



## Formulation and Physical Quality Evaluation of Lip Balm Preparations Containing a Combination of Red Fruit (*Pandanus conoideus* Lamk.) Extract and Olive Oil (*Olea europaea* L.)

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### ABSTRACT

Lip balm is a cosmetic product used to maintain lip moisture and protect against environmental factors. This study aimed to formulate and evaluate the physical quality of a lip balm containing red fruit (*Pandanus conoideus* Lam.) extract and olive oil (*Olea europaea* L.). An experimental laboratory method was used, conducted in May 2025 at the Pharmaceutical Formulation Technology Laboratory, Jayapura Health Polytechnic. Physical quality tests included organoleptic properties, pH, homogeneity, spreadability, adhesion, stability, and hedonic evaluation. All formulations showed acceptable organoleptic characteristics, pH, homogeneity, adhesion, stability, and consumer acceptance. However, spreadability did not meet the required criteria. Based on hedonic testing, formulation F3 was the most preferred among the three formulations.

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## INTRODUCTION

Lips are sensitive body parts that lack melanin as natural protection, making them highly susceptible to free radicals and direct exposure to ultraviolet (UV) radiation. Extreme weather conditions, such as excessive heat or cold, can cause lips to become dry, cracked, darkened, and uncomfortable, often accompanied by pain. Therefore, cosmetic products specifically designed to protect and care for lips are essential (Sholehah et al., 2022). Lip cosmetics are available in various forms, including lipstick, lip gloss, lip balm, liquid lipstick, and lip liners, serving both decorative and therapeutic purposes (Tampubolon, 2023).

Lip damage is not only influenced by environmental factors but also by the prolonged use of cosmetic and lip care products containing synthetic ingredients. Continuous exposure to synthetic substances may negatively affect the natural condition of the lips (Fadila et al., 2024). Consequently, the development of safe and effective lip care formulations using natural ingredients is necessary. Lip balm formulated from natural materials can be applied routinely and is considered to have fewer side effects compared to synthetic-based products (Karlina, 2024; Yuliastri et al., 2023).

Lip balm is a lip care cosmetic preparation composed mainly of waxes, fats, and oils derived from natural extracts. Its primary function is to prevent dryness by increasing lip moisture and protecting against harmful environmental factors (Setiawan, 2022). Lip balm also contains moisturizing agents, vitamins, and antioxidants that help maintain product quality and prevent lipid oxidation (Tampubolon, 2023; Yuliastri et al., 2023). However, many commercial lip balms still rely on synthetic antioxidants to enhance product stability (Pertiwi et al., 2023).

Natural antioxidants play an important role in protecting lips from free radical formation caused by unfavorable environmental conditions, thereby preventing premature aging of the lips (Pertiwi et al., 2023). One potential natural antioxidant source is red fruit (*Pandanus conoideus* Lam.), an endemic plant from Papua traditionally used by local communities as herbal medicine (Karoba et al., 2024). Red fruit contains unsaturated fatty acids such as oleic, linoleic, and palmitoleic acids, as well as active compounds including  $\alpha$ -carotene,  $\beta$ -carotene,  $\beta$ -cryptoxanthin, and  $\alpha$ -tocopherol (Primadani et al., 2023).

To enhance moisturizing properties, red fruit extract can be combined with olive oil (*Olea europaea* L.), which functions as an emollient capable of maintaining moisture, elasticity, and smoothness of the lips (Abdul et al., 2022). Olive oil is rich in oleic acid, vitamins A, D, and E, and tocopherols that act as antioxidants and help retain water in the skin (Kustina et al., 2022; Nindya & Kurniawati, 2024). In lip balm formulations, emulsifiers such as cetyl alcohol and stearic acid significantly affect physical characteristics, texture, and stability of the preparation (Nurmalasari et al., 2024; Yuliana, 2023)..

## THEORETICAL REVIEW

### *Red Fruit (Pandanus conoideus Lamk.)*

Red fruit belongs to the genus *Pandanus* and is an endemic plant species of Papua. This plant is widely distributed throughout Papua, from lowland areas

to highland regions at elevations of up to 2,300 meters above sea level (Maran et al., 2022).

### ***Plant Classification of Red Fruit (Pandanus conoideus Lamk.)***

The classification of red fruit according to Rizky (2024) is as follows:

Division : Spermatophyta  
Class : Angiospermae  
Subclass : Monocotyledonae  
Order : Pandanales  
Family : Pandanaceae  
Genus : *Pandanus*  
Species : *Pandanus conoideus* Lamk.

### ***Morphology of Red Fruit***

The red fruit plant can reach a height of up to 16 meters and is supported by prop roots at the lower part of the stem. The fruit is generally oblong in shape, with buds enclosed by bracts. Red fruit can reach a length of up to 55 cm, a diameter of 10–15 cm, and a weight of 2–3 kg. When ripe, the fruit is bright maroon red, although some varieties produce brown or yellowish-brown fruits (Husein Wawo et al., 2019). The leaves are inversely lanceolate, resembling pandan leaves, dark green in color, with pointed tips and spiny margins (Aulia, 2024).

### ***Chemical Composition of Red Fruit***

Red fruit contains active compounds such as beta-carotene, tocopherols, and fatty acids, including oleic acid, linoleic acid, and decanoic acid (Aulia, 2024).

### ***Benefits of Red Fruit***

Beta-carotene is a carotenoid that functions as provitamin A and acts as an effective antioxidant under low oxygen conditions (Azizah et al., 2023). Tocopherols also serve as antioxidants that help strengthen the immune system and neutralize free radicals (Aulia, 2024).

### ***Olive Fruit (Olea europaea)***

Olive is a fruit-bearing plant that grows predominantly in hot climates. It has the scientific name *Olea europaea* and originally comes from the Middle East and parts of Africa. Mature olive fruits are processed into extracts and further refined into olive oil. In Indonesia, olive plants are often cultivated as ornamental plants. Olives thrive in warm climatic conditions (Daffa et al., 2022).

Olive oil contains various bioactive compounds such as phenols, tocopherols, sterols, pigments, and squalene. Phenolic compounds act as powerful antioxidants. The secondary metabolites present in olive oil include alkaloids, saponins, tannins, flavonoids, apigenin, luteolin, chryseriol, and their derivatives. Olive oil also contains omega-9 and omega-3 fatty acids, which function as antioxidants (Kurniasih et al., 2022).

## **Lip Balm**

### **Definition**

Lip balm is a cosmetic preparation made using a base similar to lipstick but without added color, resulting in a transparent appearance (Supartiningsih et al., 2021). Lip balm forms an oily layer on the surface of the lips that protects against external factors and provides a moist and glossy appearance (Hidayah & Resti Erwiyani, 2022).

### **Benefits of Lip Balm**

Lip balm is used to protect lips under conditions of low humidity or cold temperatures, helping to prevent water loss and damage to the epithelial cells of the lip mucosa (Dominica et al., 2023).

## **METHODOLOGY**

### **Type of Research**

The type of research used in this study was experimental laboratory research, which involved the formulation and physical quality evaluation of lip balm preparations containing a combination of red fruit (*Pandanus conoideus* Lamk.) extract and olive oil (*Olea europaea* L.).

### **Research Instruments**

#### **Equipment**

The equipment used in this study included analytical weights, a glass stirring rod, beaker glass, porcelain dish, freezer, graduated cylinder, hot plate, caliper, watch glass, flannel cloth, parchment paper, magnetic stirrer, clamp, universal pH paper, glass plate, spatula, scoopula, analytical balance, lip balm containers, and a water bath.

#### **Materials**

The materials used in this study included stearic acid, butylated hydroxytoluene, cera alba, cetyl alcohol, nipagin, red fruit (*Pandanus conoideus* Lamk.) extract, cocoa butter, olive oil (*Olea europaea* L.), rose oil (*oleum rosae*), and propylene glycol.

**Table 1. Lip Balm Formulation (with Modification)**

Ingredient	Lip Balm Formulation (grams)			Function
	F1	F2	F3	
Red fruit extract	10	10	10	Active ingredient
Olive oil	10	10	10	Active ingredient
Propylene glycol	5	5	5	Solvent
Cera alba	20	20	20	Binder
Cetyl alcohol	3	5	7	Emulsifier
Stearic acid	2	3	4	Emulsifier

Ingredient	Lip Balm Formulation (grams)			Function
	F1	F2	F3	
Nipagin	0.2	0.2	0.2	Preservative
Butylated hydroxytoluene (BHT)	0.05	0.05	0.05	Antioxidant
Oleum rosae	3 drops	3 drops	3 drops	Fragrance
Cocoa butter ad	100	100	100	Fat base
<b>Total</b>				<b>100 g</b>

### *Lip Balm Preparation*

1. As an initial step, prepare all required equipment and materials, then weigh each ingredient accurately.
2. Dissolve the red fruit extract in propylene glycol using a beaker glass (Mixture A).
3. Place cetyl alcohol and stearic acid into a porcelain dish, add nipagin and BHT, then melt the mixture over a water bath while stirring until homogeneous (Mixture B).
4. Next, melt cera alba and cocoa butter using a water bath at 35 °C for 35 minutes. After melting, add olive oil and stir until homogeneous (Mixture C).
5. Slowly mix Mixture B and Mixture C on a hot plate using a magnetic stirrer. Then add Mixture A, followed by 3 drops of oleum rosae, and stir until a homogeneous mixture is obtained..
6. Finally, pour the mixture into lip balm containers and allow it to stand at room temperature until it solidifies or hardens.

### *Data Analysis*

Data obtained from the formulation and physical quality evaluation of lip balm preparations containing red fruit (*Pandanus conoideus* Lamk.) extract and olive oil (*Olea europaea* L.) were compared with relevant literature and presented in tabular form, followed by descriptive narration.

## **RESEARCH RESULTS**

The physical quality of the lip balm formulations was evaluated through organoleptic observation, pH measurement, homogeneity test, spreadability test, adhesion test, and stability test.

### *Organoleptic Test Results*

The results of the organoleptic evaluation of the lip balm formulations are presented as follows:

**Table 2. Organoleptic Test Results**

Formulation	Color	Aroma	Texture
F1	Reddish orange	Characteristic cocoa butter aroma	Solid
F2	Reddish orange	Characteristic cocoa butter aroma	Solid
F3	Reddish orange	Characteristic cocoa butter aroma	Solid

***pH Test Results***

The pH test results of the lip balm formulations are shown below:

**Table 3. pH Test Results**

Formulation	R1	R2	R3	Average	Remark
F1	6	6	6	6	Meets the requirement
F2	6	6	6	6	Meets the requirement
F3	6	6	6	6	Meets the requirement

***Homogeneity Test Results***

The homogeneity test results of the lip balm formulations are presented as follows:

**Table 4. Homogeneity Test Results**

Formulation	R1	R2	R3	Remark
F1	Homogeneous	Homogeneous	Homogeneous	Meets the requirement
F2	Homogeneous	Homogeneous	Homogeneous	Meets the requirement
F3	Homogeneous	Homogeneous	Homogeneous	Meets the requirement

***Spreadability Test Results***

The spreadability test results of the lip balm formulations are shown below:

**Table 5. Spreadability Test Results**

Formulation	R1 (cm)	R2 (cm)	R3 (cm)	Average (cm)	Remark
F1	2.1	2.2	2.2	2.2	Does not meet the requirement
F2	2.3	2.4	2.41	2.37	Does not meet the requirement
F3	2.5	2.6	2.7	2.62	Does not meet the requirement

### Adhesion Test Results

The adhesion test results of the lip balm formulations are presented as follows:

**Table 6. Adhesion Test Results**

Formulation	R1 (s)	R2 (s)	R3 (s)	Average (s)	Remark
F1	39.11	41.23	44.50	41.61	Meets the requirement
F2	31.20	38.10	38.32	35.87	Meets the requirement
F3	25.37	30.01	35.50	30.29	Meets the requirement

### Stability Test Results

The stability test results of the lip balm formulations using the freeze-thaw method are shown below:

**Table 7. Stability Test Results**

Formulation	R1	R2	R3	Remark
F1	No changes in shape, aroma, or color	No changes in shape, aroma, or color	No changes in shape, aroma, or color	Meets the requirement
F2	No changes in shape, aroma, or color	No changes in shape, aroma, or color	No changes in shape, aroma, or color	Meets the requirement
F3	No changes in shape, aroma, or color	No changes in shape, aroma, or color	No changes in shape, aroma, or color	Meets the requirement

## DISCUSSION

This study aimed to evaluate the physical quality of lip balm formulations containing red fruit extract (*Pandanus conoideus* Lamk.) and olive oil (*Olea europaea* L.). Lip balm was selected as the dosage form due to its moisturizing function, which enhances lip hydration and prevents dryness, peeling, and cracking caused by environmental exposure and sunlight. The use of natural-based ingredients provides improved safety for lip application (Kasih & Handayani, 2022).

A preformulation study was conducted prior to formulation to obtain essential information for developing a stable product with adequate bioavailability and scalability for large-scale production (Wicita et al., 2021). Three lip balm formulations were prepared with varying concentrations of cetyl alcohol and stearic acid as emulsifiers. Red fruit extract was dissolved in propylene glycol to enhance active compound penetration (Setiawati et al., 2024). Cetyl alcohol and stearic acid functioned as emulsifiers, nipagin as a preservative, and butylated hydroxytoluene as an antioxidant (Sueno et al., 2022; Adam et al., 2024). Cera alba and cocoa butter served as the lipid base, while olive oil was incorporated as an active ingredient. The final mixture was homogenized,

fragranced with oleum rosae, poured into containers, and allowed to solidify at room temperature.

Organoleptic evaluation showed that all formulations exhibited a reddish-orange color and a characteristic cocoa butter aroma, with differences observed in texture. Formulation F1 showed the highest hardness due to a higher cocoa butter concentration, while F3 demonstrated a softer texture attributed to increased cetyl alcohol content, which improves spreadability and ease of application (Muntu et al., 2024; Y. D. Putri et al., 2024). Stearic acid contributed to improved consistency and emollient properties (Thomas et al., 2024).

The pH values of all formulations were 6, meeting the acceptable lip pH range of 4.5–7.0 and ensuring product safety and stability (Suena et al., 2022; Fatwami et al., 2024). Homogeneity testing confirmed that all formulations were homogeneous, indicating uniform distribution of active ingredients and consistent effectiveness upon application (Wirata & Endriyanto, 2024).

Spreadability testing revealed that none of the formulations met the ideal spreadability range of 3–5 cm, likely due to the high content of solid lipid components such as cocoa butter and cera alba, which reduced the ability of the formulation to spread evenly (Simanulang, 2023). However, adhesion testing demonstrated satisfactory results, with all formulations exceeding the minimum requirement of 4 seconds, indicating good retention on the lip surface and potential for effective active ingredient absorption (Salsabila et al., 2022; Pawestri et al., 2024).

The freeze–thaw stability test showed that all formulations remained stable in terms of color, aroma, and texture over three cycles. The lip balm preparations exhibited optimal stability at room temperature, with no physical changes observed during storage (Utami et al., 2021).

## CONCLUSION

Lip balm formulations containing red fruit extract (*Pandanus conoideus* Lamk.) and olive oil (*Olea europaea* L.) demonstrated acceptable physical quality. All formulations met the requirements for organoleptic properties, pH, homogeneity, adhesion, and physical stability. The pH values were within the safe range for lip application, and the freeze–thaw test confirmed good stability. However, none of the formulations met the ideal spreadability criteria. Among the formulations, F3 showed the softest texture and the highest preference in terms of texture.

## RECOMMENDATION

Further optimization is recommended to improve spreadability by adjusting the composition of the lipid base. Additional studies on long-term stability, safety, and broader consumer acceptance are suggested to support product development.

## FURTHER STUDY

Future studies should focus on improving the spreadability of the lip balm by optimizing the lipid base composition. Long-term stability, safety evaluation,

and broader consumer acceptance testing are also recommended to support product development.

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