Research Article

Formulation and In vitro Evaluation of Polyherbal Lip Balm Containing *Moringa oleifera* and *Hibiscus sabdariffa* Extract

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ABSTRACT

The present study aimed to formulate and evaluate a polyherbal lip balm using natural ingredients such as *Moringa oleifera* seed oil, *Hibiscus sabdariffa* extract, beeswax, shea butter, almond oil, vitamin E, and vanilla essence for effective lip care. These ingredients were selected for their moisturizing, antioxidant, anti-inflammatory, and protective properties. Four formulations (F1–F4) were prepared by varying the concentrations of base components. The prepared Lip Balms were evaluated for physicochemical parameters including organoleptic properties, pH, melting point, spreadability, stability, water resistance, and skin irritation. All formulations showed satisfactory characteristics with good stability and non-irritant nature. The pH was found to be within the acceptable range for lips (F3: 6.3). The melting point of formulation F3 was observed to be 65–68°C, indicating good thermal stability. F3 exhibited excellent spreadability and excellent water resistance, along with stability under 35±2°C and relative humidity conditions. Among all formulations, F3 demonstrated optimum consistency, superior physicochemical properties, and better performance compared to others. The results indicate that the developed polyherbal lip balm is a safe, stable, and effective formulation with promising antioxidant benefits for lip care.

Keywords: *Moringa oleifera*, *Hibiscus sabdariffa*, Antioxidant Activity, Herbal Lip balm, Physicochemical evaluations.

INTRODUCTION

Lips are one of the most sensitive parts of the body due to the absence of sebaceous glands, making them highly prone to dryness, cracking, and environmental damage. External factors such as ultraviolet radiation, pollution, and dehydration significantly affect lip health and appearance[1]. Conventional lip care products often contain synthetic chemicals, which may cause irritation or allergic reactions upon prolonged use[2]. In recent years, there has been increasing interest in herbal cosmetics owing to their safety, efficacy, and minimal side effects. Herbal products are rich in bioactive compounds such as flavonoids, phenolics, and vitamins, which provide antioxidant and protective effects against free radical damage[3]. These natural constituents play an important role in maintaining lip hydration and preventing oxidative stress[4]. Natural oils like almond oil and coconut oil are widely used in cosmetic formulations due to their emollient and moisturizing properties. Almond oil is known for its high vitamin E content and ability to improve skin barrier function, while coconut oil exhibits antimicrobial and anti-inflammatory activities[5,6]. Beeswax, a natural wax, acts as an occlusive agent that forms a protective layer on the lips and prevents moisture loss[7].

Recent studies have demonstrated the effectiveness of herbal lip care formulations. A randomized controlled trial showed that herbal lip hydrants significantly improved lip dryness and smoothness without adverse effects, supporting their therapeutic potential. Additionally, polyherbal formulations provide synergistic effects, enhancing the overall efficacy of lip care products, With the growing demand for natural and eco-friendly products, the development of polyherbal lip balms has gained considerable attention. These formulations not only improve lip aesthetics but also promote healing and protection. Therefore, the present study focuses on the formulation and evaluation of a polyherbal lip balm using natural ingredients to ensure safety, stability, and effectiveness.

Figure 1: Herbal Lip balm

Benefits of Polyherbal Lip Balm

- ✓ Provides intense hydration, helping to prevent dryness and dehydration of the lips.
- ✓ Contains natural antioxidants that protect against oxidative stress and environmental damage.
- ✓ Helps reduce inflammation, redness, and irritation.
- ✓ Supports the healing of cracked and chapped lips.

- ✓ Improves overall lip texture, making them softer and smoother.
- ✓ Strengthens and restores the natural barrier function of the lips.
- ✓ Minimizes the likelihood of adverse effects compared to synthetic formulations[8].

Ideal Characteristics of Polyherbal Lip Balm

- ✓ It should possess a smooth texture with a uniform consistency to ensure easy and even application on the lips.
- ✓ The formulation must have an appropriate melting point, remaining solid at room temperature while softening at body temperature for comfortable use.
- ✓ It should spread easily over the lips without causing friction or dragging.
- ✓ The product must be safe, non-toxic, and non-irritating, making it suitable for prolonged use.
- ✓ It should effectively moisturize the lips and help minimize transepidermal water loss.
- ✓ Stability is essential, both physically and chemically, under varying environmental conditions.
- ✓ The lip balm should have an appealing odor, color, and overall appearance to enhance user acceptance.
- ✓ Its pH should be compatible with the natural lip surface to prevent any irritation.
- ✓ It should provide a long-lasting effect, reducing the need for frequent reapplication.
- ✓ The formulation must resist microbial growth, either inherently or through the inclusion of natural preservatives[9].

Advantages of Polyherbal Lip Balm

- ✓ Does not contain harmful synthetic chemicals or additives.
- ✓ Generally safe and well-tolerated due to its natural composition.
- ✓ Suitable for regular and long-term application.
- ✓ Supports sustainability and eco-conscious product use.
- ✓ Often economical and made from readily available natural materials.
- ✓ Can be tailored using different combinations of herbal ingredients.
- ✓ Widely accepted by consumers due to its natural origin[10].

Disadvantages of Polyherbal Lip Balm

- ✓ May have a shorter shelf life because of the absence of strong synthetic preservatives.
- ✓ Variability in herbal raw materials can lead to inconsistencies between batches.
- ✓ Stability can be affected by extreme environmental conditions such as heat or humidity.
- ✓ There is a potential risk of microbial contamination if not properly formulated or stored.
- ✓ Some individuals may experience allergic reactions to certain herbal components.
- ✓ The onset of action may be slower compared to formulations containing synthetic ingredients[11].

Anatomy of Lips

The lips are highly specialized and mobile structures that form the front boundary of the oral cavity, acting as a transition between external skin and internal oral mucosa. They consist of several layers, including skin, connective tissue, muscle, blood vessels, and nerves. Anatomically, the lips are divided into three regions: the outer cutaneous part, the vermilion zone, and the inner labial mucosa, each differing in structure and function[12]. The cutaneous region resembles normal skin, with keratinized epithelium and the presence of hair follicle, sebaceous glands, and sweat glands, which help in protection and hydration[13]. The vermilion zone is a thin transitional area lacking these glands, making it more prone to dryness. Its rich blood supply and thin epithelium give lips their characteristic red color but also reduce protection against environmental factors[14].

The inner labial mucosa is composed of non-keratinized epithelium and contains minor salivary glands that maintain moisture. Beneath these layers lies the orbicularis oris muscle, which enables lip movement and functions like speech and expression. Lips are highly vascular and richly supplied with nerves, making them sensitive and quick to heal, but also more vulnerable to irritation and dehydration. The thin stratum corneum and reduced pigmentation further decrease their natural protective ability[15]. Overall, the lips are structurally unique, combining protective, sensory, and functional roles, but their delicate nature makes them highly susceptible to environmental damage.

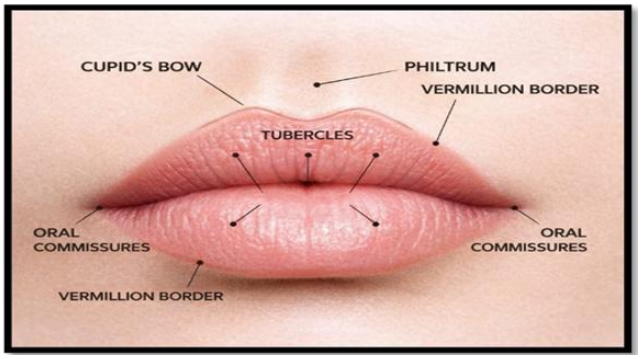

Figure 2: Anatomy of Lips

MATERIALS AND METHODS

Moringa seed oil, hibiscus flower extract, beeswax, shea butter, almond oil, vitamin E capsules, and vanilla essence were procured from local herbal and cosmetic raw material suppliers in Hyderabad. Moringa seed oil was employed as an emollient, moisturizer, antioxidant, and nourishing agent. Hibiscus flower extract was incorporated as a natural colorant and antioxidant. Beeswax served as a base, providing thickening and structuring properties to the formulation. Shea butter functioned as an occlusive and softening agent, enhancing moisture retention. Almond oil was used as an emollient and moisturizer for skin conditioning. Vitamin E capsules were included for their antioxidant, preservative, and healing properties. Vanilla essence was added as a fragrance to improve the organoleptic characteristics of the final product.

PREPARATION OF MORINGA SEED OIL EXTRACT:

The seed oil of Moringa oleifera was extracted using the Soxhlet solvent extraction method. Mature seeds were collected, dehulled, dried, and ground into a fine powder. Approximately 10 g of the powdered sample was accurately weighed and placed in a thimble, which was then inserted into the Soxhlet apparatus. About 200–250 ml of solvent, commonly hexane, was added to the round-bottom flask. The system was heated, allowing the solvent to evaporate, condense, and continuously extract the oil from the sample through repeated cycles for a period of about 6 hours. After completion of extraction, the solvent containing the extracted oil was collected and subjected to evaporation using a rotary evaporator to remove the solvent. The obtained oil was further dried to eliminate any residual solvent and then stored in an airtight container for further use. The extraction yield was calculated as the ratio of the weight of the extracted oil to the weight of the initial dry seed powder[16].

Figure 3: Moringa Seed Extract

Preparation of Hibiscus Flower Extract:

The extraction of anthocyanins from the flowers (calyx) of Hibiscus sabdariffa was carried out using the maceration method. Fresh or dried calyces were collected, cleaned, and dried under shade, then ground into a coarse powder. A known quantity of the powdered sample was soaked in a suitable solvent, typically ethanol, to improve the stability and extraction of anthocyanins. The mixture was kept at room temperature for 24–72 hours with occasional stirring to ensure maximum extraction. After maceration, the mixture was filtered to separate the liquid extract from the solid residue. The filtrate was then concentrated by evaporating the solvent using a water bath at low temperature to obtain a concentrated anthocyanin-rich extract, which was stored in a dark container for further use[17].

Figure 4: Hibiscus Flower Extract

Preparation of Polyherbal Lipbalm:

- Required quantities of beeswax, shea butter, almond oil, Moringa oleifera seed oil, Hibiscus sabdariffa extract, vitamin E, and vanilla essence were accurately weighed.
- Beeswax and shea butter were melted together using a water bath at 60–70°C until completely liquefied.
- Almond oil and Moringa oleifera seed oil were added to the molten base with continuous stirring to ensure uniform mixing.
- The prepared Hibiscus sabdariffa extract was added slowly to impart natural color and antioxidant properties.
- Vitamin E was incorporated as an antioxidant to enhance stability and prevent rancidity of oils.
- A few drops of vanilla essence were added for fragrance.

- The mixture was stirred continuously to obtain a uniform and homogeneous consistency.
- The molten mixture was poured into clean, dry lip balm containers.
- The filled containers were allowed to cool at room temperature until solidified.
- The prepared lip balm was stored in airtight containers for further evaluation[18,19].

Table 1: Formulation Design of Polyherbal Lip Balm

S.NO	Ingredients	F1	F2	F3	F4
1.	Moringa Seed Oil	2ml	2ml	2ml	2ml
2.	Hibiscus Flower Extract	1ml	1ml	1ml	1ml
3.	Beeswax	1g	2g	3g	4g
4.	Shea Butter	0.5g	1g	1.5g	2g
5.	Almond Oil	0.5ml	1ml	1.5ml	2ml
6.	Vitamin E Capsules	Q. S	Q. S	Q. S	Q. S
7.	Vanilla Essence	Q. S	Q. S	Q. S	Q. S

Figure 5: Preparation of Polyherbal Lip balm

Figure 6: Polyherbal Lip balm

EVALUATION

1. **Organoleptic Properties:** The prepared lip balm formulations were examined for their physical and sensory attributes using visual inspection. Characteristics such as color, odor, appearance, and texture were evaluated carefully. Color uniformity was checked under normal lighting conditions. The odor was assessed to ensure it was pleasant and free from any rancid or undesirable smell. The surface was observed for smoothness and to confirm the absence of defects like cracks or air bubbles. Texture was evaluated by applying a small quantity on the skin to ensure it was smooth, non-gritty, and non-sticky.
2. **Melting Point Determination:** The melting point of the lip balm was measured using the capillary tube method. A small portion of the sample was filled into a capillary tube, attached to a thermometer, and placed in a water bath. The temperature was gradually increased, and the point at which the sample began to melt was noted. This procedure was repeated three times, and the mean value was calculated.
3. **Spreadability Test:** Spreadability was assessed by placing a fixed amount of the lip balm between two clean glass slides. A specific weight was applied on the upper slide to facilitate even spreading. After a set duration, the diameter of the spread film was measured. Additionally, the ease of application and uniformity of spreading were also evaluated.
4. **pH Determination:** About 1 g of the lip balm was dispersed in 10 ml of distilled water and left undisturbed for 1–2 hours. The pH of the resulting mixture was then measured using a calibrated digital pH meter. Measurements were taken in triplicate, and the average value was recorded.
5. **Stability Study:** The stability of the lip balm formulations was evaluated by storing samples under different conditions, such as room temperature and in a humidity chamber maintained at 35 ± 2°C / 75 ± 5% RH. Observations were made at regular intervals to detect any changes in properties like color, odor, texture, or phase separation. The study was conducted over several weeks to determine the stability profile of the formulations.

6. **Skin Irritation Test:** A small quantity of the lip balm was applied to a specific area of the forearm to assess its safety. The test site was monitored for 24 hours for any signs of irritation, including redness, itching, or swelling. The absence of such reactions indicated that the formulation was safe for topical use.
7. **Water Resistance Test:** Water resistance was evaluated using the filter paper method. A thin, uniform layer of the lip balm was applied to a clean filter paper and allowed to set. A few drops of distilled water were then placed on the surface using a dropper. The filter paper was examined for any signs of dissolution, spreading, or removal of the applied layer. Formulations that showed minimal disturbance or loss of integrity were considered to have good water resistance.
8. **Perfume Stability Test:** The fragrance stability of the lip balm was assessed by storing the samples under ambient conditions for a specified period. The odor was evaluated at regular intervals to identify any changes in fragrance intensity or the development of unpleasant smells. All observations were systematically recorded [20,21].

RESULTS AND DISCUSSION

The prepared polyherbal lip balm formulations (F1–F4) were evaluated for various physicochemical parameters to ensure their suitability for topical application on lips.

1. **Organoleptic Properties:**

All the formulations showed a smooth, uniform, and homogeneous appearance without any visible lumps or phase separation. The color of the lip balm ranged from light pink to pale reddish tint due to the presence of hibiscus extract. The odour was found to be pleasant and characteristic, mainly due to the addition of vanilla essence, indicating good user acceptability.

Table 2: Organoleptic Properties of polyherbal lipblam

Parameter	F1	F2	F3	F4
Colour	Light red	Light red	Slightly deep red	Creamy red
Odour	Pleasant and characteristic	Pleasant and characteristic	Pleasant and characteristic	Pleasant and characteristic
Appearance	Smooth	Smooth	Smooth	Smooth
Texture	Uniform, no lumps	Uniform, no lumps	Uniform, no lumps	Uniform, no lumps

2. **pH:**

The pH of all the prepared lip balm formulations was determined using a digital pH meter. The results were found to be within the acceptable range, indicating suitability for lip application.

Table 3: pH Determination of polyherbal lip balm

Formulation	F1	F2	F3	F4
pH	5.6	5.9	6.3	6.2

Interpretation: The pH of all formulations was found in the range of 5.5–6.5, which is close to the natural pH of lips. This indicates that the formulations are non-irritating and safe for topical application.

3. **Melting Point:**

The melting point of the prepared lip balm formulations was determined to evaluate their stability and suitability for application under different temperature conditions. The results are given below.

Table 4: Melting points Determination of polyherbal lip balm

Formulation	F1	F2	F3	F4
Melting point (°C)	62-64	60-62	65-68	61-63

Interpretation: The melting point of all formulations was found within the range of 60–68°C, indicating good stability. Formulation F3 showed the highest melting point, suggesting better resistance to melting in hot conditions, while F2 showed a lower melting point, indicating a softer consistency.

4. **Spreadability:**

The spreadability of the prepared lip balm formulations was evaluated to determine the ease of application on the lips. The results are given below.

Table 5: Spreadability Test of polyherbal lip balm

Formulation	F1	F2	F3	F4
Spreadability	Good	Moderate	Excellent	Good

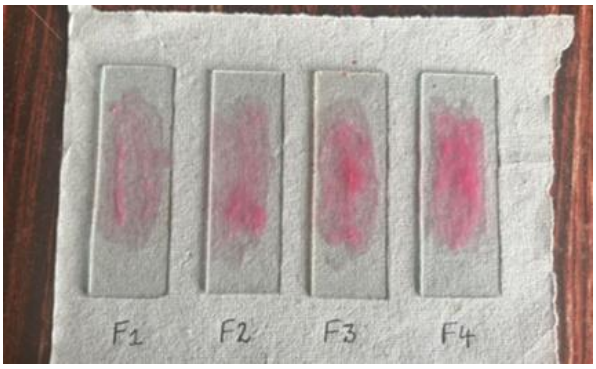

Figure 7: Spreadability

5. Skin irritation:

No signs of redness, itching, or irritation were observed during the skin irritation study of the lip balm formulations. This confirms that the lip balm is safe and non-irritant for application on lips.

Table 6: Skin irritation Test of polyherbal lip balm

Formulation	F1	F2	F3	F4
Irritancy	No	No	No	No

Figure 8: Skin irritation test

6. Stability Studies:

During the stability study of the lip balm formulations, no significant changes in color, odour, consistency, or texture were observed under different storage conditions using humidity chamber. This indicates that the formulations are physically and chemically stable.

Table 7: Stability Studies of polyherbal lip balm

Formulation	F1	F2	F3	F4
Stability	Stable at 35±2 °C / 75 ± 5% RH	Stable at 35±2 °C / 75 ± 5% RH	Stable at 35±2 °C / 75 ± 5% RH	Stable at 35±2 °C / 75 ± 5% RH

Figure 9: Stability Studies of polyherbal lipblam

7. Water Resistance

The water resistance test of the lip balm formulations was carried out using filter paper. No significant spreading or dissolution of the formulations was observed after contact with water. This indicates that the lip balms possess good water resistance and remain on the lips for a longer duration.

Table 8: Water Resistance Test of polyherbal lip balm

Formulation	F1	F2	F3	F4
Water Resistance	Moderate	Moderate	Excellent	Good

Figure 10: Water Resistance

Interpretation: Formulation F3 showed excellent water resistance due to higher beeswax content, which provides better barrier properties. F2 showed moderate resistance because of higher oil content. F1 and F4 exhibited good water resistance, indicating balanced composition and satisfactory performance.

8. Perfume stability test:

The perfume stability of the lip balm formulations was evaluated to determine any changes in fragrance during storage under different conditions.

Table 9: Perfume stability of polyherbal lip balm

Formulation	F1	F2	F3	F4
Perfume stability	Stable	Stable	Stable	Stable

Interpretation: No significant change in fragrance was observed in any of the formulations during the study period. All formulations showed good perfume stability, indicating that the lip balms retain their pleasant odour and remain acceptable during storage.

CONCLUSION

The present study successfully formulated and evaluated a polyherbal lip balm using natural ingredients such as Moringa oleifera seed oil, Hibiscus sabdariffa extract, beeswax, shea butter, and almond oil. The prepared formulations exhibited satisfactory physicochemical properties, including appropriate pH, good spreadability,

suitable melting point, and excellent stability under different conditions. Among all formulations, F3 showed comparatively better performance in terms of water resistance and consistency due to higher beeswax content. The absence of skin irritation confirmed the safety of the formulation for topical application. Overall, the polyherbal lip balm demonstrated effective moisturizing, protective, and aesthetic properties, indicating its potential as a safe, natural, and economical alternative to conventional synthetic lip care products.

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REFERENCES

1. Kobayashi H., Tagami H. Functional properties of the stratum corneum of the lips in comparison with the facial skin. British Journal of Dermatology. 2004; 150(3): 563–567.
2. Draelos Z. D. Cosmeceuticals and cosmetic ingredients. Dermatologic Clinics. 2000; 18(4): 597–607.
3. Akinmoladun A. C., Ibukun E. O., Afor E., Obuotor E. M., Farombi E. O. Phytochemical constituent and antioxidant activity of extract from the leaves of Moringa oleifera. Scientific Research and Essays. 2007; 2(12): 544–547.
4. Brigelius-Flohé R., Traber M. G. Vitamin E: function and metabolism. The FASEB Journal. 1999; 13(10): 1145–1155.
5. Ouzir M., El Bernoussi S., Tabyaoui M., Taghzouti K. Almond oil: A comprehensive review of chemical composition, extraction methods, preservation conditions, potential health benefits, and safety. Comprehensive Reviews in Food Science and Food Safety. 2021; 20(4): 3344–3387.
6. Verallo-Rowell V. M., Dillague K. M., Syah-Tjundawan B. S. Novel antibacterial and emollient effects of coconut and virgin olive oils in adult atopic dermatitis. Dermatitis. 2008; 19(6): 308–315.
7. Loden M. Role of topical emollients and moisturizers in the treatment of dry skin barrier disorders. American Journal of Clinical Dermatology. 2003; 4(11): 771–788.
8. Sutthiboonyapan P., Sriratanasak N., Innets B., Angkanaporn N., Suntornchot P., Panyain W., Porntaveetus T., Wiriyakijja P., Chanvorachote P. A randomized double-blind controlled evaluation of the therapeutic benefits of an herbal lip hydrant. Journal of Cosmetic Dermatology. 2025; 24(3): e70041.
9. Ghazali N. A., Sulaiman I. S., Hashim N. H. Formulation and evaluation of herbal lip balm containing natural ingredients. International Journal of Pharmaceutical Sciences and Research. 2019; 10(8): 3802–3808.
10. Kadu M., Vishwasrao S., Singh S. Review on natural lip balm formulation and evaluation. International Journal of Research in Cosmetic Science. 2015; 5(1): 1–7.
11. Sharma S., Sahu R. K., Roy A., Singh A. Challenges in standardization of herbal formulations. Journal of Pharmacognosy and Phytochemistry. 2015; 4(5): 104–109.
12. Walters K. A., Roberts M. S. Dermatological and Transdermal Formulations. Marcel Dekker. 2002.
13. Freinkel R. K., Woodley D. T. The Biology of the Skin. Parthenon Publishing. 2001.
14. Barry B. W. Dermatological Formulations: Percutaneous Absorption. Marcel Dekker. 1983.
15. Elias P. M. Stratum corneum defensive functions: An integrated view. Journal of Investigative Dermatology. 2005; 125(2): 183–200.
16. Ogunlesi A., Okiei W., Ofor E., Osibote E.; The effect of different extraction methods on the quality of Moringa oleifera seed oil. Food Chemistry. 2010; 120(1),125–130.
17. Suzery M., Lestari S., Cahyono B.; Determination of total anthocyanin from roselle (Hibiscus sabdariffa L.) calyx using maceration and Soxhletation methods. Journal Sains dan Matematika. 2010; 18(1), 1–6.
18. Sharma N., Sharma S.; Formulation and evaluation of herbal lip balm. Journal of Pharmaceutical Sciences and Research. 2018; 10(3), 645–648.
19. Deshmukh S. S., Chavan M., Sutar M., Singh S.; Preparation and evaluation of natural lip balm. International Journal of Pharmaceutical Sciences Review and Research. 2018; 50(2), 130–134.
20. Barel A. O., Paye M., Maibach H. I. Handbook of Cosmetic Science and Technology. CRC Press. 2014.
21. Ali A., Yosipovitch G. Skin pH: From basic science to basic skin care. Acta Dermato-Venereologica. 2013; 93(3): 261–267.