition (7.14 mm). With a pH of 7.5, Dove had the lowest, suggesting a gentler nature for skin compatibility. This comparative analysis provides insights into the performance differences between herbal and synthetic soaps, aiding consumer choice based on efficacy and skin sensitivity.

INTRODUCTION

1.1 Skin

The skin, the human body's largest organ, serves as a protective barrier against environmental threats while regulating temperature and sensory input. It is a multifaceted structure comprising several layers, each serving unique functions crucial for sustaining homeostasis.[1]

1.2 Importance of skin care.[2]

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

1.3 Soap

Soap, which is a cleansing agent, is produced by reacting fats or oils with an alkali such as sodium hydroxide. It aids in eliminating dirt, oil, and microbes from the skin, ensuring it remains clean and healthy. However, soaps are not all the same; they can be herbal or synthetic, each offering its own advantages and disadvantages.[3]

i. Herbal Soaps (Natural Soaps)

Soap, which is a cleansing agent, is produced by reacting fats or oils with an alkali such as sodium hydroxide. It aids in eliminating dirt, oil, and microbes from the skin, ensuring it remains clean and healthy. However, soaps are not all the same; they can be herbal or synthetic, each offering its own advantages and disadvantages.[3]

ii. Synthetic soaps (Commercial or Mass-Produced Soaps).

Synthetic soaps can be defined as a soap made with chemical detergents, artificial fragrances, and preservatives. These soaps are mass-produced and often cheaper to make. [3]

1.4 Soap molecules composed mainly of two parts:[4]

Hydrophilic head (water-attracting) — dissolves in water.

Hydrophobic tail (water-repelling) — dissolves in oils and grease.

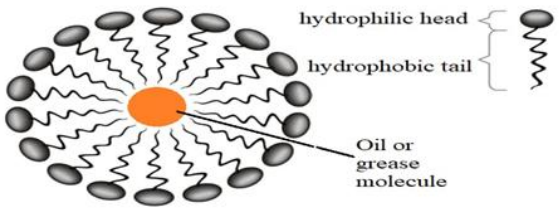


Fig no 2: Soap molecule

This dual nature allows soap to break down oils, dirt, and germs so they can be washed away with water.

1.5 General Formula: R-COO $^{-}$ Na

1.6 Types of Soaps

a. Herbal/Natural Soaps: Made with plant oils, herbs, and essential oils.
b. Synthetic/Commercial Soaps: Contain detergents, synthetic fragrances, and preservatives.
c. Medicated Soaps: Contain antiseptic agents (like triclosan) to treat skin infections.
d. Beauty/Moisturizing Soaps: Include ingredients like glycerin or shea butter for hydration.
e. Transparent Soaps: Made with sugar and alcohol to give a clear appearance (e.g., Pears soap).

Fig no 3: Types of soaps

1.7 Advantages and Disadvantages of soaps (5,6,7,8,9,10,11,12)

Sr.no	Advantages of soap	Disadvantages of soap
1.	Effective Cleaning Action.	limited Efficacy Against Resistant Bacteria.
2.	Soap has antimicrobial Properties.	Variable Antimicrobial Performance.
3.	Moisturizing Effects.	Skin Dryness and Irritation.
4.	Cost-Effective and Accessible.	Risk of Antimicrobial Resistance
5.	Biodegradable	Environmental Impact.

1.8 Good characteristics of soap

a. It should clean skin effectively.
b. It should maintains skin natural pH (5.5 – 7).
c. It should be gentle, non-irritating, and free from harsh chemicals.
d. It should have antimicrobial properties.
e. It should be biodegradable and eco-friendly.

2. MATERIALS AND METHODS

2.1 Materials:

Dettol, Lifebuoy, Dove, Himalaya, Patanjali and Medimix soaps were purchased from the local market of Nagpur. All the chemical reagent used for the project work is of analytical grade for the antibacterial studies, pure culture of *E.coli*, *Bacillus subtilis*, *S.aureus* bacterial strains were used which are available in laboratory.

2.2 Preparation of soap samples

Soap samples were prepared based on requirements of tests.

3) EVALUATION OF SOAPS[13]

The selected marketed soaps are evaluated for the following parameters

3.1 Physical characteristics:

Organoleptic characteristics of soaps are evaluated for the parameters such as colour, odour, texture, clarity, size, shape, and weight.

3.2 Determination of pH:

The pH of soaps was determined by using a digital pH meter Delta electronics, Model no-101.

3.3 Determination of percentage free alkali:

The % of free alkali of soap was determined by following procedure weigh 5g of finely grated soap and transfer it into a 250 mL conical flask. Add 50 mL of 95% ethanol and heat gently (without boiling) to dissolve the soap completely. Allow the solution to cool to room temperature. Add 2–3 drops of phenolphthalein indicator. Titrate the solution with 0.1 N hydrochloric acid (HCl) until the pink color disappears (indicating neutralization). Note the volume of HCl consumed (V mL) and calculate.

% of Free Alkali = Volume of acid used × Normality of acid × Equivalent weigh of alkali × 100 / weight of sample in gram.

3.4 Determination of foam height:

The foam height was determined by using this procedure 25 ml of sterilised water were used to dissolve a 0.5g sample of soap. It was diluted with water to a volume of 50 ml before being put into a 100 ml measuring cylinder. It took 25 strokes. It was permitted to stand until an aqueous volume of 50 ml has been measured. We measured the height of the foam above the aqueous volume.

3.5 Determination of foam retention:

The foam height was determined by using this procedure 1% soap solution was made. In a graduated measuring cylinder with a volume of 100 ml, 25 ml of 1% soap solution was taken. Ten times the cylinder shaken with the cover off. The amount of time it took for the foam to vanish was noted.

3.6 Determination of alcohol insoluble matter:

The alcohol insoluble matter was determined under the test conditions, the majority of the alkaline salts, such as borates, carbonates, silicates, and phosphates, talc along with sulphates and starch, are insoluble in alcohol. Alcohol insoluble matter also includes substances that are insoluble in alcohol under other conditions. 50 ml of warm ethanol was added to a conical flask containing 5g of soap sample, and the flask was vigorously shaken until the sample was completely dissolved. The solution was passed through a tare filter paper along with 20 cc of warm ethanol and dried at 105°C for an hour. It was observed the dried paper's weight.

% Alcohol insoluble matter = Weight of residue/ Weight of sample x 100

3.7 Determination of Sensitivity:

Through patch testing, it was tested. Apply the product to a 1-cm-long area of skin; if there are no rashes swelling, it was regarded to be non-sensitive.

3.8 Determination of Irritation:

Applying a product to the skin for 10 minutes is how it's done. It was regarded as a non-irritation product if there was no irritation.

3.9 Moisture content:

The total amount of water in soap was determined using the moisture content. To calculate the amount of moisture in 5g of soap, the weight was noted as wet weight or initial weight. In a hot air oven set to 100 to 115°C during one hour, a sample was dried. Once the sample had cooled, it was weighed. The sample's dry weight is indicated by this measurement. The formula shown below was used to calculate the moisture content.

% Moisture content = Initial Final weight/ Final weight 100

3.10 Emolliency test:

The emolliency of soap was determined by this process occlusiveness of soap compositions was assessed by an emolliency test. After each soap formulation's 2g portion was put on the surface of white sheets of paper across an area of around 5 cm and let to stand on the laboratory shelf for 24 hours, the degree of translucency was evaluated into a three-level rating of mild, moderate, or strong translucency.

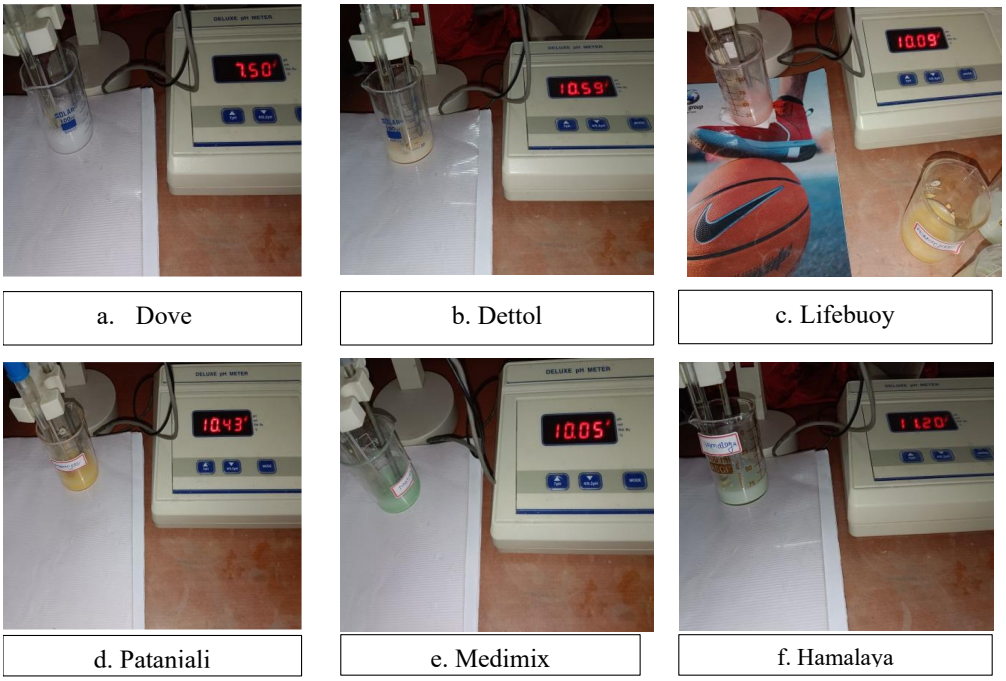
4. RESULTS AND DISCUSSION

4.1 pH of Soaps Using pH Meter

The pH of the soaps was determined of all synthetic and herbal soaps with the help of pH meter and results was mentioned in table no:2

Table no 2: pH of soaps

Sr.no	Soaps	pH
1	Dove	7.5
2	Dettol	10.59
3	Medimix	10.05
4	Patanjali	10.43
5	Lifebuoy	10.09
6	Himalaya	11.20



a. Dove | b. Dettol | c. Lifebuoy

d. Pataniali | e. Medimix | f. Hamalaya

Fig.No 4: pH of Soaps Using pH Meter Meter

4.2. pH using pH paper

The pH of soaps was determined using pH paper and found to be

Table no 3: pH of soaps using pH paper

Sr.no	Soaps	pH
1	Dove	Slightly Alkaline
2	Dettol	Alkaline
3	Medimix	Alkaline
4	Patanjali	Alkaline
5	Lifebuoy	Alkaline
6	Himalaya	Alkaline

Fig.No 5: pH using pH paper

4.3 Determination of Moisture Content

The moisture content was determined and found to be

Table no 4: Moisture Content

Sr.no	Soaps	Moisture content
1	Dove	8%
2	Dettol	13%

3	Medimix	7%
4	Patanjali	12%
5	Lifebuoy	9%

6	Himalaya	9%

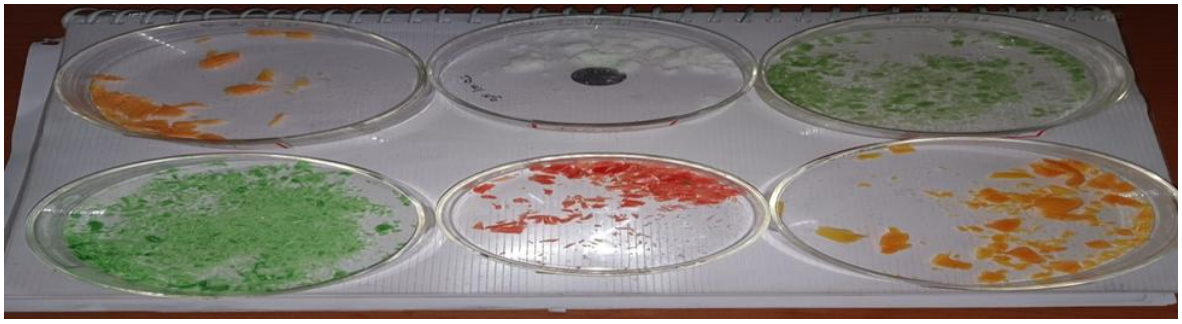


Fig.No 6: Moisture Content

- **Determination of Foam Height and Foam retention**

– Dove and Himalaya produced the highest foam volume (65 ml) with extended retention time 10 min (Dove),11 min (Himalaya) indicating a strong surfactant action.

– Patanjali Produced foam height 65 ml slightly lower than Dove and Himalaya.

– Medimix, despite lower foam height, demonstrated longer foam retention (11 min), possibly due to the presence of natural thickeners and herbal extracts that stabilize foam structure.

– Lifebuoy and Dettol has Lower foam height 50 ml and 45 ml with lowest foam retention 7 min (Lifebuoy) and 6 ml (Dettol).

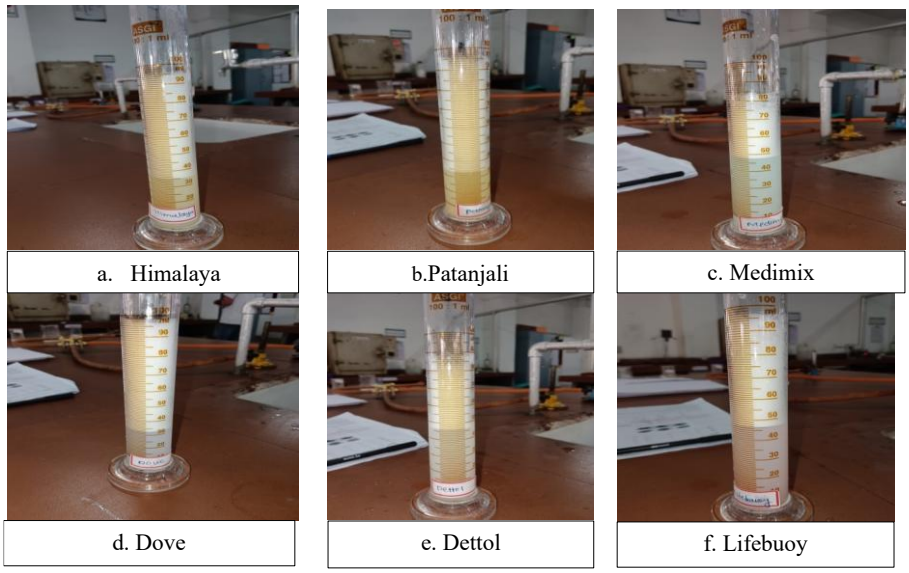


Fig.No 7: Determination of Foam heigh and foam Retention

4.4 Results of synthetic and herbal soaps

Table No:5 Results of synthetic and herbal soaps

Sr. No	Evaluation parameters	Observation Result					
		Synthetic Soaps			Herbal Soaps		
		Dove	Lifebuoy	Dettol	Medimix	Himalaya	Patanjali
1	Colour	White	Red	Light Orange	Dark Green	Light Green	Yellow

2	**Odour**	Creamy, floral	Strong medicinal	Medicinal or Antiseptic	Strong Herbal	Strong Herbal, fresh	Herbal and Turmeric
3	**Texture**	Smooth	Gritty	Gritty	Gritty	smooth	Gritty
4	**Clarity**	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque
5	**Shape**	Oval	Rectangula-r with rounded edges	Rectangul a-r curved edges	Rectangul-ar with curved edges	Rectangula r Rounded edges	Rectangular with curved edges
6	**Weight gm**	90	125	100	75	75	75
7	**pH**	7.50	10.09	10.59	10.05	11.20	10.43
8	**% Free Alkali**	0.02%	0.06%	0.05%	0.04%	0.03%	0.04%
9	**Foam Height**	65 ml	50 ml	45 ml	31 ml	65 ml	64 ml
10	**Foam Retention**	10 min	7 min	6min	11min	11 min	8 min
11	**Alcohol Insoluble Matter %**	22%	28.4%	19%	16.2%	19.2%	10.6%
12	**Sensitivity**	No Sensitivity	No Sensitivity	No Sensitivity	No Sensitivity	No Sensitivity	No Sensitivity
13	**Irritation**	No Irritation	No Irritation	No Irritation	No Irritation	No Irritation	No Irritation
14	**Moisture content**	8%	9%	13%	7%	9%	12%
15	**Emolliency test**	Very High	Low to Moderate	Low	Moderate	Low	Low to Moderate

5) MICROBIAL STUDY OF SOAPS

Method: Agar Well Diffusion Method for Antimicrobial Activity of Soap Solutions.

i. Sterilization of Materials:

Sterilize the Petri plates, agar media, and other necessary equipment using an autoclave at 121°C for 15 minutes.

ii. Preparation of Agar Medium:

Weigh the required amount of nutrient agar powder and dissolve it in distilled water. Heat the solution on a heating mantle until completely dissolved.

iii. Pouring and Setting the Agar:

Pour the molten agar into sterile Petri plates and allow it to solidify at room temperature under aseptic conditions.

iv. Inoculation of Bacteria:

Inoculate the surface of the solidified agar with the test bacteria (e.g., Staphylococcus aureus, E. coli) by spreading the bacterial suspension evenly using a sterile cotton swab.

v. Well Creation:

Use a sterile cork borer or pipette tip to create uniform wells in the agar.

vii. Addition of Soap Solution:

Prepare soap solutions by dissolving a specific amount of soap in sterile distilled water. Fill the wells with the soap solutions using a micropipette.

viii. Incubation:

Incubate the plates in an inverted position at 37°C for 24 hours.

ix. Observation and Measurement:

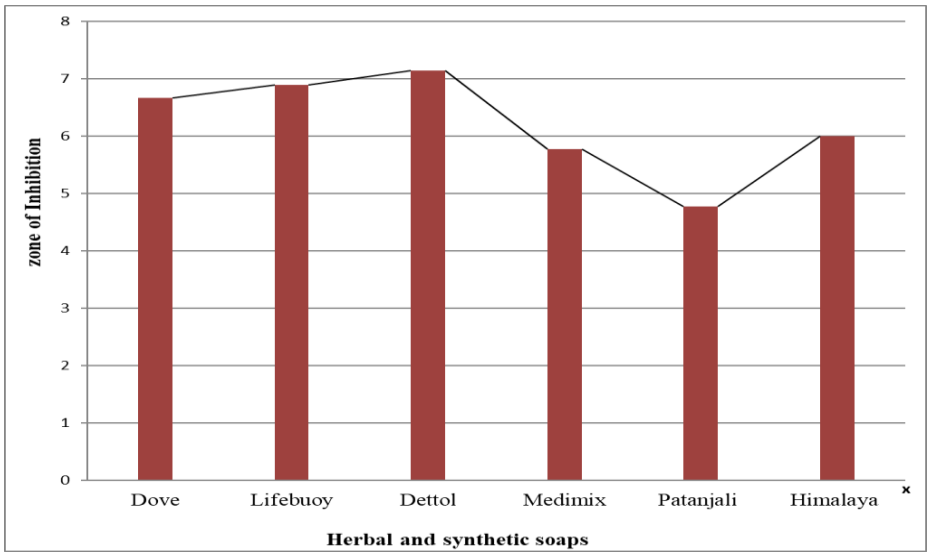
After incubation, observe the plates for clear zones of inhibition around the wells. Measure the diameter of the inhibition zones (in mm) to assess the antimicrobial activity of each soap sample.

5.1 Zone of Inhibition Values of Soap Sample

Table No 6 : Zone of Inhibition Values of Soap Samples

	Synthetic Soaps			Herbal Soaps		
Org/Stock	**Dove**	**Lifebuoy**	**Dettol**	**Medimix**	**Patanjali**	**Himalaya**
E.Coli	6.67 mm	7 mm	6.77 mm	5.67 mm	4 mm	6.67 mm
S.Aureas	7.67 mm	7 mm	7.33 mm	6.33 mm	5 mm	6.33 mm
B.Subtilis	5.67 mm	6.67 mm	7.33 mm	5.33 mm	5.33 mm	5 mm
Results	6.67 mm	6.89mm	7.14mm	5.78 mm	4.78mm	6mm

Graphical representation of antibacterial activity of soaps



CONCLUSION

The aim of the present research work was to evaluate and compare the synthetic and herbal marketed soaps. In the present study, to evaluate the efficacy of synthetic and herbal marketed soaps, the microbial study was performed by using various microbial strains *E. coli, S. Aures, B. Subtilis*. Himalaya, Medimix, and Patanjali soaps are selected as herbal, and Dove, Lifebuoy and Dettol are selected as synthetic soaps from the local market. They are characterized for the evaluation parameters such as color, odor, texture, clarity, weight, shape, pH, %free alkali, foam height, foam retention, alcohol insoluble matter, sensitivity, irritation, moisture content , emolliency test, and antibacterial activity. Based on the evaluation table No. 5 and antimicrobial activity results table no. 6, synthetic soaps demonstrated superior antimicrobial efficacy compared to herbal soaps, with Dettol showing the highest inhibition (7.14mm), followed by Lifebuoy (6.89 mm) and Dove (6.67 mm). Among herbal soaps, Himalaya exhibited the best antimicrobial activity (6 mm), followed by Medimix (5.78 mm) and Patanjali (4.78 mm). In

terms of physical properties, synthetic soaps and herbal soaps had good foam height but synthetic soaps have lower foam retention compared to herbal soaps. Himalaya had the highest pH (11.20), while Dove had the lowest (7.5), indicating variations in skin compatibility. Moisture content and emolliency were generally higher in synthetic soaps, making them more hydrating, whereas herbal soaps showed better foam retention. Hence, it was concluded that synthetic soaps provided better antimicrobial action, whereas herbal soaps exhibited milder skin-friendly properties with extended foam retention**.**

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HOW TO CITE: Syed Ahefaz Ali, V. M. Barethiya, Comparative Evaluation of Synthetic and Herbal Marketed Soaps, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 5, 2287-2295. https://doi.org/10.5281/zenodo.15645340