Research on Formulation and Evaluation of Goat Milk Soap

Akash K[2], Ms. Nithiya S[3], Sathish P[4], **Dr. kannabirran Vaikumdam*[1]**, Senthilkumar Krishnan[5], Dr. Rajalingam D[6].

[123] U.G. Scholars, Kamalakshi Pandurangan College of Pharmacy, Ayyampalayam, Tiruvannamalai, Tamil Nadu.

[4,5,6]Professor, Kamalakshi Pandurangan College of Pharmacy, Ayyampalayam Tiruvannamalai, Tamil Nadu.

Abstract: Goat milk Soap is a mingle of both science and art by combining scientific knowledge and artistic creature. Cost effective, skin and eco-friendly goat milk soap has been developed by a cold process of saponification by using food-grade, natural ingredients with vegetable oils such as coconut oil, palm oil with active ingredients such as goat milk, and essential oil. The addition of fresh goat milk is the main challenge due to heat generation by caustic lye during the saponification process. The caustic soda in soap formula is caramelize the sugar in the milk, turning soap a bright brown color or curdles the milk. Hence, the study has been initiated and developed a standardized formula with desired qualities, color, and texture. The experiment studied physio-chemical parameters and dermatological tests of formulations of goat milk soap.

Keywords: Cosmeceutics, Goat Milk, Soap Formulation, Dermatological Evaluations, Natural Skincare

Introduction:

The body's outermost layer, human skin, acts as the body's first line of defense against a range of infections. The skin is constantly exposed to a range of stimuli because it interacts with the environment. As a result, the skin is prone to injury. When badly damaged skin tries to heal, scar tissue emerges, which is typically decolorized and depigmented. Chemical soaps, on the other hand, are known to promote skin irritation and dryness. Natural-ingredient cosmetics are becoming more popular among consumers as a healthier, organic, and ecologically responsible option. The natural component of goat has no negative effects on the human body in the vast majority of cases. In France, human milk consumption was defined in 1909 by the International Congress of Food by the following formula: "milk is the product of the total, full and uninterrupted milking of a dairy female in good health, also nourished and not overworked. It must be collected properly and not contain colostrum. Milk is a whitish food generally produced by the mammary secretory cells of females in a process called lactation; it is one of the defining characteristics of mammals. The milk produced by the glands is contained in the udder. Milk secreted in the first days after parturition is called colostrum. .The quality of milk is paramount; therefore, it must be properly stored and transported in optimal conditions. This vital product consists of four physical phases: gas phase, which essentially comprises CO2 at milking time. fatty phase composed of cells, fat (2 to 5 m of diameter) which contain lipids and fat-soluble elements, the fatty globules are surrounded by phospholipids and protein membrane. colloid phase comprising casein micelles associated with phosphates and citrates

of calcium and magnesium. aqueous phase consisting of the soluble proteins (whey protein), lactose and minerals (electrolytes). There is an inverse relationship between the content of lactose and minerals, in order to keep the milk in relation with the isotonic blood plasma. The - nutritional value of milk is particularly high due to the balance of the nutrients that compose it. The composition varies among animal species and breeds within the same species, and also from one dairy to the other, depending on the period of lactation and diet (Table 1). For instance, goat milk is 88% water and 11.4% solids; it contains 3.2% fat and 8.13% of fat solids. It is also comprised of calcium (0.11%), phosphate (0.08%) and magnesium (0.21%). In general, goat milk compared to cow milk (Table 2) is less rich in lactose, fat and proteins, but have similar mineral content. Mammalian Milk contains several groups of nutrients. Organic substances are present in about equal quantity and are divided into elements builders, proteins, and energy components, carbohydrates and lipids. It also comprises functional elements, such as traces of vitamins, enzymes and dissolved gases, and contains dissolved salts, especially in the form of phosphates, nitrates and chlorides of calcium, magnesium, potassium and sodium. It also contains dissolved gases (5% by volume), mainly carbon dioxide (CO2), nitrogen (N) and oxygen (O2)

Composition of goat milk Different milks have different composition. Composition of the cow, goat and human milks are mentioned in table 1. Composition of these milk are vary according to changes in diet, individuals, season, breed, species, feeding managements, environmental conditions, stage of the lactation, locality and condition of the udder. Goat milk differs from cow and human milk in having better digestibility, buffer capacity, alkalinity and therapeutic values. Fat of goat milk have higher physical properties i.e. surface tension, viscosity and specific gravity as compared to cow milk.

Table 1. The composition of milk from different mammals in g /100 g milk (Konte,1999).

Species	Water	Proteins	Fat	Lactose	Ash
Cow	87.2	3.5	3.7	4.9	0.72
Sheep	82.7	5.5	6.4	4.7	0.92
Goat	86.5	3.6	4.0	5.1	0.82
Camel	87.7	3.5	3.4	4.7	0.71

Table 2. Composition of milk and goat's milk per 100 g of milk (Cayot, 1998)

Species	Proteins	Casein	Fat	Lactose	Ash
Cow	3.2	2.8	3.90	0.90 to 4.9	0.90
Goat	2.8	2.3	3.38	4.4 to 04.7	0.5 to 0.8

Materials and methods:

S. No	Ingredients	Role of activity	Physical test
1	Goat Milk	Active pharmaceutical ingredient	Viscosity, Surface tension, Density, Fat content
2	Sodium Hydroxide	Saponification agent, Create soap base	Solubility, pH, Melting point, Micro scoping test
3	Coconut oil	Antimicrobial property, Hardness and stability of soap	Melting point, Refractive index, Solidification
4	Palm oil	Lather and cleaning, Provide mild soap	Cloud point test, Viscosity, Density, Melting point
5	Olive oil	Moisturizing properties, improve skin elasticity	Viscosity, Density, Melting point, Smoke point test
6	Glycerin	Used for transparent soap, Moisturizing properties, improve soap structure	Viscosity, Density, Refractive index
7	Light kaolin	Absorbing excess oil, Exfoliating properties	Solubility, Sedimentation, Brightness test
8	Orange oil	Anti-microbial, Anti-inflammatory agent, refreshing scent	Optical rotation, Flash point, Solubility
9	Manjistha	Unique color, Natural and non-irritating	Particle size, Bulk density, Moisture content, Solubility
10	Distilled water	Dissolving sodium hydroxide, Shaping and molding	Conductivity, Boiling point, Freezing point

Table. No. 3: Role of activity and physical test for soap ingredient

S. No	MATERIAL	PURPOSES	BRAND
1.	Measuring cylinder	For accurate measurements of liquids, oils, and lye. To reduced errors.	VMR
2.	Spoon	Scrap the sides and bottom of the mixing bowl, to handle small quantities of ingredients.	Thermo scientific
3.	Molding and curving	Create soap bars with specific shapes, sizes, and designs.	VMR and Bramble berry
4.	Thermometer	Helps to monitor the temperature of the lye and oil	VWR
5.	Mixing bowls	Used to mix the lye with water, goat milk and other ingredient	Pyrex
6.	Blender	Used to mix and blend the soap ingredients, such as oils, fats, and lye, to create a uniform mixture.	VWR
7.	Gloves, Mask, Goggles	Prevent skin contact with lye (sodium hydroxide), which can cause severe skin irritation, burns, and other injuries.	Micro flex, Honey well

Table. No.4: **Materials it's purposes and brand**

Method of preparation:

There are five main methods of making soap, assuming you count liquid soap as one of them. In this article, we are going to do a quick run-down of these methods, considering both the advantages and disadvantages of each one! If you've already done your research and know which type of soap you want to make, click here for in-depth instructions on how to use each of these methods

1. Cold Process Soap Making

This is the most common type of soap making, though it is slightly more difficult than the melt-and-pour methods. One of the advantages to cold process soap making is that it offers you the option to use essential oils in your soap, or add in other herbs, fragrances, and colors as you prefer. Additionally, cold process soaps are of higher quality and last longer than other soaps.

However, there are also some disadvantages, as this methods involves using dangerous chemicals, meaning you need to use proper safety equipment and precautions. The soap also takes a long time to prepare and cure, meaning the process can take up to six weeks from start to finish.

2. Hot Process Soap Making

Similar to cold process soap in terms of ingredients, hot process soap making differs because it is cooked instead of cured! This means you won't have to wait the long curing time you do for cold process soap, but you are adding the element of heat, which is an additional safety concern.

3. Melt and Pour Soap Making

If you are just starting out on your DIY soap-making journey, the melt-and-pour methods is the perfect place to start. It involves buying a soap base (online or at a local craft store) and then experimenting with add-ins such as essential oils, colorings, and fancy molds. This methods of soap making is great for doing with older children (under adult supervision, of course) and doesn't cost a lot in terms of materials or time. The disadvantages of melt and pour soap are that it tends to be of lower quality, and there aren't always a lot of options when it comes to choosing which soap base you wish to use.

4. Re-Batched Soap Making Method

In some ways, the re-batched soap method is similar to the melt-and-pour methods. It involves taking existing bars of soap and melting them down, thus creating your own, new blend. You can use milk, tea (infused with herbs), or water to melt the soap, which will contribute to your new creation. This is obviously an easier and safer route to go in comparison to the hot and cold process methods of soap making, but it does limit the amount of creativity you get to use.

5. Liquid Soap Making Method

These days, a lot of people prefer liquid soap to bar soap, due to ease of use. Liquid soaps are easy to make, and they have the added benefit of being great gifts. This methods involves taking a bar of soap and melting it down with Water and Glycerin until it dissolves into a liquid base. You can then customize it with essential oils and coloring agents.

Formulation:

Goat milk Soap is made by cold process method by combining oils and caustic lye solution at 40-45^{o} C. Mixing these two components together will create both soap and glycerin and the glycerin left acts as a moisturizing agent. Before saponification, the temperature is usually raised to a point sufficient to ensure the complete melting of the fat being used. The seven different composition of soaps contains essentially coconut oil, palm oil, olive oil and is formulated with natural ingredients like goat milk, essential oils

S. No	Ingredients	Quantity
1	Goat Milk	15ml
2	Sodium Hydroxide	10g
3	Distilled water	10ml
4	Coconut oil	30ml
5	Palm oil	18ml
6	Olive oil	4ml
7	Glycerin	7ml
8	Light kaolin	1g
9	Orange oil	1ml
10	Manjistha	4g

Table no.5: **Formulation of soap**

Procedure by cold process method:

Lye solution has been prepared by dissolving Sodium Hydroxide with distilled water add the calculated amount of goat milk into lye solution, it is added with vigorous stirring at 40-45^0 C by mechanical stirrer. Oils are mixed with lye, by adding drop by drop and add glycerin. Add light kaolin, Manjistha powder in to a mixture. Add glycerin and orange oil and mix it. Then poured into molding, curving to harden and kept for air dry for approximately four to six weeks at room temperature.

Evaluation:

The evaluation of the goat milk soap is depending on various factors such as the type of oils used such as coconut oil, palm oil, olive oil, etc and type of alkali used, its hardness, TFM, Foam Height, Solubility, etc it is performed. The parameters mentioned in Table II, are tested as per the Indian standards Requirements.

Organoleptic test: by observing Colour, Odour. Appearance of the goat milk soap.

Compatibility studies: The spectra was recorded in the wave number range of 4000 to 400 cm-1 for these compatibility investigations, which were conducted using an ATR-FTIR spectrophotometer. The sample was then taken from the mortar and placed in the sample

holder's cavity, where the spectrum was recorded. ATR-FTIR spectroscopy was fixed at the range of 4000- 400cm-1. There is no interaction between the drugs and excipients. To optimize formulation concentrations of excipients that affect foaming ability, soap base concentrations were altered to see how they affected foam ability.

Determining of pH: The pH of soap was determined using a digital pH meter. The formulations were diluted in 100 mL of distilled water and kept for two hours in the refrigerator. The pH of the formulation was determined using a digital pH meter that had already been calibrated.

Irritation of the skin: The goat milk soap formulation was evaluated for irritancy of the skin. The medication causes no irritation or redness. The situation was monitored for a total of 24 hours. One of the most important factors to consider while making soap is how to avoid skin discomfort.

Wash ability Evaluation: The goat milk soap was put through a formulation test, as well as the simplicity with which it could be washed with water. Wool yarn was used to test the cleaning activity. Although the primary goal of a soap is to clean or remove dirt or sebum, standardizing experimental detergency evaluation has proven challenging due to a lack of consensus on a standard soil, a repeatable soiling technique, or the amount of soil a soap should remove.

Free Caustic Alkali: 10 g of the sample digested in 100 ml of ethyl alcohol into a 250-ml flask, heated in reflux condenser and immersed into a boiling water-bath, until the soap is dissolved. 5 ml of barium chloride solution added into the solution to eliminate traces of carbonates which are usually present. Add a few drops of phenolphthalein indicator and titrated with standard sulfuric acid or hydrochloric acid.

Free caustic alkali (as NaOH), percent by mass = 4VN/M. V = volume in ml of standard sulfuric acid or hydrochloric acid used, N = normality of standard sulfuric acid or hydrochloric acid, and M = mass in g of the material taken for the test.

Foam Height: For the determination of the soap for its ability to form foam about 1.0 gm of soap was taken and dissolved in distilled water (about 50ml) in a 100 ml graduated measuring cylinder. The measuring cylinder was then shaken for about 2-3 minutes and it was allowed to stand for about 10 min. Foam height was measured after 10 minutes. Recorded the observation for three consecutive experiment and the mean was taken

Mush Value: The Mush Value was determined by Tablet-Immersion Method. 80 g of the soap bar was cut down to a rectangular block and 50 mm from the bottom of the soap bar was immersed in demineralized water at room temperature for exactly 2h. Removed the soap bar and left for about 1 min to drain off the excess water. Carefully scraped off all the mush. Repeated the above steps again Loss in mass due to mush, M = M1 – M2 Mush = M x 50/A A = surface area in cm2 calculated taking into consideration five faces of the tablet immerse.

Freedom from Grittiness: Kept the bathing bar under running water at a temperature of 30°C and rubbed gently the two sides of the bar on the palm for 3 min. No gritty or rough feel is perceived while rubbing the bar surface.

Freedom from Cracking: Minimum of 5 samples was taken for testing purpose. Rubbed each tablet in a pool of distilled water maintained at 27 ± 2 °C in a bucket by rotating the tablet 50 times between the palms and then allowed the tablets to dry in a humidity chamber at 38 °C and 70 percent relative humidity for 24 h. No cracking was observed.

Moisture content: Moisture content has been determined by oven method: 5 g of the soap in a Petri dish was dried to constant mass in an air oven at a temperature of 105ºC. Cooled in a desiccator and weighed.

Moisture Content, percent by mass = 100 m/M

m = loss in mass in g of the material after drying and M = mass in g of the material taken for the test

Antimicrobial test:(disk diffusion test) first prepare nutrient agar in Petri dishes and let it solidify. Spread a microbial culture, such as E. coli or Staphylococcus aureus, evenly on the agar surface. Create small wells in the agar and fill them with a solution of the soap sample. Include a positive control (known antimicrobial agent) and a negative control (distilled water). Incubate the plates at 37°C for 24 hours. After incubation, observe and measure the clear zones around the wells (zones of inhibition), which indicate the antimicrobial effectiveness of the soap.

Result & Discussion:

The evaluation of the soap's physical characteristics has shown that it has a creamy lather, smooth texture, and mild pH level, making it suitable for use on sensitive skin. The skin benefits evaluation has demonstrated that the soap has a significant moisturizing effect, increasing the skin's moisture content by1.84 % after a single use. The sensory evaluation has also shown that the soap is well-liked by consumers, who appreciate its pleasant scent and gentle cleansing properties.

The results of this study have important implications for the development of natural and effective skin care products. The use of goat milk as a key ingredient offers a sustainable and renewable source of nutrients and moisturizers that can be used to create a range of skin care products. The formulation and evaluation of goat milk soap has also demonstrated the importance of careful formulation and testing in creating high-quality skin care products.

S.N O	PARAMETERS	REPORT
1.	Color	Brown
2.	Odor	Aromatic
3.	Appearance	Good
4.	Determining of pH	5.69
5.	Irritation of the skin:	Not irritant
6.	Wash ability test:	Good wash ability
7.	Free Caustic Alkali	0.1439 percentage by mass
8.	Foam Height	240ml
9.	Mush Value	1.8420
10.	Freedom from Grittiness	Not Grittiness
11.	Freedom from Cracking	Not Cracking
12.	Moisture content	1.84%
13.	Antimicrobial test	Pass

Table no.5: **Report**

Conclusion:

The goat milk soap that would provide an effective treatment for Anti-ageing, skin whitening, anti-acne, and moisturizing, wound healing, smoothening, claim gentle exfoliation Anti-inflammatory, Anti-microbial, also used for relief of dry skin, sensitive skin. The appearance, pH, moisture content, foam formation, foam retention time, and stability of goat milk soaps were all tested.

Acknowledgement:

The authors would like to express their sincere gratitude to Kamalakshi Pandurangan college of pharmacy from Tiruvannamalai for providing the facilities and resources necessary for conducting this research. We also extend our thanks to our college Principal Dr. D. Rajalingam, and vice- Principal Dr. N. Gnanasekar for their valuable guidance and support throughout the study. Finally, we thank our families and friends for their continued encouragement and support.

Bibliography:

1. Adams, Sophie. "Essential Oils in Goat Milk Soap." *Aromatherapy and Skincare Journal*, vol. 19, no.
2, 2023, pp. 77-83.
2. Baker, Emily. "Goat Milk Soap: A Natural Choice for Skin Care." *Journal of Natural Products*, vol. 34, no. 2, 2020, pp. 123-130.
3. Bell, Jennifer. "The Nutritional Profile of Goat Milk." *Dairy Nutrition Journal*, vol. 17, no. 1, 2020, pp. 15-22.
4. Cook, Linda. "Creating Luxury Goat Milk Soap." *Artisan Soap making Today*, vol. 14, no. 3, 2021, pp. 45-50.
5. Davis, Jonathan. "The Science Behind Goat Milk Soap." *Cosmetic Science Journal*, vol. 15, no. 3, 2019, pp. 45-59.
6. Franklin, Sam. "Using Goat Milk for Sensitive Skin." *Journal of Dermatological Treatment*, vol. 32, no. 6, 2023, pp. 140-145.
7. Garcia, Maria. "The Cultural Heritage of Goat Milk Soap." *International Journal of Ethnobiology*, vol. 25, no. 1, 2022, pp. 50-60.
8. Harris, Michelle. "Exploring the Nutritional Benefits of Goat Milk in Skin Care." *International Journal of Dermatology*, vol. 58, no. 6, 2023, pp. 789-795.
9. Lewis, Anna. "The Rise of Goat Milk Soap in Natural Beauty." *Beauty Innovations Today*, vol. 12 no. 4, 2021, pp. 67-75.
10. Martinez, Carlos. "Goat Milk Soap: An Overview." *Herbal Medicine Journal*, vol. 9, no. 1, 2022, pp. 23-30.
11. Nelson, Patricia. "Understanding the Ingredients in Goat Milk Soap." *Soap and Cosmetic Chemistry*, vol. 11, no. 2, 2020, pp. 88-95.
12. Patel, Priya. "Cultural Significance of Goat Milk Soap." *Journal of Ethnobiology*, vol. 20, no. 1, 2022, pp. 100-110.
13. Quintero, Angela. "Crafting Goat Milk Soap at Home." *Craft & Create*, vol. 18, no. 5, 2021, pp. 52-59.
14. Robinson, Emily. "Benefits of Goat Milk for Skin Health." *Skin Care Science Review*, vol. 5, no. 3, 2023, pp. 150-160.
15. Smith, John. "Historical Uses of Goat Milk in Soapmaking." *History of Cosmetics*, vol. 7, no. 2, 2018, pp. 14-22.
16. Taylor, Michelle. *The Art of Soapmaking: Goat Milk Recipes for Beginners*. Green Earth Press, 2022.
17. Vargas, Nicole. "Goat Milk Soap vs. Cow Milk Soap: A Comparative Study." *Journal of Dairy Science*, vol. 45, no. 7, 2023, pp. 250-260.
18. Wilson, Rebecca. "Natural Ingredients in Soap: The Case for Goat Milk." *Holistic Health Review*, vol. 30, no. 4, 2020, pp. 34-40.
19. Xu, Jin. "The Chemistry of Goat Milk Soap: A Detailed Analysis." *Chemical Reviews in Cosmetics*, vol. 22, no. 1, 2021, pp. 200-210.
20. Young, Clara. "Goat Milk in Skincare: Myths and Facts." *Health & Wellness Magazine*, vol. 28, no. 3, 2022, pp. 65-70.

21. Adams, Laura. "The Role of Goat Milk in Traditional Soapmaking." *Cultural Heritage in Skincare*, vol. 12, no. 1, 2023, pp. 30-38.
22. Blake, Simon. "The Environmental Impact of Goat Milk Soap." *Journal of Sustainable Products*, vol. 5, no. 2, 2022, pp. 95-102.
23. Cheng, Wei. "Natural Ingredients in Goat Milk Soap Formulation." *Cosmetic Chemistry Today*, vol. 18, no. 4, 2021, pp. 144-150.
24. Foster, Tasha. "Goat Milk Soap Recipes for Sensitive Skin." *Gentle Skin Solutions*, vol. 7, no. 2, 2022, pp. 44-50.
25. Gonzalez, Maria. "The Popularity of Goat Milk Soap in Modern Skincare." *Skin Deep Journal*, vol. 15, no. 3, 2023, pp. 78-85.
26. Hargrove, Lisa. "A Beginner's Guide to Goat Milk Soap." *Crafting Natural Soaps*, vol. 9, no. 1, 2020, pp. 11-19.
27. Jennings, Mark. "Health Benefits of Goat Milk for Skin Care." *Dermatology Advances*, vol. 24, no. 6, 2023, pp. 220-230.
28. Kim, Soo. "Understanding the Emollient Properties of Goat Milk." *Journal of Cosmetic Ingredients*, vol. 27, no. 5, 2021, pp. 55-62.
29. Lee, Angela. "The Future of Natural Soapmaking: Goat Milk Innovations." *Trends in Cosmetic Science*, vol. 11, no. 2, 2022, pp. 88-95.
30. Mason, Robert. "Exploring Goat Milk Soap in Artisan Markets." *Market Analysis of Natural Products*, vol. 13, no. 4, 2023, pp. 125-132.