

HERBAL SOAP FORMULATION AND TESTING FOR ANTIBACTERIAL AND SKIN LIGHTENING PROPERTIESN. Pooja^{*1}, P. Mounika², D. Shailaja³, N. Rakesh⁴, J. Nandini⁵, D. Keerthi Priya⁶, R. Ramya⁷, Potina Mounika⁸¹Assistant Professor, ^{2,3,4,5,6,7,8}Students, Vijaya College of Pharmacy, Munaganoor, Hyderabad, India-501511.***Corresponding Author: N. Pooja**

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ABSTRACT

Ayurvedic cosmetics are the natural substances of herbs that have no adverse impact on the human body. The majority of herbal supplements are made out of plant substances that have been used in traditional or folk medicine for many years. The neem (*Azadirachta indica*) tree has gained worldwide recognition for its wide range of medicinal properties. Herbal soap offers a variety of benefits, including skin healing, natural aroma, and smoothing. Manufactured with natural elements that are not harmful to the environment and are biodegradable. Herbal soap ingredients use neem, Tulsi, and turmeric, neem leaf and seed were found effective against dermatophytes, turmeric shows anti-inflammatory and antibacterial properties, and Tulsi shows anti-viral and Herbal soap contains a combination of herbs such as Turmeric (*curcuma longa*), Flax seeds (*Linum usitatissimum*), Neem (*Azadirachta Indica*) to improve antimicrobial and skin-brightening properties. Marketed Antimicrobial soaps show better therapeutic effects against microbes, but they have the disadvantage of making skin brittle and dry, potentially increasing allergic reactions. To overcome the present approach by using mainly flax seeds, Turmeric, Sandalwood oil, Neem and Tulasi. The objective of this study formulate a polyherbal soap for antimicrobial and beautification process.

KEYWORDS: Antimicrobial, cosmetics, herbal soap, natural skin, neem, non-toxic, Tulsi, turmeric, skin health.**1. INTRODUCTION**

The word cosmetic was derived from the Greek word “kosm tikos” meaning the power of organic ability in adorning. The origin of cosmetics forms a continuous narrative throughout history. In 3000 BC, men utilized colors to get protect themselves from animals and avoid attacks by decorating their bodies and coloring their skin to frighten off potential enemies.

Cosmetics are substances that are intended to be rubbed, poured, sprinkled, sprayed, injected into, or applied in any other manner to the human body or any part of it to cleanse, beautify, enhance attractiveness, or alter appearance, according to the Drugs and Cosmetics Act of 1940 the drug license preview does not cover the cosmetic.^[2] Products containing phytochemicals from various botanical sources that influence skin function and provide nutrients for healthy skin or hair are known as herbal cosmetics. Natural herbs and their derivatives are cherished in cosmetic formulations for their healing properties. Herbal soap, in particular, is seen as a therapeutic option that includes beneficial antibacterial and antifungal elements. These ingredients are usually taken from different parts of medicinal plants, such as leaves, stems, roots, and fruits, and they can help with

healing, addressing infections, or improving overall skin health. Thanks to their antimicrobial qualities, these herbal mixtures are often used topically and come in various forms like soaps, gels, lotions, creams, ointments, and extracts. They have a long history of being effective for various skin issues, particularly those linked to pathogens like fungi, *Staphylococcus aureus*, and *Streptococcus* species. In traditional medicine, extracts or juices from plant leaves are applied externally to alleviate skin problems due to their anti-inflammatory and antimicrobial properties. Conditions like eczema, ringworm, and itching (pruritus) are frequently treated using these herbal solutions. Gel preparations made from succulent plants have proven effective for managing psoriasis and other long-lasting skin concerns. Plus, crude extracts from naturally soapy plants can help soften the outer layer of the skin (epidermis), which improves the absorption of active ingredients, assisting in acne treatment, and facilitating quicker healing and skin renewal.

Using ayurvedic herbs really enhances the appeal of cosmetic products! Ayurveda is widely recognized for its ability to provide lasting solutions for various health issues, and it seems that herbal cosmetics are on the rise

in today's market. Understanding the structure and the basic functions of our skin, along with knowledge of natural or herbal remedies for common skin problems, highlights the significance of herbal cosmetics. Our skin has a wonderful ability to repair itself to keep functioning well. In our youth, we often deal with issues like oily skin and acne, while as we age, dryness becomes more common. To achieve healthier skin, it's crucial to understand how our skin works and take the right steps to care for it.

Herbal soap is really popular, especially for folks with sensitive or dry skin, because it's super soothing and healing. These soaps are packed with natural stuff like essential oils and extracts from medicinal plants, which is why they've become a go-to choice lately. People love them for their health perks, being eco-friendly, and not having all those harsh chemicals that regular soaps do. You'll usually find ingredients like Aloe vera, Neem, Turmeric, and Tulsi in herbal soaps, and each of these has its own cool health benefits. It's a bit worrying, though, since a lot of beauty products today have all sorts of additives that can be pretty sketchy, leading to issues like skin rashes or allergic reactions. Some of them can even contribute to skin diseases.^[1]

Herbal soaps mainly use parts of plants like seeds and roots. They can help with things like bacteria, aging, and they even have antioxidant properties, which is nice. Plus, they're free of those synthetic colors, flavors, and fluoride that you often find in commercial soaps. A lot of people don't really realize how commercial soaps can mess with your health over time because they have ingredients that might not be great for your body.



Fig 1: Composition of Herbal soap.

Herbal soaps are crafted using a mix of natural ingredients that can really benefit your skin. The exact blend can change based on the brand and what you're looking for, but there are some common ingredients you'll find. For starters, base oils like olive oil, coconut oil, palm oil, or castor oil are often used. These oils help keep your skin moisturized and make a nice lather. Then there are essential oils, which come from different plants and add both scent and healing properties to the soaps. For instance, lavender oil helps you chill out, tea tree oil fights bacteria, and eucalyptus oil has a calming effect.

Plus, dried herbs or botanicals can be included for their skin-soothing or gentle exfoliating perks. Think chamomile for relaxation, calendula for reducing inflammation, or oatmeal for a soft scrub.^[8]

When it comes to skin issues, we've got Eczema, Acne, Rashes, Psoriasis, Allergies, dry skin, urticaria, and more. There are herbal remedies out there for specific skin problems that you can check out. And let's not forget, soap is a cleaning staple we all know about. People have tried to define soap in all kinds of ways. One way to think of it is that soap is any water-soluble substance made from fatty acids that have eight or more carbon atoms. Soaps are made for all kinds of uses, whether it's washing, bathing, or even for medicinal purposes. It's all about how the hydrocarbon chain loves oil and grease, while the carboxylic group connects with water, making soap super useful for cleaning.^[9]

2. LITERATURE REVIEW

The objective of this study is to develop a herbal soap that incorporates flaxseed and tomato juice, which will then undergo physicochemical evaluations including assessments of color, odor, texture, foam height, foam retention, irritation, saponification value, and pH. Flaxseed, the primary ingredient, is also referred to as green gram and is known for its therapeutic properties. Moong dal is particularly beneficial for enhancing oily and acne-prone skin. Green gram effectively eliminates harmful bacteria, removes impurities and excess oil, resulting in skin that is clear, supple, and wrinkle-free.^[4] The antibacterial efficacy of the soap was evaluated using the agar diffusion method, revealing moderate activity against *S. aureus* and *E. coli*. The findings indicate that the soap exhibits moderate antimicrobial properties. This study aims to create a polyherbal soap for beautification purposes. Consequently, it is concluded that the developed polyherbal soap can serve both cleansing and beautification functions. The culmination of our research involves the creation of a herbal aseptic cleaner utilizing a cold process system that includes antimicrobial agents. The herbal cleaner was formulated using various oils such as coconut, castor, neem, lavender, and rose. The herbal formulation was prepared and analyzed for pH, moisture content, color indicators, froth retention time, saponification, total fatty matter (TFM), and antimicrobial testing at different concentrations, with results compared to standard benchmarks. The herbal cleaner demonstrated satisfactory antimicrobial results when compared to antibiotics. Additionally, the oils used are beneficial for treating skin infections and for daily use.^[5]

Polyherbal soap is a unique type of soap that incorporates a blend of herbal extracts. Its popularity has surged due to its perceived effectiveness in addressing various skin issues. The creation of polyherbal soap entails the careful selection and combination of herbs, taking into account their therapeutic benefits and compatibility with soap-making components. The

assessment of polyherbal soap includes testing its physical, chemical, and microbiological characteristics to guarantee its quality and safety. Numerous studies have been conducted to assess the efficacy of polyherbal soap in treating skin ailments such as acne, eczema, and psoriasis. These investigations have yielded encouraging outcomes, indicating that polyherbal soap could serve as a safe and effective alternative to traditional soaps.^[6] In summary, the formulation and assessment of polyherbal soap require the selection and combination of herbs based on their therapeutic properties, along with testing the soap's physical, chemical, and microbiological attributes. Additional research is necessary to confirm the efficacy and safety of polyherbal soap for the treatment of various skin conditions.^[20]

Poly-herbal skin glowing soap was created using herbs such as Manilkara zapota (sapodilla), Cinnamomum zeylanicum (cinnamon), and Azadirachta indica extract. Herbal cosmetics, often referred to as traditional cosmetics, are recognized for their natural ingredients, which typically do not cause adverse effects on the human body. Sapodilla boasts a wide array of medicinal benefits, with its components providing moisturizing, skin-brightening, anti-aging effects, and antioxidant properties. It is an excellent source of carotenoids, multiple vitamins, essential minerals, and a significant amount of fiber.^[7] Additionally, it is rich in sugars, proteins, ascorbic acid, and minerals such as iron, copper, zinc, calcium, and potassium. Carotenoids possess antioxidant properties, contributing to a skin-brightening effect and reducing wrinkles. Cinnamon is known for its antifungal, antioxidant, and antibacterial properties, and it helps to dry out the skin by promoting improved blood circulation. Neem effectively balances oil production, promotes collagen synthesis, diminishes post-acne scars, and reduces skin inflammation.^[10] The herbal formulation was created and assessed for pH, moisture content, foaming index, foam retention time, alcohol insoluble matter, total fatty matter, and microbial testing using the microorganism *Escherichia coli* through the zone of inhibition method. The resulting polyherbal soap boasts an appealing appearance, excellent cleansing properties, a strong foaming effect, and enhances skin radiance without causing any side effects.^[11]

The antibacterial efficacy of the formulation was evaluated using the agar well diffusion method against *Staphylococcus aureus* and *Bacillus subtilis*. The polyherbal formulations demonstrated significant antibacterial activity. Various physicochemical parameters, including pH and foam retention time, were assessed for the prepared polyherbal soap, yielding positive results. The accessibility of these plants and their effectiveness on the skin provide manufacturers with cost-effective advantages, easy sourcing, and minimal or no side effects. Given that certain herbal plant extracts possess antibacterial properties, this research aims to develop an antibacterial polyherbal bath soap utilizing *Azadirachta indica* and *Curcuma longa*.^[12]

The polyherbal formulation was prepared and subsequently evaluated for pH, moisture content, saponification, foaming index, foam retention time, ethanol soluble matter, and antimicrobial activity at different soap solution concentrations compared to the standards. The evaluation tests confirmed that the herbal soap exhibits satisfactory antimicrobial results.^[13]

3. METHODOLOGY

Tulsi is rich in Vitamin C and zinc. It thus acts as a natural immunity booster and keeps infections at bay. It has immense anti-bacterial, anti-viral, and anti-fungal properties which protect us from various infections. Tulsi leaf extract increases the T helper and natural killer cells' activity, boosting the immune system. Some of the common ayurvedic which to prepare commonly prepared with good testing follows.

TURMERIC

- Biological Source: *Curcuma Longa*
- Common Name: Haldi
- Part Typically Used: Root
- Effect: Dark Spot, Natural Glow, Diminish Scars
- Properties: Antibacterial, Antiaging, Antioxidant.



Fig 2: Turmeric.

Benefits: Inflammation, Degenerative eye conditions, Metabolic syndrome, Arthritis, Hyperlipidaemia (cholesterol in the blood), Anxiety Muscle soreness after exercise, Kidney health.

NEEM

- Family: Meliaceae
- Biological Source Active: *Azadirachta Indica*
- Constituents: *Azadirachta*, Nimbin, Nimbidin
- Parts Use: Leaves, Seed, Flower, Bark
- Uses: Moisturising, Cooling,
- Properties: Antibacterial. Anti-Septic
- Other Uses: Insecticide, Antifeedant
- Benefits: Neem preparations are reportedly efficacious against a variety of skin diseases, septic sores, and infected burn.



Fig 3: Neem.

FLAX SEEDS

- Biological source: *Linum usitatissimu*
- Family: Linaceae



Fig 4: Flax Seeds.

- Geographical sources: Argentina, India, Russia, and Canada.
- Chemical Composition: Flaxseed is well-known for the content of chemical compounds with specific biological activity and functional properties: Polyunsaturated fatty acids (PUFA) omega3 family, soluble dietary fibres, lignans, proteins and carbohydrates.
- Uses: nutritional supplement, anti-aging property, also used for purpose of printing notes and cigarette paper.

RITHA

- Botanical name: *Sapindus mukorossi*
- Part typical used: seed

All the required herbs were collected from different areas of Solapur, like flax was collected from local masala market in Solapur, and other ingredients, such as tomato juice, from fresh tomatoes found in college area and they were finely chopped and juice was done by using mixer.^[14]

Table 1: Formulation.

INGRIDIENT	QUANTITY	PURPOSE
Coconut oil	200g	Base oil--cleansing, lather
Stearic acid	50g	Hardener and opacifier
Glycerine	250g	Humectant
Propylene glycol	100g	Solvent, improves clarity
Sorbital	150g	Transparency
Ethanol	100g	Clarifying agent
Sodium hydroxide	40-60g	Alkali--for saponification
Distilled water	100g	To dissolve NaOH
Perfume	Q.S	Fragrance

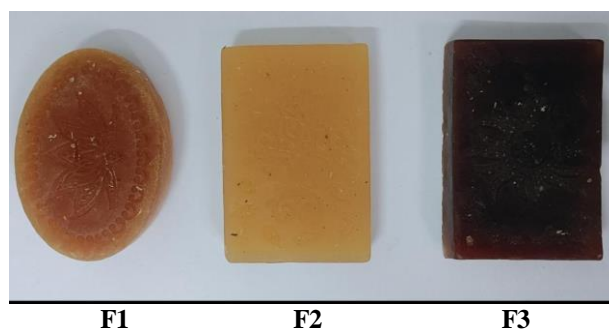


Fig 5: Evaluation of soaps.

METHOD OF PREPARATION

Step 1: Prepare the Lye Solution

Carefully dissolve 40–60 g of NaOH in 100 g of distilled water. Stir slowly and allow it to cool to room temperature. Safety Note: Always add NaOH to water (not the reverse) and wear gloves and goggles.

Step 2: Melt Oils and Stearic Acid

In a stainless-steel vessel, melt 200 g coconut oil and 50 g stearic acid using a water bath. Heat gently to around 50–55°C.

Step 3: Saponification

Slowly pour the cooled lye solution into the melted oils with constant stirring. Blend until a trace appears (it thickens like pudding).

Step 4: Add Other Ingredients

Add 250 g glycerine, 100 g propylene glycol, and 150 g sorbitol. Then slowly mix in 100 g ethanol while maintaining low heat (don't boil).

Stir continuously until the mixture becomes clear and uniform.

Step 5: Add Fragrance and Color

Let the mixture cool slightly, then add essential oils and color (if needed). Mix well.

Step 6: Melding and Solidification

Pour the hot soap base into soap molds. Allow it to cool and set for 24–48 hours at room temperature. Once

hardened, remove from molds and store in airtight containers.



Fig 6: pH Test.

Melt And Pour Method

- Very first, weighed the all required ingredients and kept them aside.
- After that kept a beaker on hot crack pot containing water, that breaker contained oil bases such as wax, oil (nourishing purpose).
- Wait until they get melted, after that we added our herbs, with continuous stirring and temperature must be kept at 35°C to 40 °C does not exceed.
- Once the all ingredients were mixed properly, at last added essential oils for fragrance and soap lye for coloring purpose with stirring.
- Poured the formulation into the moulds (plastic, glass or steel) and kept for room temperature for 24hrs.
- Removed the soap from the moulds and kept for 12 to 14 hrs and then soap was ready after that it was ready to packing.

Table 2: Foam Retention Time.

Batch	1 minute	2 minute	3 minute	4 minute	Average
F1	0cm	0cm	0cm	0cm	0cm
F2	3sec	4sec	4.5sec	5sec	4.12sec
F3	2sec	3sec	3sec	3.5sec	2.87sec

APPLICATIONS

Crafted with natural ingredients and plant extracts, herbal soaps provide a diverse array of advantages for both skin health and over-all well-being. Benefits of herbal soaps. Gentle and mild: Herbal soaps are typically gentle and mild on the skin, making them suitable for individuals with sensitive skin. Herbal soaps present a healthier alternative to conventional soaps, as they are devoid of harsh chemicals, artificial fragrances, and synthetic additives that may lead to skin irritation.^[15]

Natural ingredients: Formulated using natural ingredients like herbs, botanical extracts, essential oils, and plant-based oils, herbal soaps offer a wholesome

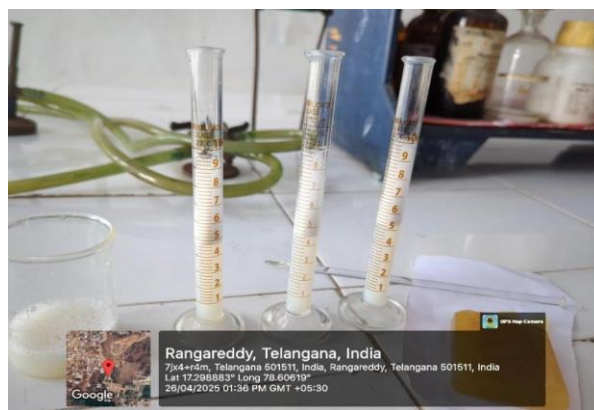


Fig 7: Foam Retention Time.

Foam Retention Time

25ml of the 1% soap solution was taken into a 100ml graduated measuring cylinder. The cylinder was covered with hand and shaken for 10 times. The volume of foam at 1min interval for 4 minutes was recorded.

Anti-microbial test: The prepared soap was subjected to antimicrobial screening by the agar well diffusion standard cup plate method. Organisms used were *E. coli*, *S. aureus*, and *P. aeruginosa*. One gram of soap was mixed with 5ml of sterile water¹⁴. Evaluation of Prepared Herbal Soap Formulation for Antimicrobial Activity. The [agar-well diffusion] standard cup plate technique was used to determine the antimicrobial activity by using Sabouraud's dextrose agar [Hi- media]. The melted media were seeded with the suspension of microorganisms and allowed to solidify. The formulations were aseptically transferred to the Hi-media in Petri-dish with the help of sterile forceps. The medicated soap was kept for incubation in an incubator at 30°C for 5-7 days. Observation: The assessment of antimicrobial activity was based on the measurement of the diameter of the zone of inhibition in mm. The values were recorded and given in a table.

approach to skincare. These ingredients are often chosen for their nourishing, soothing, and healing properties. They provide the skin with beneficial nutrients, vitamins, and antioxidants.^[16]

Moisturizing: Many herbal soaps contain natural oils, such as olive oil, coconut oil, shea butter, or cocoa butter, which help moisturize and hydrate the skin. These oils helps in forming a protective barrier preventing dryness. It makes the skin soft, supple, and smooth.^[17]

Soothing and calming: Herbal soaps frequently include herbs and botanical extracts renowned for their soothing and calming attributes. Ingredients like chamomile,

lavender, calendula, and aloe vera can help alleviate skin irritation, redness, and inflammation, providing relief for conditions like eczema, psoriasis, or sunburn.^[18]

Deep hydration: Omega-3 fatty acids in flax oil strengthen the skin barrier and retain moisture.

Gentle exfoliation: Ground flaxseed in the soap helps remove dead skin cells, leaving the complexion soft and smooth.

Anti-aging: Rich in antioxidants (vitamin E, lignans), flaxseed combats free radicals and may diminish wrinkles and blemishes.

Acne relief: The soap's anti-inflammatory and mild antimicrobial properties help soothe acne and prevent breakouts.

4. RESULTS AND DISCUSSIONS

The evaluation of anti-microbial herbal soap was performed successfully and tabulated in table no 8. The prepared herbal soap was shown in figure. The physicochemical parameters for herbal soap formulations F1, F2 and F3 such as colour, appearance, pH are determined. The formulations have a light yellow colour with an aromatic odour and had a good appearance as well as the pH was found to be in the range of 6 to 7. Healthy skin has a pH of 5.4 to 5.9 and the prepared formulations pH was found to be neutral in nature and doesn't cause any irritation or sensitization to the skin. Other parameters like foam height, foam retention are also performed and showed good results, the prepared soaps produced good lather i.e. 2.5-3.0 cm and retained on the skin for 3 minutes. Alcohol insoluble matter was also evaluated successfully which was found to be 15-18 %, indicates that the prepared soaps were free from non-soap ingredients and soft soaps were produced which improves the overall quality of the soap. The antimicrobial activities of herbal soaps were studied.

Table 3: Antimicrobial test.

Formulation Code	Zone of inhibition(mm)		
	Microorganisms		
	<i>P. aeruginosa</i>	<i>S. aureus</i>	<i>E. coli</i>
F1	11	13	12
F2	16	19	15
F3	15	16	13

The zone of inhibition for F, F2 and F3 formulations were calculated. F2 formulation showed a maximum zone of inhibition than the F1 and F3 formulation. A significant result was obtained for F2 formulation against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli*, which were found to be 16mm, 19mm, and 15 mm respectively due to the synergistic effect produced by the incorporation of alcohol in the F2 formula which showed significant zone of inhibition and acts effectively against bacteria on the skin and can be used to treat acne and bacterial infections on the skin. F2

formulation was found to be the best formulation due to good quality of the soap with a neutral pH, safe to use on the skin without any irritation to the skin and also it forms good lather and retains well on the skin. The prepared Soap had minimal matter insoluble in alcohol and the soap prepared was pure with minimal moisture content and with increased shelf life. The F2 formulation has high amounts of fatty acid (stearic acid) which imparts lubrication effect to the skin while washing, which was the basic criterion of good quality soap.

Table 4: Test report.

S.NO	TEST	REPORT
1	PHYSICAL EVALUATION	PASS
2	SAPONIFICATION VALUE	PASS
3	PH VALUE	PASS
4	IRRITABILITY TEST	PASS
5	FOAM RETENTION TEST	PASS

5. CONCLUSION

The formulated herbal soap demonstrated significant antimicrobial activity and skin-brightening potential due to the synergistic effect of natural plant-based ingredients. Through a systematic evaluation of physical parameters such as pH, foam stability, hardness, and skin compatibility, the soap was found to be both safe and effective for regular use. The incorporation of herbal extracts with known antimicrobial (e.g., neem, tulsi) and skin-brightening (e.g., turmeric, licorice) properties provided a multifunctional benefit, making it a promising alternative to conventional chemical-based soaps. This formulation offers a natural, eco-friendly, and skin-friendly solution that meets the growing consumer demand for herbal cosmetic products. The prepared herbal soap's physical, biological, and organoleptic characteristics were examined. The composition had a pleasing colour and scent, and it looked good. It was discovered that the pH was within the designated range of 8 to 10. Other factors that represented the standard values for soap were found, including moisture content, alcohol insoluble matter, and the percentage of foamability and foam stability. According to biological characteristics, such as an antibacterial study that was done, the produced soap has a strong antibacterial effect. Based on the findings of this research study, it is possible to formulate herbal soap using the decoction method while taking into account a variety of factors, including skin condition and the potential and activity of the herbs. When examined for various tests, the created mixture produced positive findings.

REFERENCES

- Kapoor. V. P., Herbal Cosmetics for Skin and Hair Care, Natural Product Radiance, p 306-314.
- Harry R.G, In: Modern Cosmeticology, Vol 1(Revision Eds), Wilkinson J.B., Clark.R., Green E., McLaughlin T.P., 1962, Leonard Hill (Books) Ltd, London.
- Sankholkar.D.S, Current Regulations and Suggested Way Forward, The Pharma Times, 2009; 41(8):

- 30-31.
4. Kareru, P. G., Keriko, J. M., Kenji, G. M., Thiong'o, G. T., Gachanja, A. N., and Mukiira, H. N. (2010). Antimicrobial activities of skincare preparations from plant extracts. *African Journal of Traditional, Complementary and Alternative Medicines*, 7(3).
 5. Bandyopadhyay, U., Biswas, K., Sengupta, A., Moitra, P., Dutta, P., Sarkar, D., ... and Banerjee, R. K. (2004). Clinical studies on the effect of Neem (*Azadirachta indica*) bark extract on gastric secretion and gastroduodenal ulcer. *Life Sciences*, 75(24): 2867-2878.
 7. Sharma, J., Gairola, S., Sharma, Y. P., and Gaur, R. D. (2014). Ethnomedicinal plants used to treat skin diseases by Tharu community of district Udham Singh Nagar, Uttarakhand, India. *Journal of Ethnopharmacology*, 158: 140-206.
 8. Kapoor, V. P. (2005). Herbal cosmetics for skin and hair care, 4(4): 306-315.
 9. Charaka Samhita, Handbook on Ayurveda, Editor, Gabriel Van Loon, 2002-2003 Vol 1.
 10. Prashant, L., Kole et al, Cosmetics potential of herbal Extracts, natural Product Radiance, 2005; 4(4): 315-321.
 11. The Wealth of India: A Dictionary of Indian raw Materials and Industrial products- Raw materials Series, Publication and Information Directorate, CSIR, New Delhi, Vols I-XI, 1948-1976; Revised Series IA, Information Directorate, CSIR, New Delhi, Vols I-XI, 1948-1976; Revised Series IA, 1985; 2B, 1988; 3 Ca-Ci, 1992.
 12. Chopra R.N., Nayar S.I., Chopra I.C., Glossary of Indian Medicinal Plants, Publications and Information Directorate, CSIR, New Delhi, 1956.
 13. D'Amelio F.S, Sr, In: Botanicals A Phytocosmetic Desk Reference (Ed. FS D'Amelio, Sr), 1999, CRC Press, London.
 14. Kumar S, Medicinal Plants in Skin Care Director, Central Institute of Medicinal and Aromatic Plants, Lucknow, 1994.
 15. Thakur R.S., Puri, H.S., Hussain, A, In: Major Medicinal Plants of India, 1989, CIMAP, Lucknow.
 16. The British herbal Pharmacopoeia, British Herbal Medicine Association, 1996.
 17. Ceres A, The healing power of herbal teas. Thorsons Publishers, London, 1984.
 18. Warra, A. A. (2013) Soap making in Nigeria using indigenous technology and raw materials, *African Journal of Pure and Applied Chemistry*, 7(4): 139-145
 19. Okeke, S. U. N. (2009) Home economics for schools and colleges, Onitsha: Africana First publishers Plc Nigeria.
 20. Adaku, U. and Melody, M. (2013) Soap Production Using Waste Materials of Cassava Peel and Plantain Peel Ash as an Alternative Active Ingredient, Implication for Entrepreneurship, *IOSR Journal of VLSI and Signal Processing*, 3(3): 2319 – 4197.
 21. Antezana, W., Calve, S., Beccaccia, A., Ferrer, P., Blas, C. D., Rebollar, P. G. and Cerisuelo, A. (2015) Effects of nutrition on digestion efficiency and gaseous emissions from slurry in growing pigs.
 22. Phanseil, O. N., Dueno, E. and Xianghong, W. Q. (1998) Synthesis of exotic soaps in the chemistry laboratory, *Journal of Chemistry Education*, 75(5): 612.