

FORMULATION OF AVOCADO FRUIT EXTRACT SHAMPOO (*Persea americana mill*) AS AN ALTERNATIVE FOR HAIR HEALTH

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A B S T R A C T

Background: Avocado fruit (*Persea americana mill.*) is one of the fruits known to contain bioactive compounds, such as saponins, flavonoids, alkaloids, and oleic acid, which have antioxidant and antibacterial activities. In the world of beauty industry avocado fruit is widely used in the process of making skin care products such as body lotion, shampoo and body wash. Apart from being used as a treatment, avocados are often used as food additives such as bread, juice and other foods. **Objective:** This study aims to develop an avocado fruit extract-based shampoo formulation and evaluate its physical characteristics as a natural alternative for hair care. **Methods:** This study used a laboratory experimental approach with a qualitative method to develop avocado extract shampoo formulas with concentrations of F0 (0%), F1 (1%), F2 (2%), and F3 (3%). The ingredients used in the shampoo formulation included Sodium Lauryl Ether Sulfate (SLES), glycerin, tea tree oil, and Cetrimonium Bromide (CPBA), all of which were chosen to support the stability and effectiveness of the final product. **Results:** Evaluation included organoleptic test, pH, viscosity, homogeneity, foam height, and hedonic test. Results showed that all formulas met the standards for organoleptic test, pH, homogeneity, and foam height, but the viscosity of each formula was below the SNI standard (400-4000 cps). Formula F3 showed the highest viscosity of 243 cps. These findings indicate that avocado extract is proven effective as an active ingredient that has the potential to be used in shampoo formulations that are efficacious for hair health.

INTRODUCTION

Avocado (*Persea americana Mill.*) is a widely known fruit due to its diverse uses in various industries, including food and beauty. In the beauty industry, avocado extract is commonly used in the production of skincare and haircare products, such as sheet masks, body lotions, shampoos, and body washes. Additionally, avocado is frequently used as an ingredient in food products like bread, juice, and various other dishes. Avocados are rich in essential nutrients, including vitamin C, healthy fats, minerals, and fiber, which provide significant benefits for overall health, particularly for skin and digestive health (Azkiyah et al., 2022).

Chemically, avocados contain secondary metabolites such as alkaloids, saponins, flavonoids, and oleic acid, which have various therapeutic activities. These compounds, particularly saponins and flavonoids, are known to have antioxidant and antibacterial properties beneficial for skin and hair health (Jayustin & Putra Fratama, 2019). However, the effectiveness of these compounds is greatly influenced by the plant part used and the extraction method applied. Various extraction methods, both hot techniques like reflux and Soxhlet, and cold techniques like maceration and percolation, can affect the optimal extraction of bioactive compounds. The presence of pathogenic bacteria, such as *Staphylococcus aureus*, a common cause of skin infections and dandruff, can also affect scalp and hair health, leading to scalp disorders (Yusnitasari et al., 2023).

Shampoo, as a widely used haircare product, serves to cleanse hair of dirt, oil, and bacteria while maintaining scalp health. Shampoo formulations typically contain surfactants or detergents as the main ingredients to produce foam and cleanse the hair and scalp. In addition to the main ingredients, shampoos also contain supporting ingredients that enhance the stability and effectiveness of the product (Fauzi et al., 2024). In this regard, avocado extract, rich in bioactive compounds such as saponins, flavonoids, alkaloids, and antioxidants, is believed to have potential as an active ingredient in shampoo formulations. The saponins and flavonoids in avocado extract may also help reduce dandruff caused by bacterial infections, particularly those from the genera *Staphylococcus* and *Propionibacteria*. *Staphylococcus aureus*, a common Gram-positive bacterium, is known as the primary cause of dandruff and scalp disorders. This bacterium is coccoid, with a diameter of approximately 0.8-1.0 microns, non-

motile, non-spore-forming, and appears as grape-like clusters under a microscope. It grows optimally at temperatures between 15°C and 40°C (Billa et al., 2024).

Previous studies have shown that avocado extract is widely known for its benefits in skincare and haircare. However, most of the existing research focuses on the application of avocado extract in skin cosmetics and food products. Research on the formulation of avocado extract-based shampoo for haircare is still very limited. Moreover, although avocado extract contains bioactive compounds with antibacterial and antioxidant properties, there has been no comprehensive study that develops an avocado extract-based shampoo formulation and evaluates its therapeutic benefits in improving hair and scalp health in greater depth.

Based on this background, this study aims to develop a shampoo formulation based on avocado fruit extract as a natural alternative for haircare. It is hoped that the shampoo formulated with avocado extract will provide significant benefits in improving overall hair health by utilizing the antibacterial, antioxidant, and natural moisturizing properties of avocado extract, while also offering protection against infections and dandruff on the scalp.

METHODS

Research Type

This study is a laboratory experimental research aimed at developing a shampoo formulation based on avocado fruit extract (*Persea americana* Mill.) and evaluating its physical characteristics as an alternative for hair care. The sample used in this research is avocado fruit extract, which has been processed through an extraction process to obtain the bioactive compounds beneficial for hair health. The study also involves physical evaluation tests on the formulated shampoo to assess its stability, texture, and viscosity.

Time and Place of Research

The research was conducted from May 25 to July 10, 2025, at the Laboratory of Universitas Mandala Waluya and the Pharmaceutical Laboratory of Politeknik Baubau.

Equipment and Materials

The laboratory equipment used in this research includes stirring rods, beakers, spatulas, analytical balances, porcelain dishes, measuring cylinders, knives, blenders, parchment paper, Gegep, tripods, Bunsen burners, glass jars, shampoo containers, rotary evaporators, viscometers, pH meters, and watch glasses. These tools were selected based on their functions to support the extraction and shampoo formulation processes, as well as to ensure the accuracy of physical and chemical measurements of the final product.

The materials used in this research include avocado, 96% ethanol, aquadest, Sodium Lauryl Ether Sulfate (SLES), glycerin, tea tree oil, cocamidopropyl betaine (CPBA), methyl paraben, sodium benzoate, and cocamonoethanolamine (cocamono DEA). Each material plays a crucial role in the shampoo formulation process, ranging from emulsifiers, preservatives, to agents that provide therapeutic and cosmetic effects in the resulting product.

Procedures

Sample Preparation

The sample used in this research is avocado pulp. The initial process involves wet sorting to remove any dirt or contaminants adhering to the surface of the avocado, ensuring that the sample is clean and ready for the next stage. After that, the avocado is cut into pieces. The pulp is then dried by air-drying in a shaded area, avoiding direct sunlight, to reduce the water content in the avocado pulp (Harsep Rosi & Belia, 2023).

Extraction of Avocado (*Persea americana* Mill.)

Extraction is carried out using the maceration method. Fresh avocados are cleaned, cut, and weighed to 466.4 grams. The sample is then placed in a jar and soaked in 96% ethanol for 72 hours (3 × 24 hours) in a cool, dark place. Every 24 hours, the solvent is replaced, and the sample is stirred to ensure optimal extraction. After the maceration period, the resulting filtrate is evaporated using a rotary vacuum evaporator at 30°C, removing ethanol and leaving behind a concentrated extract (Harsep Rosi & Belia, 2023).

sample of Yield Calculation:

$$\text{Yield (\%)} = \frac{\text{weight of concentrated extract (grams)}}{\text{weight of initial sample (grams)}} \times 100\%$$

Formulation of Avocado Fruit Extract Shampoo (*Persea americana* mill)

Table 1. Formulation of Avocado Fruit Extract Shampoo (*Persea americana* mill)

Ingredient	Function	Composition (%)			
		F0	F1	F2	F3
Ekstrak Buah Alpukat	Zat aktif	-	1	2	3
SLES	Surfaktan	30	30	30	30
Gliserin	Pelembab	18	18	18	18
CPBA	Surfaktan	6	6	6	6
Tea tree oil	Anti Jamur	0,5	0,5	0,5	0,5
Methyl paraben	Anti Jamur	0,5	0,5	0,5	0,5
Natrium benzoate	Pengawet	1,5	1,5	1,5	1,5
Cocamono DEA	Surfaktan	4	4	4	4
Parfum	Pewangi	Qs	Qs	Qs	Qs
Aquadest	Pelarut	Ad 100	Ad 100	Ad 100	Ad 100

Source: (Erwiyani et al., 2023).

Note:

F0: No active ingredient

F1: 1% avocado fruit extract formulation

F2: 2% avocado fruit extract formulation

F3: 3% avocado fruit extract formulation

Preparation of Avocado Fruit Extract Shampoo (*Persea americana* mill)

The preparation of avocado fruit extract shampoo begins by dissolving Sodium Lauryl Ether Sulfate (SLES) in warm aquadest until fully dissolved. Then, glycerin and cocamidopropyl betaine (CPBA) are added gradually while continuously stirring until a homogeneous mixture is achieved. Afterward, the avocado extract is added to the mixture and stirred to ensure uniformity. Preservatives methyl paraben and sodium benzoate are then added, and the mixture is stirred again to achieve a homogeneous blend. Next, 0.5 mL of tea tree oil is added, followed by avocado fragrance to provide aroma to the shampoo. After all ingredients are well-mixed, the final product is stirred until perfect homogeneity is achieved (Nurwanti et al., 2024)

Physical Evaluation Tests

Organoleptic Test

The organoleptic test is performed to evaluate the physical characteristics of the shampoo by observing changes in texture, aroma, and color of the product (Hia, 2019).

pH Test

The pH measurement of the shampoo is carried out to ensure that the product has the appropriate acidity level and is safe to use on the scalp without causing irritation. This process begins with calibrating the pH meter to ensure measurement accuracy. Then, 1 gram of shampoo is dissolved in 10 mL of aquadest, and the pH meter is immersed in the solution to measure the pH. The resulting pH value should fall within the range of 4.5 to 6.5, which is the ideal pH range for the scalp to ensure safe use without disturbing the skin's natural balance (Hia, 2019).

Homogeneity Test

The homogeneity test is conducted to examine the presence of coarse particles in the shampoo and to assess the uniformity of the texture. The shampoo is tested by spreading it on a watch glass at various concentrations. A good shampoo formulation should demonstrate a uniform consistency without any coarse particles to ensure quality and user comfort (Luhung et al., 2024).

Foam Height Test

The foam test is conducted to evaluate the shampoo's ability to generate foam. 10 mL of shampoo is dissolved in a graduated cylinder and stirred to create foam. The height of the foam is then observed within a specified time interval. The foam height measurement is taken after a few minutes to assess the stability and quality of the foam produced. The standard foam height should fall between 13 and 220 mm (Fitriani et al., 2024).

Viscosity Test

The viscosity of the shampoo is measured using a Brookfield viscometer. 100 mL of shampoo is placed in a beaker, and the spindle is installed and lowered until it reaches the specified limit. The viscosity of the shampoo is measured at a spindle speed of 60 rpm to determine the product's thickness.

According to SNI standards, the viscosity of the shampoo should range from 400 to 4000 cps (Hidayat et al., 2021).

Hedonic Test

The hedonic test, also known as the preference test, involves asking respondents to provide their personal opinions regarding their liking or disliking of a product, measured using a hedonic scale. This scale includes categories such as "dislike," "slightly like," "like," and "strongly like." In this study, respondents were asked to evaluate the shampoo based on its physical characteristics, including color, texture, aroma, and the amount of foam produced (Gea, 2018).

RESULTS & DISCUSSION

This study aims to develop a shampoo formulation based on avocado fruit extract (*Persea americana* Mill.) for use as a hair care product. Avocado has high potential due to its beneficial nutritional content, making it an effective ingredient for shampoo. Several studies have shown that avocado contains monounsaturated fatty acids, particularly oleic acid, which helps slow down hair loss and stimulate hair growth. Oleic acid functions as an antioxidant, helping protect hair from damage caused by chemicals in hair care products, pollution, and nutrient deficiencies (Zebua, 2023).

Shampoo Evaluation Tests

The shampoo characteristics were evaluated based on several aspects, including organoleptic test, pH test, homogeneity test, foam height test, viscosity test, and hedonic test.

Table 1. Results of Organoleptic Test

Parameter	F0	F1	F2	F3
Color	Clear	Faded Yellow	Yellow	Deep Yellow
Aroma	Avocado Scent	Avocado Scent	Avocado Scent	Avocado Scent
Texture	Slightly Viscous	Slightly Viscous	Slightly Viscous	Slightly Viscous

Source: Primary data, 2025.

The organoleptic test for the avocado fruit extract shampoo (*Persea americana* Mill.) presented in Table 4.1 aims to evaluate the physical characteristics of the product, including aroma, color, and texture (Atina et al., 2024). Based on the results, formulation F0 has a clear color, distinct avocado aroma, slightly viscous texture, smooth consistency, and is easy to apply. Formulation F1 shows a faded yellow color, distinct avocado aroma, slightly viscous texture, smooth consistency, and is easy to use. Formulation F2 has a bright yellow color, refreshing avocado aroma, slightly viscous texture, smooth consistency, and is easy to apply. Formulation F3, with a deep yellow color, distinct avocado aroma, slightly viscous texture, smooth consistency, and easy application, shows similar results to the other formulations, though the color is slightly more intense.

Table 2. pH Test Results

Formulation	pH	Description	Standard
F0	6,0	Meets standard	4,5 – 6,5
F1	6,0		
F2	6,0		
F3	6,0		

Source: Primary data, 2025.

The pH test, presented in Table 4.2, is an essential quality control measure for shampoos since they are directly applied to hair. The pH measurement ensures that the shampoo does not damage the hair and scalp. The ideal pH for shampoo is within the range of 4.5–6.5. The pH meter is calibrated before use, and 1 gram of shampoo is dissolved in 10 mL of aquadest. The pH meter is then dipped into the solution, and the reading is recorded. The pH results for all formulations (F0, F1, F2, and F3) are 6.0, which meets the expected pH range and can be considered acceptable.

Table 3. Homogeneity Test Results

Formulation	Homogeneity	Description	Standard
F0	Homogeneous	Meets standard	Homogeneous
F1	Homogeneous		
F2	Homogeneous		
F3	Homogeneous		

Source: Primary data, 2025.

The homogeneity test, presented in Table 4.3, evaluates whether the shampoo samples from formulations F0, F1, F2, and F3 are homogeneous and meet the set standards. The results indicate that all formulations are homogeneous. If any clumps or particles are found in the formulation, it would fail the homogeneity test.

Tabel 4. Foam Height Test Results

Formulation	Foam Height	Description	Standard
F0	30 mm	Meets standard	13-220 mm
F1	40 mm		
F2	50 mm		
F3	50 mm		

Source: Primary data, 2025.

The foam height test, presented in Table 4.4, evaluates the shampoo's ability to generate foam. 10 mL of shampoo is dissolved in a graduated cylinder and stirred three times to create foam. The foam height is observed over a period of 15 to 45 minutes to assess the stability and volume of foam produced. The foam height is measured after 5 minutes, and the results are recorded. The standard foam height is between 13 and 220 mm. Based on the test results, the foam heights are as follows: formulation F0 produced 30 mm, F1 produced 40 mm, and F2 and F3 each produced 50 mm. Thus, all shampoo formulations meet the set standard

Table 5. Viscosity Test Results

Formulation	Viscosity (cps)	Description	Standar
F0	42,7 cps	Does not meet standard	400-4000 cps
F1	29,4 cps		
F2	153 cps		
F3	243 cps		

Source: Primary data, 2025.

The viscosity test results indicate that all formulations have a viscosity below the SNI standard range of 400–4000 cps. Formulations F0 and F1, with lower concentrations of avocado extract, show the lowest viscosity, 42.7 cps and 29.4 cps, respectively. This lower viscosity can be attributed to the limited amount of extract, which affects the overall consistency and thickness of the solution. On the other hand, formulations F2 (2%) and F3 (3%), which contain higher concentrations of avocado extract, exhibit significant increases in viscosity, with values of 153 cps and 243 cps, respectively. This increase in viscosity suggests that avocado extract contributes significantly to the thickness of the shampoo.

However, the viscosity values for both formulations still do not meet the required SNI standard range. The increase in viscosity with higher concentrations of extract in formulations F2 and F3 demonstrates that adding more avocado extract results in a thicker shampoo. The thicker consistency of avocado extract plays a key role in this, where a larger amount of extract increases the viscosity of the shampoo. Formulation F3, with a higher concentration of extract, exhibits the highest viscosity compared to the other formulations, indicating that avocado extract has the potential to improve the physical quality of the shampoo (Erwiyani et al., 2023).

Shampoos with low viscosity, while easy to apply, tend to wash out quickly from the hair due to low surface tension, which causes the shampoo to flow away with water. Low surface tension leads to faster runoff, making it less effective for providing long-lasting benefits to the hair (Nareswari et al., 2022). Therefore, higher viscosity in shampoos is essential to ensure that the product stays on the hair longer, providing more optimal results.

Table 6. Hedonic Test Results

Samplel	Skor Penilaian Indikator Uji Hedonik			
	Color	Aroma	Foam	Viscosity
F0	18	18	26	21
F1	23	21	26	23
F2	24	23	29	24
F3	29	24	28	28

Source: Primary data, 2025.

Keterangan:

Indikator : W = Warna

A = Aroma

B = Busa

K = Kekentalan

Nilai: Skor 0 = Tidak Suka

1 = Agak Suka

2 = Suka

3 = Sangat Suka

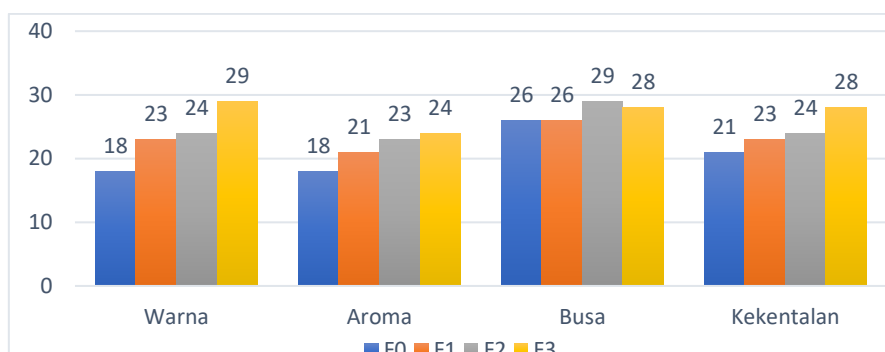


Figure 1. Diagram of the Relationship in the Hedonic Test

Respondents tended to prefer the color of formulation F3 compared to F0, F1, and F2. Formulation F3, with its deep yellow color, was perceived to reflect a higher content of natural ingredients, particularly avocado extract. The deep yellow color gives the impression that the shampoo contains more active ingredients, enhancing its perceived value and aesthetic appeal to consumers. In contrast, F0, with its clear color, received the lowest score, as it was seen as less attractive and not representative of natural ingredients. This underscores the importance of visual appeal (color) in attracting consumer interest in cosmetic products.

For texture, formulation F3 received the highest score (28), followed by F2 (24), F1 (23), and F0 (21). This shows that increasing the concentration of avocado extract affects the shampoo's viscosity, resulting in a texture that is more preferred by users. A slightly thick yet not overly dense texture was considered ideal as it facilitates application and provides a smooth and comfortable sensation during use. Formulation F0, with the lowest viscosity score (21), indicates that the shampoo is too runny and lacks an exclusive feel. Watery shampoos are often associated with lower quality or formulation instability.

The aroma of the four formulations shared the same base scent, which was the avocado aroma from the extract and added fragrance. However, F3 had the highest aroma score (29), while F2 received the lowest score (24). Respondents seemed to prefer a stronger, more "distinct" aroma, which typically comes from higher concentrations of active ingredients. The aroma of F3 was felt to be more distinct and refreshing, signaling the identity of the natural ingredients used.

A mild, fresh, and non-overpowering fragrance is essential for user comfort, especially since the product is applied to the scalp area. Formulation F0 still achieved a fairly high aroma score (18), as the added fragrance gave a pleasant scent despite the absence of avocado extract.

Foam quantity and characteristics are also important indicators in the hedonic test as they are closely related to the user's sensory experience when using the shampoo. Interestingly, all formulations received high and relatively similar scores for foam, ranging from 28 to 29. Formulations F3 and F2 scored the highest (29), while F1 and F0 scored 26. This indicates that all formulations are capable of generating a satisfactory amount of foam.

The foam formation ability is primarily supported by the surfactants such as SLES, CPBA, and Cocamono DEA, which help produce foam, clean the scalp, and provide a pleasant experience during use. The inclusion of avocado fruit extract in the formula did not significantly reduce foam production, even in the highest concentration.

CONCLUSION

Based on the research results and discussions on the formulation of avocado fruit extract shampoo (*Persea americana* Mill.), it can be concluded that avocado fruit extract has the potential to be used as an ingredient in shampoo formulations with good physical characteristics. All tested formulations met the SNI standards for pH, homogeneity, foam height, and hedonic tests, indicating that the product meets the expected quality criteria. However, the viscosity test results showed values still below the SNI standard, indicating that although other aspects meet the criteria, the shampoo has not yet fully met the established quality standards.

The limitations of this study include the need to increase the concentration of avocado extract and add thickeners to achieve a viscosity that meets the SNI standard. This would help improve the product quality and user comfort when using the shampoo.

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