# Innovative Formulation of a Facial Serum Using Avocado Oil (*Persea americana* Mill.) as a Facial Skin Moisturizer

Rahmat Muliadi*, Astrid Indalifiany, Fery Indradewi Armadany, Vica Aspadiah, Wa Ode Nur Alidah
Department of Pharmacy, Faculty of Pharmacy, Universitas Halu Oleo, Kendari, Indonesia

*Corresponding Author: rahmatmuliadi@uho.ac.id

## ABSTRACT

Ultraviolet radiation, temperature, and humidity can cause a reduction in the skin's moisture content, leading to dryness. Therefore, an effective moisturizing preparation is required to maintain skin hydration. Avocado (*Persea americana* Mill.) oil is known to contain unsaturated fatty acids, vitamins, and antioxidants, making it a potential natural moisturizer. This study aimed to formulate a facial serum utilizing avocado oil as the active ingredient and to evaluate its physical characteristics, stability, and moisturizing activity. An experimental approach was employed, creating four facial serum formulations with avocado oil concentrations of 0%, 5%, 10%, and 15%. The evaluations encompassed organoleptic properties, homogeneity, pH, adhesiveness, spreadability, viscosity, phase separation, and emulsion type. Physical stability was assessed using the cycling test method, and moisturizing activity was evaluated in vitro. The results indicated that all formulations exhibited good physical characteristics, were homogeneous, experienced no phase separation, were oil-in-water (O/W) emulsions, and possessed pH values compatible with the skin's physiological pH. The preparations maintained physical stability following the cycling test. Furthermore, the moisturizing activity tests revealed that an increased concentration of avocado oil enhanced the moisturizing efficacy, with formula F3 (15%) yielding the highest moisture values: 52.830% before the cycling test and 42.970% afterward. Based on these findings, it can be concluded that the avocado oil-based facial serum, particularly formula F3, demonstrates the potential to be developed as a stable, safe, and effective facial skin moisturizer.

**Keywords:** Facial serum, avocado oil, skin moisturizer, stability

## INTRODUCTION

Indonesia is known as a tropical country because of its abundant sunlight throughout the year. Ultraviolet (UV) rays, which include UV-A, UV-B, and UV-C, are among the many types of radiation emitted by the sun. Human health is significantly influenced by UV radiation, both positively and negatively. Because the skin is the outermost layer of the body, it is vulnerable to various external elements, including the UV radiation naturally emitted by the sun. The primary cause of skin alterations is excessive exposure to UV radiation. Ultraviolet rays are the most harmful external elements that induce skin changes (Wijayadi et al., 2024). Excessive exposure to ultraviolet (UV) radiation, temperature variations, and air humidity can undoubtedly disrupt the skin's equilibrium, particularly its water content, resulting in decreased skin moisture and dryness (Suharsanti & Ariyani, 2018).

Dry skin occurs due to a significant decrease in moisture within the *stratum corneum*, which contains approximately 10% water and plays a crucial role in maintaining skin hydration, elasticity, and protection against external factors. The skin can become dry and lose its moisture due to an increase in water loss through the Transepidermal Water Loss (TEWL) mechanism, which leads to excessive water evaporation. Damage to the skin barrier, the protective layer that functions to maintain skin hydration and shield it from exposure to pollutants, UV radiation, and extreme temperatures, is the primary cause of dry skin. When the skin barrier function is compromised, the skin becomes more susceptible to moisture loss and is easily irritated (Delivery & Kunci, 2025). Therefore, moisturizers are necessary to address dry skin issues to keep the skin healthy and prevent dehydration-induced dryness (Agustin et al., 2024).

Moisturizers are topical products designed to treat dry skin conditions. Their mechanism of action involves the formation of a thin protective layer on the skin's surface that acts as a barrier against fluid loss, providing a soothing sensation to the deeper skin layers, and helping to restore the skin's texture so that it feels softer and more comfortable (Farida et al., 2022). Individual needs and compatibility determine the most suitable moisturizer. Humectants, occlusive moisturizers, and intercellular lipids within the *stratum corneum* (SC) are among the categories into which moisturizing agents can be divided. Because they contain a combination of lipids capable of restoring skin moisture, occlusives and humectants are the most commonly used ingredients in moisturizer product formulations (Butarbutar & Chaerunisaa, 2020). Moisturizers are generally formulated from substances that create a lipid layer on the skin's surface, which serves to enhance elasticity and repair dry, rough skin layers. A natural ingredient that can help overcome dry skin problems is avocado oil (Agustin et al., 2024).

Avocado oil (*Persea americana* Mill.) is a natural source of various unsaturated fatty acids, such as oleic, linoleic, and palmitic acids, which are highly effective for moisturizing the skin and enhancing skin permeability. In addition, avocado oil naturally contains potassium, lecithin, vitamins A, D, and E, as well as other nutrients that play a role in helping to cleanse and nourish the skin. The phytosterols contained in avocado oil also play a vital role in supporting the formation of new skin cells, as well as maintaining skin health and function (Hanifa et al., 2023). Avocado oil utilized as a cosmetic ingredient is typically formulated into creams, shampoos, hair care products, and sunscreens. This oil possesses natural sunscreen and antibacterial activities. Furthermore, avocado oil is easily absorbed into the skin and provides moisturizing, antioxidant, and emollient effects, while improving skin elasticity to help maintain a healthy and radiant complexion (Slamet et al., 2024). Cosmetic preparations in the form of facial serums are currently among the widely developed and extensively used cosmetics by the public (Hidayah et al., 2021).

Serums are widely used by the public because they deliver faster-noticeable effects compared to other skin care products. Moisturizing serums are a form of skincare cosmetic designed to reduce the signs or symptoms of dry, scaly, and rough skin, and can help render the skin smoother and softer. Additionally, moisturizers help maintain the hydration of the *stratum corneum* by reducing transepidermal water loss and protecting the skin from environmental influences that can cause dryness (Thomas et al., 2024). Facial serums are liquid preparations formulated to provide intensive moisture to the skin. Serums are utilized to help address skin issues such as blackheads, fine wrinkles, dry skin, and fading acne scars. The utilization of natural components in serum formulations yields preparations that are safe for topical application on the skin (Lustianah et al., 2023).

Therefore, a facial serum preparation containing avocado oil was selected as a facial skin moisturizer due to its potential to help maintain skin health. Avocado oil is easily absorbed into the skin, offering moisturizing, antioxidant, and emollient effects, while also enhancing skin elasticity. Despite its extensive use in various cosmetic preparations, avocado oil-based serum products remain limited. Serums are considered to possess excellent moisturizing efficacy due to their lightweight texture, ease of application, and ability to provide comfort to the skin (Slamet et al., 2024).

## METHODS

The entire series of research activities was conducted using an experimental approach.

### Materials and Equipment

The equipment used in this study included an analytical balance (Fujitsu FSAR®), magnetic stirrer, pH meter (Jenway®), stirring rod (Pyrex®), glass slides, dropper pipettes (Pyrex®), beakers (Pyrex®), volumetric flasks (Pyrex®), hotplate, viscometer (Brookfield®), centrifuge, refrigerator, incubator, and serum bottles.

The materials used consisted of avocado oil, xanthan gum, dimethicone, glycerin, phenoxyethanol, Tween 80, Span 80, butylated hydroxytoluene (BHT), DMDM hydantoin, vanillin, and distilled water.

### *Facial Serum* Formulation

The facial serum formulas were developed with avocado oil concentrations of 0%, 5%, 10%, and 15% in 30 g preparations with a volume of 30 mL. This can be seen in **Table 1**.

**Table 1**. Composition of facial serum preparation formula

| Materials | Function | Concentration (%b/v) | | | |
|---|---|---|---|---|---|
| | | F0 | F1 | F2 | F3 |
| Avocado Oil | Active ingredient | 0 | 5 | 10 | 15 |
| Dimethicone | Occlusive agent | 0.5 | 0.5 | 0.5 | 0.5 |
| Xanthan Gum | Viscosity enhancer | 0.4 | 0.4 | 0.4 | 0.4 |
| Glycerin | Humectant | 6 | 6 | 6 | 6 |
| Phenoxyethanol | Oil phase preservative | 0.5 | 0.5 | 0.5 | 0.5 |
| DMDM Hydantoin | Water phase preservative | 0.6 | 0.6 | 0.6 | 0.6 |
| Tween 80 | Water phase emulsifier | 1.4 | 1.4 | 1.4 | 1.4 |
| Span 80 | Oil phase emulsifier | 2.6 | 2.6 | 2.6 | 2.6 |
| Butylated Hydroxytoluene | Antioxidants | 0.5 | 0.5 | 0.5 | 0.5 |
| Vanilin | Fragrance | 0.5 | 0.5 | 0.5 | 0.5 |
| Aquades | Solvent | Ad 100 | Ad 100 | Ad 100 | Ad 100 |

**Preparation of *Facial Serum***

The avocado oil facial serum was formulated at concentrations of 0%, 5%, 10%, and 15% in a total volume of 30 mL. Preparation began by preparing the equipment and weighing all materials according to the specified concentrations. The oil phase components, avocado oil, dimethicone, phenoxyethanol, span 80, and BHT, were mixed using a magnetic stirrer for 15 minutes on a hotplate at 50°C to homogenize the solution.

Simultaneously, the aqueous phase components xanthan gum, glycerin, DMDM hydantoin, Tween 80, and distilled water were mixed using a magnetic stirrer for 15 minutes on a hotplate at 50°C. The oil phase was then added gradually to the aqueous phase while stirring with a magnetic stirrer at 300-400 rpm at 50°C until a homogeneous mass was formed. Once uniformly mixed and the temperature began to decrease, vanillin was added as a fragrance in the final stage. The preparations were then packaged in containers for evaluation.

**Physical Characteristic Evaluation**

**Organoleptic Test**

The physical form of the serum was observed through organoleptic testing, which involved examining the texture, color, and odor of the preparation (Setiawan et al., 2023).

**Homogeneity Test**

Homogeneity was tested by applying the serum onto a glass slide to observe whether the ingredients were uniformly dispersed. The preparation is considered homogeneous if no coarse particles are visible (Qamariah et al., 2022).

**pH Test**

The pH of the formulas was measured using a pH meter. The device was first calibrated using standard buffer solutions of pH 4 (acidic) and pH 7 (neutral). After calibration, the electrode was rinsed with distilled water and dried. The electrode was then immersed in the serum until a constant pH value was displayed. The physiological pH range for human skin is 4.5-6.5 (Hanifah & Amalia, 2023)

**Adhesion Test**

A 0.25 g sample of the serum was placed between two glass slides for 5 minutes. The slides were then mounted on an adhesion tester and subjected to an 80 g load. Once the load was released, the time required for the slides to separate was recorded. Effective adhesion is characterized by a value of > 4 seconds (Setiawan et al., 2023b).

**Spreadability Test**

A 0.5 g sample was placed in the center of a transparent glass plate. Another plate was placed on top with an additional 150 g weight. After 1 minute, the diameter of the spread was measured (Fitria & Ratu, 2022). The standard spreadability for serum is approximately 5–7 cm (Hikmah et al., 2024).

**Phase Separation Test**

The stability of the preparation was evaluated via centrifugation. The samples were placed in centrifuge tubes and spun at 3,750 rpm for 30 minutes. Instability in the preparation is indicated by the occurrence of phase separation (Aspadiah et al., 2025).

**Viscosity Test**

Viscosity was measured to determine the thickness of the preparation. The standard viscosity for serum ranges from 230-1150 cPs, measured using a viscometer with spindle number 2 at a speed of 60 rpm (Al Gifari et al., 2023).

### Emulsion Type Test

The emulsion type (oil-in-water or water-in-oil) was determined using a dye method with water-soluble methylene blue. In an oil-in-water (O/W) emulsion, the surface water merges with the water-soluble dye, resulting in a uniform color throughout the sample (Chandra & Rahmah, 2022).

### Moisturizing (Occlusivity) Test

An *in vitro* occlusivity test was conducted using 50 mL beakers (3.2 cm diameter, 4.6 cm height). Each beaker was filled with 10 mL of distilled water and sealed with filter paper (0.45 µm pore size) coated uniformly with 200 mg of the sample. The beakers were stored in an oven at 37°C ± 2°C with 60% ± 5% relative humidity (RH) for 48 hours. After incubation, the amount of evaporated water was measured. A higher capacity to prevent evaporation indicates higher occlusive properties.

The percentage of water loss was calculated using the following formula:

$$F = \frac{(A-B)}{A} \times 100$$

Description:

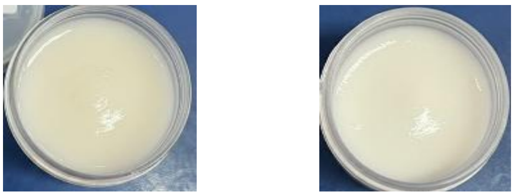
F : The value indicating the material's activity in reducing water loss (occlusivity factor)

A : Percentage of water loss from the beaker with a filter without a sample (control)

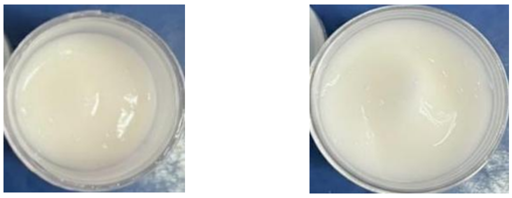
B : Percentage of water loss from the beaker with a filter treated with the sample.

## RESULTS AND DISCUSSION

Serum is a formulation with a high concentration of active ingredients but low viscosity, enabling it to form a thin layer of active substances on the skin surface. Serum is generally formulated with low thickness and a less clear appearance (semitransparent), and it contains a higher concentration of active ingredients compared with other topical preparations.



(F0) (F1)



(F2) (F3)

**Figure 1.** Facial serum formulations using avocado oil at varying concentrations: F0 (0%), F1 (5%), F2 (10%), and F3 (15%)

### Organoleptic Test

Sensory or organoleptic testing is widely employed to evaluate product quality using the human senses as the main assessment instrument. The evaluation includes several attributes, such as visual appearance, aroma, taste, texture or consistency, and other quality-related characteristics that contribute to the overall acceptability of the product (Ismanto, 2023). The organoleptic characteristics of the formulated facial serum are shown in **Table 2.**

**Table 2.** Organoleptic Evaluation

| | Formula | | | |
|---|---|---|---|---|
| | **F0** | **F1** | **F2** | **F3** |
| Color | White | White | White | White |
| Texture | Viscous | Viscous | Viscous | Viscous |
| Aroma | Vanilla | Vanilla | Vanilla | Vanilla |

Based on the organoleptic observations, the facial serum preparations in formulas F0 to F3 did not show significant color differences, although they were prepared with avocado oil concentrations of 0%, 5%, 10%, and 15%. All formulas exhibited a white color, which resulted from the mixing and homogenization process during preparation. The texture of the facial serum tended to be thick, influenced by the use of xanthan gum as the thickening agent, while most of the other ingredients used were liquid in form. The aroma produced by the facial serum was mild with a slight vanilla scent originating from the added fragrance ingredient.

### Homogeneity Test

The homogeneity test results of the facial serum before and after the cycling test showed that all formulas remained in a homogeneous condition. No coarse particles were observed either before or after the test. This indicates that the melting and mixing processes between the oil phase and the aqueous phase occurred properly and evenly, so the preparation remained stable during the cycling test. Factors that can affect the homogeneity of a preparation during formulation include temperature, speed, and duration of stirring during the mixing of the active substance and excipients (Prasetya & Endriyatno, 2025).

**pH Test**

The pH test results of the facial serum before and after the cycling test, as presented in **Table 3**, showed that all formulas had stable pH values. The pH values obtained both before and after testing remained within the normal skin pH range, namely 4.5–6.5 (Setiawan et al., 2023).

**Table 3.** pH Test Results

| Formula | pH | |
|---|---|---|
| | Before | After |
| F0 | 5,60 ± 0,01 | 6,29 ± 0,28 |
| F1 | 5,71 ± 0,05 | 6,52 ± 0,03 |
| F2 | 5,78 ± 0,01 | 6,54 ± 0,04 |
| F3 | 5,81 ± 0,08 | 6,56 ± 0,02 |

The increase in pH values in all formulas after the cycling test, from an initial range of 5.60–5.81 to 6.29–6.56, is closely related to the characteristics of avocado oil in the formulation. Avocado oil contains unsaturated fatty acids that may undergo oxidation or degradation when exposed to extreme temperature fluctuations during testing (Hanifa et al., 2023). This process causes acidic components in the oil to break down and reduce acidity, thereby shifting the pH value upward. The most noticeable increase was observed in F0, which rose from 5.60 to 6.29, and in F3, which showed the highest increase from 5.81 to 6.56. This indicates that the higher the concentration of active ingredient or oil in the formula, the greater the potential for chemical interactions that may induce alkaline characteristics upon heating (Budi et al., 2023).
During the cycling test from cycle 1 to cycle 6, the pH values fluctuated due to temperature changes during testing (Lumentut et al., 2018). Although the values increased, all formulas were still considered stable because their final pH values remained within the safe range for human skin according to Setiawan dkk. (2023), namely 4.5–6.5, although F3 (6.56) was very close to the upper limit (Setiawan et al., 2023).

**Adhesion Test**

The adhesion test results shown in **Table 4** indicate that the adhesion values of formulas F0, F1, F2, and F3 increased. Nevertheless, all formulas still exhibited good adhesion values because they remained above the minimum requirement for serum preparations, namely >4 seconds (Setiawan et al., 2023b).

**Table 4.** Adhesion Test

| Formula | Adhesion (Seconds) | |
|---|---|---|
| | Before | After |
| F0 | 7,19 ± 0,76 | 8,42 ± 0,08 |
| F1 | 7,24 ± 0,63 | 8,48 ± 0,58 |
| F2 | 8,03 ± 1,08 | 8,68 ± 0,44 |
| F3 | 8,07 ± 1,28 | 9,23 ± 0,09 |

All formulas showed an increase in adhesion value after the cycling test. The adhesion time increased from an initial range of 7.19–8.07 seconds to 8.42–9.23 seconds after testing. Technically, this change was caused by the evaporation of part of the aqueous phase in the preparation due to temperature fluctuations during the test cycle, which resulted in a higher concentration of thickening agents and oil in the serum. This more viscous condition increased intermolecular attraction, thereby prolonging the ability of the preparation to adhere to the skin surface.

In the control formula (F0), adhesion increased from 7.19 seconds to 8.42 seconds, indicating that the base formulation it self became more concentrated due to temperature effects. Meanwhile, the highest increase was observed in F3, reaching 9.23 seconds. This was due to the higher avocado oil content interacting with the serum components, resulting in a stickier texture after heating. Although an increase occurred, all formulas (F0, F1, F2, and F3) were still considered to have good quality because their adhesion values remained above the minimum requirement for serum preparations, namely >4 seconds (Setiawan et al., 2023)

**Spreadability Test**

The spreadability test results shown in **Table 5** indicate that the spreadability values of formulas F0, F1, F2, and F3 changed. However, all formulas still met the criteria for good spreadability for serum preparations, because the values obtained were within the required range of 5–7 cm (Hikmah et al., 2023)**.**

**Table 5.** Spreadability Test

| Formula | Spreadability (cm) | |
|---|---|---|
| | Before | After |
| F0 | 6,2 ± 0,25 | 5,4 ± 0,47 |
| F1 | 6,3 ± 0,15 | 5,5 ± 0,43 |
| F2 | 6,4 ± 0,41 | 5,6 ± 0,75 |
| F3 | 6,6 ± 0,23 | 5,7 ± 0,17 |

The spreadability values of all formulas decreased after the cycling test. The initial spreadability range of 6.2–6.6 cm decreased to 5.4–5.7 cm. This reduction was caused by changes in the texture of the preparation, which became thicker due to repeated exposure to hot and cold temperatures during the testing process. Extreme temperatures triggered evaporation of the aqueous phase and increased interactions among the components in the serum, making the structure denser and more difficult to spread under load.

In the control formula (F0), spreadability decreased from 6.2 cm to 5.4 cm, demonstrating that the serum base mixture itself became more viscous due to temperature stress. A similar effect was observed in F3, where spreadability decreased from 6.6 cm to 5.7 cm. Although a decrease occurred, all preparations were still considered stable and of good quality because the values remained within the ideal serum spreadability range of 5–7 cm (Hikmah et al., 2024). This indicates that the serum remains easy and comfortable to apply to the skin surface even after exposure to extreme storage conditions.

**Phase Separation Test**

Based on observations after the cycling test, all serum formulas showed good physical stability because no phase separation was found. Although the preparations were repeatedly exposed to drastic hot and cold temperature changes, the emulsion system in the serum remained completely unified and did not break into separate oil and water layers.

This proves that the combination of emulsifying agents, thickening agents, and viscosity in the serum functioned optimally to maintain the preparation in a homogeneous state during storage. Because no phase separation occurred, the active ingredients in the serum remained evenly distributed.

**Viscosity Test**

The viscosity test results are shown in **Table 6.** Based on the test data, all formulas showed an increase in viscosity after treatment. Although an increase occurred, the viscosity values obtained remained within the acceptable viscosity range for serum preparations, namely 230–1150 centipoise (cP) (Al Gifari et al., 2023).

**Table 6.** Viscosity Test

| Formula | Viscosity (cP) | |
|---|---|---|
| | Before | After |
| F0 | 368,25 ± 1,79 | 370,77 ± 50,23 |
| F1 | 377,50 ± 11,45 | 401,76 ± 5,00 |
| F2 | 403,30 ± 2,37 | 410.96 ± 15,21 |
| F3 | 409,04 ± 15,40 | 413,57 ± 6,21 |

The viscosity of the facial serum preparations became slightly higher after undergoing the cycling test. The viscosity values increased from an initial range of 368.25–409.04 cP to 370.77–413.57 cP. This change occurred because repeated exposure to alternating high and low temperatures affected particle movement within the formulation. Such extreme temperature conditions can lead to evaporation of the aqueous phase, resulting in a denser and more viscous serum (Al Gifari et al., 2023).

In the control formula (F0), viscosity increased from 368.25 cP to 370.77 cP, indicating that the base formulation itself underwent physical changes due to temperature exposure. The highest increase was observed in F3, rising from 409.04 cP to 413.57 cP. These results are consistent with previous tests, as increased viscosity generally leads to reduced spreadability but prolonged adhesion on the skin surface. Despite the increase, all formulas were considered stable because the changes were minimal and the preparations maintained acceptable consistency.

## Emulsion Type Test

The emulsion type test was conducted to determine whether the formulation formed an oil-in-water (O/W) or water-in-oil (W/O) emulsion. This test was performed using a staining method with a water-soluble dye (methylene blue) applied to the preparation. In an oil-in-water emulsion, oil droplets are dispersed within the aqueous phase. The water present on the surface interacts with the water-soluble dye, resulting in a uniform or homogeneous coloration (Chandra & Rahmah, 2022).

Based on the test results, the facial serum preparations exhibited an oil-in-water (O/W) emulsion type both before and after the cycling test. These findings indicate that repeated exposure to alternating hot and cold temperatures during the cycling test did not alter the emulsion type. This suggests that the emulsion system possesses good thermal stability. The successful maintenance of the oil-in-water emulsion type is supported by the appropriate selection and combination of emulsifiers, ensuring that the oil phase remains evenly dispersed within the aqueous phase. Thus, the facial serum retains suitable characteristics for topical application both before and after the cycling test.

## Moisturizing Test

The moisturizing test was conducted to evaluate the ability of the formulation to retain moisture in the skin after application. This test aimed to assess the effectiveness of the preparation in reducing transepidermal water loss. The effectiveness of the facial serum can be evaluated based on the increase in moisture percentage achieved. The test results showed that all facial serum formulations were capable of moisturizing the skin. A higher occlusivity value indicates greater effectiveness in preventing water loss, thereby better maintaining skin hydration. Conversely, lower occlusivity values indicate a reduced ability to inhibit water loss (Maru & Lahoti, 2018 ). The percentage results of the moisturizing test are presented in **Figure 2.**

Based on the moisturizing test results, formulations F1, F2, and F3, before the cycling test, showed increased moisture values, indicating their ability to reduce water loss from the skin. This increase is attributed to the different concentrations of avocado oil used in the formulations. Avocado oil contains monounsaturated fatty acids such as oleic and linoleic acids, as well as vitamins A, D, and E (tocopherol), which contribute to skin hydration. These components help improve the skin barrier function, making them essential for maintaining skin moisture and preventing transepidermal water loss. Therefore, avocado oil plays an important role in maintaining healthy and hydrated skin (Hanifa et al., 2023).

The results after the cycling test showed a decrease in moisture percentage. This reduction is due to temperature variations during the stability test, which affected both the physical characteristics and active ingredient content of the formulation, thereby influencing its ability to retain skin moisture (Wahyuningsih et al., 2021).

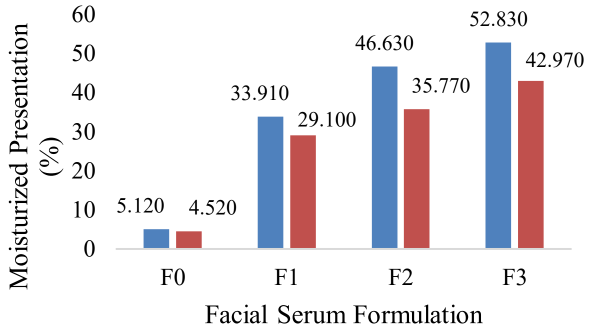



**Figure 2.** In vitro moisture percentage of facial serum preparations with varying concentrations of avocado oil (F0: 0%, F1: 5%, F2: 10%, F3: 15%)

Based on the diagram in Figure 2, increasing the concentration of avocado oil was directly proportional to the moisture value of the preparation, with F3 (15%) showing the highest moisture percentage at 52.830%. This demonstrates that avocado oil effectively enhances the serum's ability to maintain skin hydration. However, after the cycling test, almost all formulations showed a decrease in moisture values; for example, F3 decreased to 42.970%. This decline was caused by extreme temperature exposure during testing, which triggered evaporation of the aqueous phase and structural changes in the formulation, thereby reducing its water-retention capacity.

According to established criteria, skin moisture levels are categorized as follows (Situmorang et al., 2020).

Overall, although a decrease in performance was observed due to temperature effects, the use of avocado oil demonstrated a significant contribution to maintaining skin moisture compared to the formulation without active ingredients.

## CONCLUSION

The results of this study indicate that the characteristics of facial serum formulations containing avocado oil met the required standards, based on evaluations of organoleptic properties, pH, homogeneity, spreadability, adhesion, viscosity, phase separation, and emulsion type. Stability testing of the facial serum formulations demonstrated that all preparations remained stable and fulfilled the specified requirements across all tested parameters, including organoleptic properties, pH, homogeneity, spreadability, adhesion, viscosity, phase separation, and emulsion type The results of skin moisturizing activity measurements showed that the avocado oil-based facial serum, particularly formula F3, was the most optimal formulation, with moisture values of 52.830% before the cycling test and 42.800% after the cycling test.

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## REFERENCES

Agustin, E. W., Tumangger, M. H., Nugroho, A. S., Rinjani, F. K. A., Setyowati, M. J. A., Yosheaningtyas, D. F., Rachma, D. F., & Hiadayat, K. A. A. Z. P. (2024). Kosmetik herbal bahan alami yang berfungsi sebagai pelembab kulit berdasarkan kajian pustaka. *Jurnal Ventilator*, *2*(4), 235–245.

Al Gifari, M., Noval, N., & Audina, M. (2023). Formulasi Dan Uji Stabilitas Sediaan Serum Ekstrak Etanol Kulit Jeruk Nipis (Citrus aurantifolia L.) Sebagai Antiacne. *Sains Medisina*, *1*(5), 246–253.

Aspadiah, V., Akib, N. I., Muliadi, R., & Rahayu, N. (2025). *Lansau : Jurnal Ilmu Kefarmasian (LJIK)*. *3*(1), 27–42.

Budi, S., Studi, P., Farmasi, S., Kesehatan, F., Sari, U., & Banjarmasin, M. (2023). Formulasi Dan Uji Stabilitas Fisik Facial Wash Ekstrak Daun Sepat *( Mitragyna Speciosa Kroth )*. *Innovative: Journal Of Social Science Research*. *3*, 9832–9841.

Butarbutar, M. E. T., & Chaerunisaa, A. Y. (2020). Peran Pelembab dalam Mengatasi Kondisi Kulit Kering. *Majalah Farmasetika*, *6*(1), 56–69.

Chandra, D., & Rahmah, R. (2022). Uji fisikokimia sediaan emulsi, gel, emulgel ekstrak etanol goji berry (Lycium barbarum l.). *MEDFARM: Jurnal Farmasi Dan Kesehatan*, *11*(2), 219–228.

Farida, S. N., Agustina, A., & Mahdi, N. (2022). Formulasi dan Evaluasi Sifat Fisik Sediaan Krim Pelembab Wajah (Moisturizer) dari Ekstrak Etanol Daun Ginseng Jawa (Talinum paniculatum gaertn). *Borneo Journal of Pharmascientech*, *6*(2), 104–107. https://doi.org/10.51817/bjp.v6i2.445

Fitria, N., & Ratu, A. P. (2022). Karakteristik Dan Stabilitas Sediaan Serum Ekstrak Buah Kersen (*Muntingia calabura L.*) Dengan Variasi Konsentrasi. *Jurnal Farmamedika*. *7*(1), 17–27.

Hanifa, D., Ningsih, W., & Bakhtiar, A. (2023). Formulasi Dan Evaluasi Masker Peel-Off Dari Minyak Buah Alpukat (Persea Americana). *Jurnal Katalisator*, *8*(1), 99–110.

Hanifah, R., & Amalia, N. (2023). Uji Aktivitas Antioksidan Sediaan Serum Wajah Ekstrak Etanol Daun Kelor (*Moringa oleifera* Lam.) Dengan Metode DPPH. *Journal of Pharmacopolium*. *1*(2), 27–40.

Hidayah, H., Kusumawati, A. H., Sahevtiyani, S., & Amal, S. (2021). Literature Review Article: Aktivitas Antioksidan Formulasi Serum Wajah Dari Berbagai Tanaman. *Journal of Pharmacopolium*, *4*(2), 75–80.

Hikmah, F. N., Malahayati, S., & Nugraha, D. F. (2023). Formulasi Dan Evaluasi Sediaan Serum Gel Ekstrak Bunga Melati (Jasminum sambac L.). *Journal Pharmaceutical Care and Sciences*, *3*(2), 93–108.

Hikmah, F. N., Malahayati, S., & NUgraha, D. F. (2024). Formulasi Dan Evaluasi Sediaan Serum Gel Ekstrak Bunga Melati (Jasminum sambac L.). *Sains Medisina*, *2*(3), 110–120.

Ismanto, H. (2023). Penggorengan Vakum Organoleptic Test Of Shrimp Chips *( L .*

*vannamei )* Using Vacuum. *Jurnal AgroSainTa. 6*(2), 53–58.

Lumentut, N., Jaya, H., & Melindah, E. (2018). Formulasi dan Uji Stabilitas Fisik Sediaan Krim Ekstrak Etanol Kulit Buah Pisang Goroho ( Musa acuminafe L .) Konsentrasi 12 . 5 % Sebagai Tabir Surya. *9*(2), 42–46.

Lustianah, T., Nurheni, A., Septiani, A. R., Srifitriani, E., Fatmawati, F., Haryadi, R., Azzahra, S. K., & Yuniarsih, N. (2023). Literature Riview : Serum Dari Berbagai Bahan Alam Yang Berpotensi Sebagai Antioksidan. *Jurnal Ilmiah Wahana Pendidikan*, *9*(17), 34–40.

Maru, A. D., & Lahoti, S. R. (2018). Formulation and evaluation of moisturizing cream containing sunflower wax. *Int J Pharm Pharm Sci*, *10*(11), 54–59.

Prasetya, E. Y., & Endriyatno, N. C. (2025). Formulasi dan Penentuan Nilai SPF Krim Ekstrak Rimpang Temu Mangga ( Curcuma manga Val .) Dengan Kombinasi Emulgator Tween 80 Dan Span 80. *11*(1), 216–225.

Qamariah, N., Handayani, R., & Maretania, J. (2022). The Serum Formulation of Hati Tanah Tuber Ethanol Extract from Central Kalimantan. *Pharmacognosy Journal*, *14*.

Setiawan, P. A., Rahmawanty, D., & Sari, D. I. (2023a). Formulasi dan evaluasi sifat fisik sediaan serum wajah ekstrak daun singkong (Manihot esculenta) dengan variasi konsentrasi xanthan gum. *Jurnal Pharmascience*, *10*(2), 394–404.

Setiawan, P. A., Rahmawanty, D., & Sari, D. I. (2023b). Formulasi dan Evaluasi Sifat Fisik Sediaan Serum Wajah Ekstrak Daun Singkong (Manihot esculenta) dengan Variasi Konsentrasi Xanthan Gum. *Jurnal Pharmascience*, *10*(2), 394.

Situmorang, N. B., Marpaung, D. M., Aminah, S., Anna, R., Marbun, T., Kesehatan, I., Lubuk, M., & No, J. S. (2020). Efektivitas Formulasi Sediaan Sabun Mandi Padat Ekstrak Etanol Daun Belimbing Wuluh (Averrhoa Bilimbi) Sebagai Pelembab Kulit. *Jurnal Farmasimed*. *2*(2), 50–55.

Slamet, T., Erna, I., Maryam, S., & Ghifari, U. Al. (2024). Tinjauan Sistematis Potensi Pemanfaatan Minyak Alpukat (Persea Americana Mill ) Sebagai Pembuatan Serum. *Indonesian Nursing Journal of Education and Clinic, 4*(2), 79–92.

Suharsanti, R., & Ariyani, L. W. (2018). Efek Pelembab Kulit Sediaan Shooting Gel Kombinasi Daun Lidah Buaya Dan Buah Anggur. *Jurnal Farmasi & Sains Indonesia*, *1*(1), 25–30.

Thomas, N. A., Suryadi, A. M. A., Latif, M. S., Hutuba, A. H., & Susanti, S. (2024). Formulasi dan Uji Stabilitas Fisik Krim Pelembab Ekstrak Rumput Laut (Eucheuma cottonii). *Indonesian Journal of Pharmaceutical Education (e-Journal)*, *4*(1), 2775–3670. https://doi.org/10.37311/ijpe.v4i1.20522

Wahyuningsih, S., Bachri, N., Awaluddin, N., Andriani, I., Farmasi, F., Megarezky, U., & Farmasi, F. (2021). *Jurnal Katalisator*. *6*(2), 270–283.

Wijayadi, L. Y., Kurniawan, J., & Satyanegara, W. G. (2024). Penyuluhan dan Pemeriksaan Untuk Mencegah Kerusakan Kulit Akibat Paparan Sinar Matahari. *Communnity Development Journal*, *5*(2), 2801–2807.