Pharmaciana
Vol.13, No.1, March 2023, Page. 87-99
ISSN: 2088 4559; e-ISSN: 2477 0256
DOI: 10.12928/pharmaciana.v13i1.23965

Evaluation and clinical activity test of various concentrations of peel-off gel mask of robusta coffee seed extract (*Coffea canephora*) as anti-aging

Angga Saputra Yasir[1*], Agesta Yesti Renita[2], Tutik[2]
[1]*Department of Cosmetic Engineering, Sumatera Institute of Technology,*
Jl. Terusan Ryacudu, Way Huwi, Jati Agung Districts, South Lampung Regency, Lampung, Indonesia
[2]*Department of Pharmacy, Malahayati University,*
Jl. Pramuka No.27, Kemiling Permai, Kemiling Districts, Bandar Lampung, Lampung, Indonesia

Submitted: 28-04-2022 ***Reviewed: 06-02-2023*** ***Accepted: 07-03-2023***

ABSTRACT

Robusta coffee beans contain antioxidant compounds having anti-aging properties. This study aims to determine the content of secondary metabolites in robusta coffee bean extract, anti-aging effectiveness, and the best peel-off gel mask preparation concentration. The extraction method in this study used maceration with 96% ethanol as solvent. The extraction results were carried out by phytochemical screening and formulation of peel-off gel mask preparations, then tested for anti-aging effectiveness using 12 female volunteers and observed signs of aging, including pores, spots, wrinkles, and moisture for four weeks. Robusta coffee bean extraction results obtained a yield of 9.2%. The results of phytochemical screening showed that robusta coffee bean extract contains flavonoid compounds, alkaloids, tannins, and saponins. The results of the evaluation of the 0.5% formula of robusta coffee bean extract were the most preferred by volunteers. The best effectiveness and concentration test results were found in the peel-off gel mask preparation of 2% robusta coffee bean extract formula (F2) compared to blank and F1 (p-value <0.05). The percentage of improvement in the condition of the volunteers' skin, including pores, spots, wrinkles, and moisture, is 21.88 ± 4.22%, 21.57 ± 3.25%, 17.71 ± 2.44%, and 21.25 ± 3.62%, respectively.

Keywords: Robusta coffee bean (*Coffea canephora*), anti-aging, peel-off gel mask, skin analyzer.

Corresponding author:
Angga Saputra Yasir
Department of Cosmetic Engineering, Sumatera Institute of Technology
Jl. Terusan Ryacudu, Way Huwi, Jati Agung Districts, South Lampung Regency, Lampung, Indonesia
Email: angga.yasir@km.itera.ac.id

INTRODUCTION

Skin is the outermost part of the body that is flexible and soft. In cosmetology, skin care is the main emphasis to get an attractive appearance. However, signs of aging will appear (Maharani, 2015). Aging, in general, can be caused by intrinsic or chronological factors associated with increasing age and extrinsic factors associated with exposure to external factors such as UV rays. The signs of aging can be analyzed with a magic mirror skin analyzer (Sjerobabski-Masnec & Situm, 2010).

Anti-aging cosmetic products are available in various dosage forms, including a mask. Peel-off gel masks have several benefits, including relaxing facial muscles, cleaning, refreshing, moisturizing, and softening facial skin (Ningrum, 2018). In addition to the practicality of use in this era, various cosmetic companies issue many cheaper natural products, safe, with low side effects. A natural ingredient that has the potential as cosmetics is robusta coffee.

Robusta coffee contains alkaloids, flavonoids, saponins, tannins, phenols, and caffeine. The phenolic compounds in coffee have antioxidant activity. Research conducted by (Yasir et al., 2022) showed that a peel-off gel mask of robusta coffee from Lampung has an IC_{50} value of 7 ppm which is classified as very strong. Bogor robusta coffee shows antioxidant activity. The value of IC_{50} is 54.14 ppm which is classified as a potent antioxidant (Wigati et al., 2018). Similar research has been conducted by (Wulandari et al., 2019) on the formulation of extracts and robusta coffee beans obtained from Tanjung Sari Puncak, Bogor, in a peel-off mask preparation, the best formulation of 2.5% robusta coffee bean extract is considered adequate for increasing humidity and smoothness of facial skin. With this, researchers are interested in utilizing natural ingredients for robusta coffee originating from the West Lampung area as an active substance in cosmetic peel-off mask preparations due to differences in the conditions of the coffee-growing region. The ability to synthesize collagen and elastin, which significantly contribute to skin appearance, is influenced by the concentration of Green coffee (*C. arabica* L.) oil (Del Carmen Velazquez Pereda et al., 2009) so that the coffee bean extract needs to be varied in concentration to determine the effect of the coffee bean extract concentration on the ability measured anti-aging.

Evaluation of cosmetic preparations is carried out to see the effect of excipients on the physical properties of cosmetic preparations and to ensure that cosmetic preparations are made to meet the aspects of quality, effectiveness, and safety. The quality of cosmetic preparations was evaluated, including homogeneity, pH, spreadability, and adhesion. The anti-aging effectiveness of cosmetic preparations can be evaluated by measuring the improvement in skin condition, including signs of aging such as pores, spots, wrinkles, and moisture (Fusco, 2001). Cosmetic safety can be evaluated through an irritation test on the most sensitive part of human skin, behind the ear (Mielke et al., 2017).

Based on the description above, research will be carried out covering the extraction of Lampung Robusta coffee by maceration method, phytochemical screening, formulation of peel-off gel mask (PGM), physical evaluation of the preparation and testing the anti-aging effect of the peel-off gel preparation with a LD6021 Magic Mirror Skin Analyzer to check the condition of the face including pores, spots, wrinkles, and moisture.

MATERIALS AND METHODS

Materials

The materials used in this study were robusta coffee beans obtained from Sumber Jaya, West Lampung, ethanol 96% (Technical grade / Biochemical and Packaging Ltd., India), polyvinyl alcohol (cosmetic grade / Aneka-Chemical Inc, Indonesia), Hydroxy Propyl Methyl Cellulose (cosmetic grade / Aneka-Chemical Inc, Indonesia), glycerin (cosmetic grade / Wilmart Nabati Inc, Indonesia), methylparaben (cosmetic grade / Aneka-Chemical Inc, Indonesia), propylparaben (cosmetic grade / Wilmart Nabati Inc, Indonesia), triethanolamine (cosmetic grade / Wilmart Nabati Inc, Indonesia), niacinamide (cosmetic grade / Sigma, St.Louis, MO, USA), aquadest, Magnesium powder (Wilmart Nabati Inc, Indonesia), Hydrochloric Acid (HCl) (technical grade / Chemball, China), aqueous solution $FeCl_3$, Mayer's reagent (Analytical grade / Sigma, St.Louis, MO, USA).

Methods

Robusta coffee bean extraction

A total of 500 grams of simplicial robusta coffee beans, macerated with 6 liters of 96% ethanol. The solvent was replaced every 24 hours until the solvent added was colorless after filtering the filtrate. The filtrate obtained was collected, and the solvent was evaporated with the evaporator (IKA® Rotary Evaporator RV10) at 40ºC; then, the extract was heated in the oven at 40ºC until a thick paste-shaped extract was obtained.

Phytochemical test

Phytochemical testing was carried out following the previous procedure with slight modifications (Vaghasiya et al., 2011).

Flavonoids

The following ingredients were added: 0.1 grams of magnesium powder, five drops of concentrated HCl, and 0.5 grams of robusta coffee bean extract, which had been dissolved in 10 mL of hot methanol. Flavonoids can be detected by the production of an orange or dark red tint that lasts longer than three minutes.

Alkaloids

A combination of 19 mL of distilled water, 1 mL of 2 M HCl solution, and 0.5 grams of robusta coffee bean extract was warmed for 5 minutes before cooling and filtering. Meyer's reagent was used to evaluate the filtrate that was obtained. By using Mayer's reagent to create a white precipitate, alkaloids were detected.

Tannins

20 mL of boiling water was used to dissolve 0.5 grams of robusta coffee bean extract before the mixture was cooled and filtered. 2–3 drops of 1% $FeCl_3$ solution were added to the filter after it had been collected. The production of a vivid green, red, purple, blue, or black hue is a sign that tannins are present.

Saponins

20 mL of boiling water was used to dissolve 0.5 grams of robusta coffee bean extract before the combination was cooled and filtered. The recovered filtrate was violently shaken for 10 seconds. The development of a stable foam is an indication that saponins are available.

Robusta coffee bean extract PGM formulation

In making a peel-off gel mask is that each active substance is dissolved in distilled water. Polyvinyl alcohol (PVA) (Material A) was soaked in warm water (80ºC) and stirred until homogeneous. HPMC (Material B) was soaked in distilled water. Meanwhile, methyl paraben and propyl paraben (Material C) was dissolved in glycerin. Material B, C, and TEA were added simultaneously to ingredient A and then stirred until homogeneous. Furthermore, distilled water is added until it reaches a weight of 100 grams. This peel-off gel mask preparation is then put in a tightly closed container. The formula of PGM can be seen in Table 1.

Physical evaluation of Robusta Coffee bean PGM

Homogeneity test

A transparent glass was used to perform the homogeneity test, which involved applying 0.1 grams of the combination to it and looking to see whether any portions were not thoroughly blended.

pH measurement

A pH meter was used to measure the pH of the robusta coffee bean extract in PGM. After being dipped in a solution of 6 grams of peel-off mask in 20 mL of water, the pH meter's reading was taken. The preparation's pH level must match the skin's pH range of 4.5 to 6.5 (Ali & Yosipovitch, 2013).

Spreadability test

A PGM of robusta coffee bean extract in the amount of 0.5 grams is deposited on a transparent glass plate with sizes 20 x 20 cm. After being left for a short period of time (1 minute), the preparation is enlarged to a certain diameter. Afterward, it was coated with glass and subjected to a specific load of up to 125 grams for a minute. After applying force, the diameter measurement is taken. The dispersion range should be between 5 and 7 cm (Helal et al., 2012).

Adhesion test

The PGM was placed on an object glass, weighted at 0.5 grams, sealed with another object glass, and pressed for 5 minutes with a 1 kg weight before the weight was withdrawn. The two object glasses were then pulled with a weight of 80 g, and the time, until both could separate, was recorded. The adhesion time must be more than 4 seconds (Vieira et al., 2009).

Mask drying time

This methodology was developed and standardized based on the use of commercial products. A paintbrush was used to apply 0.5 grams of the robusta coffee bean extract-based PGM preparation on the 5,0 x 2,5 cm glass slide. At room temperature, at 25°C, the preparation's drying time was then measured (Vieira et al., 2009).

Table 1. Robusta coffee bean extract PGM formula

Component	Composition (%)				Function
	(K-)	F1	F2	(K+)	
Robusta Coffee Bean Extract	0	0,5	2	-	Active ingredients
Niacinamide	-	-	-	2	Active ingredients
PVA	12	12	12	12	Film forming
HPMC	2	2	2	2	Gelling agent
Glycerin	9	9	9	9	Humectant
Triethanolamine	2	2	2	2	Alkalizing
Methylparaben	0.2	0.2	0.2	0.2	Preservative
Propylparaben	0.05	0.05	0.05	0.05	Preservative
Ethanol 70%	8	8	8	8	Solvent
Aquadest	66.75	66.25	64.75	64.75	Solvent
Total	100	100	100	100	

Irritation test on human

This experiment was carried out following the previous procedure (Yasir et al., 2022). This experiment was carried out after obtaining permission from the ethics committee of the Faculty of Medicine, University of Malahayati (Ethical Clearance No. 1567/EC/KEP-UNMAL/II/2021) to test 12

female volunteers. In each formula group, an irritation test was carried out on three volunteers. The volunteers used in this irritation had criteria including being healthy, aged 20-25 years, not having a history of disease related to allergies, and being willing to volunteer. A dose of 0.5 grams is applied behind the ear with a diameter of 3 cm, then left for 30 minutes, and see the changes that occur in the form of redness, itching, and swelling of the skin in 0, 24, 48, and 72 hours after application (Kim et al., 2016).

Hedonic test

A total of 10 volunteers in each test of 4 peel-off gel formulations (a total of 40 volunteers) assessed their preference for the gel formula that had been made. Gel was scored by the hedonic system from 1-4 (dislike very much – like very much), including liking for texture, color, aroma, and ease of peel-off gel mask. The volunteer testing method used is a completely randomized design so that each volunteer gets the same opportunity to be tested on a particular formula (Yasir et al., 2022).

Anti-aging effectiveness

This experiment was conducted after obtaining permission from the ethics committee of the Faculty of Medicine, Malahayati University (Ethical Clearance No. 1567/EC/KEP-UNMAL/II/2021). Anti-aging effectiveness testing was carried out on female volunteers with the criteria of being in good health, aged 20-25 years, not having a history of disease related to allergies, and being willing to volunteer. Then check the condition of the face, including pores, spots, wrinkles, and moisture, with a LD6021 Magic Mirror skin analyzer before using the mask and after using the mask every week on a regular basis for four weeks (Hanum et al., 2019).

Data Analysis

The research data were analyzed using the SPSS program, data including the percentage decrease in the number of pores, spots, and wrinkles, as well as the percentage increase in skin moisture, were analyzed for homogeneity of the data, and then one-way ANOVA test was carried out to see the significance of the differences between PGM Formula. The test was continued to see the significance of the differences in all anti-aging parameters with the Tukey HDS test to find out the differences in each PGM Formula.

RESULT AND DISCUSSION

Robusta coffee bean extraction results

The sample used in this study was robusta coffee beans which were determined in the Chemistry laboratory of the Faculty of Mathematics and Natural Sciences, University of Lampung, according to the Cronquist (1981) clarification system. Determination aims to determine the correctness of the identity of the plant that will be used in the study to avoid errors in the sampling used in the study. It is true that robusta coffee beans are of the type Coffea canephora Pierre.

Robusta coffee bean simplicia was extracted by maceration method using ethanol 96% as a solvent; the yield obtained was 9.2%. The advantages of the maceration extraction method are an easy way of working, the tools used are simple, and it is suitable for secondary metabolites that are not heat-resistant (Departemen Kesehatan Republik Indonesia, 1979). The use of 96% ethanol as solvent is due to having the same level of polarity as the compounds to be taken, such as flavonoids, tannins, and saponins.

Phytochemical screening results

Identification of the chemical content of robusta coffee bean extract aims to check the presence of secondary metabolites extracted. The results of the phytochemical screening, as shown in Table 2, showed that robusta coffee beans contain secondary metabolites of flavonoids, alkaloids, tannins, and saponins.

Table 2. Robusta coffee bean extract phytochemical test results

Phytochemical Test	Result
Flavonoid test	Positive
Alkaloid test	Positive
Tannin test	Positive
Saponin test	Positive

Alkaloid compounds such as caffeine in robusta coffee bean extract contained in peel-off gel masks have an effect as a competitive tyrosinase inhibitor enzyme which inhibits tyrosine, thereby inhibiting the increase in the amount of melanin in melanocyte cells and also has an antioxidant effect that can function to protect the skin from free radicals (Kanokwan et al., 2016). Flavonoid and Tannin compounds have antioxidant activity so that they can inhibit damage to skin cells due to free radicals, so they have anti-aging properties (Guo et al., 2019; Riedl et al., 2002).

Physical evaluation of robusta coffee bean PGM

Homogeneity test

A Homogeneous preparation is identified by the color being evenly mixed, there are no lumps, and there are no palpable coarse particles (Figure 1). This homogeneity test was carried out so that the PGM preparation had an even dose distribution between the gel base and the active substance. Based on the results of observations that have been made, it is found that all preparations meet the homogeneity test requirements.

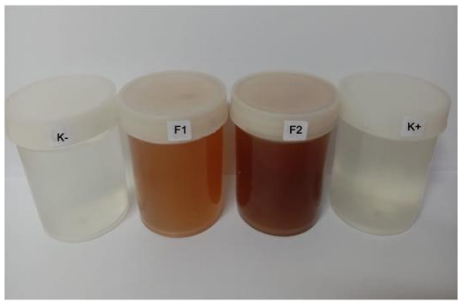

Figure 1. Picture of PGM

pH measurement

The goal of assessing pH is to determine whether the preparation's pH is in harmony with the skin's pH range. The pH level of the PGM must match the skin's pH because it is administered topically. The pH of the PGM K+ (positive control), F1, F2, and K+ (negative control), respectively, was 6.0; 5.5; 5.3; and 5.3. The pH decreases as extract concentration increases. This is brought on by the presence of chlorogenic acid, which is present in dry coffee at a concentration of 14%. Skin that has a low pH might become dry, damaged, and vulnerable to infection (Farah & Donangelo, 2006). While a high pH can cause the skin to become dry, this is because the use of cosmetics with an inappropriate pH can dissolve the oil layer, which functions to prevent the skin from becoming dehydrated. The pH value of the peel-off gel mask in this study corresponds to the pH of the skin, which is 4.5-6.5, so it is safe when applied to the skin.

Spreadability test

The capability to spread the peel-off gel mask over the skin's surface will be tested since it can have an impact on therapeutic absorption and the rate at which active ingredients are released at the site of application. The pace at which the peel-off gel mask spreads with only a small application increases

with the spread diameter value, increasing the contact of the medicine with the skin surface. A semi-solid consistency that is quite comfortable to use is demonstrated by the spread of 5-7 cm (Rahmawanty et al., 2015). The characteristics of the distribution and release of the active ingredient from the gel might be impacted by viscosity. A gel preparation's ideal viscosity will allow the active ingredient to stay distributed on the gel base and have good active ingredient absorption into the skin (Al-Nima, 2022). The Spread of the peel-off gel masks K-, F1, F2, and K+ provided respective values of 6.5 cm, 6.0 cm, 5.7 cm, and 5.8 cm. This test demonstrates that spreadability decreases with increasing extract concentration; this is because the peel-off gel mask preparation contains less water, and the PGM preparation becomes more viscous. The spreadability test results are acceptable and fall within the required range of 5-7 cm.

Adhesion test

The adhesion of topical preparations dramatically affects the effectiveness of the preparation in providing a therapeutic effect. The goal of the adhesion test is to assess how well the gel preparation will attach to the skin over a certain amount of time, allowing it to deliver the active ingredient to the skin at its best. The adhesion of semi-solid preparations is not subject to any specific criteria, although it is advised that it last for at least four seconds. The adhesiveness of the peel-off gel masks K-, F1, F2, and K+ findings fulfill the standards for more than 4-second adherence. Because the preparation will stay in touch with the skin surface longer and cosmetic absorption through the skin will be more substantial, the longer the gel is connected to the skin surface, the longer the therapeutic impact that the gel may give. This enables the final product to deliver the best possible effect (Chillistone & Hardman, 2017).

Mask drying time

The drying time needs to be tested because the peel-off gel mask preparation must be able to dry after being applied to the skin after some time and can be utterly peel-off from the skin; this also affects the user's comfort during application, the longer it takes to dry it will reduce the ease of use. In accordance with the data presented (Table 3), preparations tested on glass had varying drying times; the PGM K- has a drying time of 23 minutes, while F1, F2, and K+ have a drying time of 20 minutes; with this, all preparations can be declared to meet the requirements. The requirement for the preparation time to dry is 15-30 minutes (Shai et al., 2009).

Irritation test

Irritation of the skin usually occurs because of the interaction between the skin and substances that can cause irritation. Irritation testing is carried out to see the safety of the preparations made before being marketed. This test was conducted on 12 women volunteers by applying a PGM preparation behind the ear for ± 15 minutes. Table 3 shows that K-, F1, F2, and K+ do not irritate the skin with irritation reaction parameters such as redness, itching, and swelling in 0, 24, 48, and 72 hours after application. With this, it can be concluded that all preparations meet the safety requirements before the anti-aging effectiveness test on the skin.

Hedonic test

The hedonic test was conducted to determine the respondents' preferences for PGM. The results obtained from the test show that the formulas K -, F1, F2, and K + have good acceptability, with the percentage values of preference for textures being 75%, 92%, 83%, and 92%, respectively (Figure 2). The preference for color and aroma shows that F1 is the most preferred with the color parameter value very like 100%; this is because the concentration of robusta coffee bean extract used in F1 is very small, so the PGM produced has a weak yellow color, is transparent with no odor, so that it is comfortable to use, while in the hedonic test, the ease of peeling off the formula favored by the

panelists for K -, F1, F2, and K + was 67%; 83%; 75%; and 75%, respectively. Formula K - has the smallest value because the formula contains more water, so it is thinner and takes longer to dry.

Table 3. Homogeneity, pH, spreadability, adhesion, and irritation test results

Formula	Homogeneity (no coarse particles required)	pH (4.5-6.5)	Spreadability (cm)	Adhesion (seconds)	Irritation	Mask Drying Time (minutes)
K-	No Coarse Particles	6.0	6.5	5	No signs of irritation were observed in 0, 24, 48, and 72 hours after application	23
F1	No Coarse Particles	5.5	6.0	6	No signs of irritation were observed in 0, 24, 48, and 72 hours after application	20
F2	No Coarse Particles	5.3	5.7	8	No signs of irritation were observed in 0, 24, 48, and 72 hours after application	20
K+	No Coarse Particles	5.3	5.8	7	No signs of irritation were observed in 0, 24, 48, and 72 hours after application	20

Anti-aging effectiveness test

The measurement parameters include pores, spots, wrinkles, and moisture.

Pores

The results of measurements for four weeks of treatment by giving PGM preparations once a week on a regular basis can be seen in Table 4. The percentage decrease in pores size is calculated by subtracting the percentage of pores shown on the LD6021 Magic Mirror Skin Analyzer after using PGM in a particular week by the percentage before using PGM in week 0 (Baseline). The size of the pores is related to the production activity of the skin's oil glands. The more active this gland is in producing oil, the more oil must be channeled to the surface of the skin through the gland channel so that the size of the pores will be larger (Sulastomo, 2013). Free radicals in the skin also aggravate the condition because it causes damage to skin cells so that more sebum is produced. F1 and F2 have the ability to shrink pores better than K- (P Value < 0,05) due to the compound content of alpha-tocopherol (vitamin E) in robusta coffee bean extract that can protect the FUPA phospholipid membrane and act as an antioxidant (Hamid et al., 2010). Even though F2 has a better ability than F1

in the fourth week, K+ has the best ability compared to F2 in reducing pores (P Value < 0.05). This is because Niacinamide has an excellent ability to reduce pores (Boo, 2021).

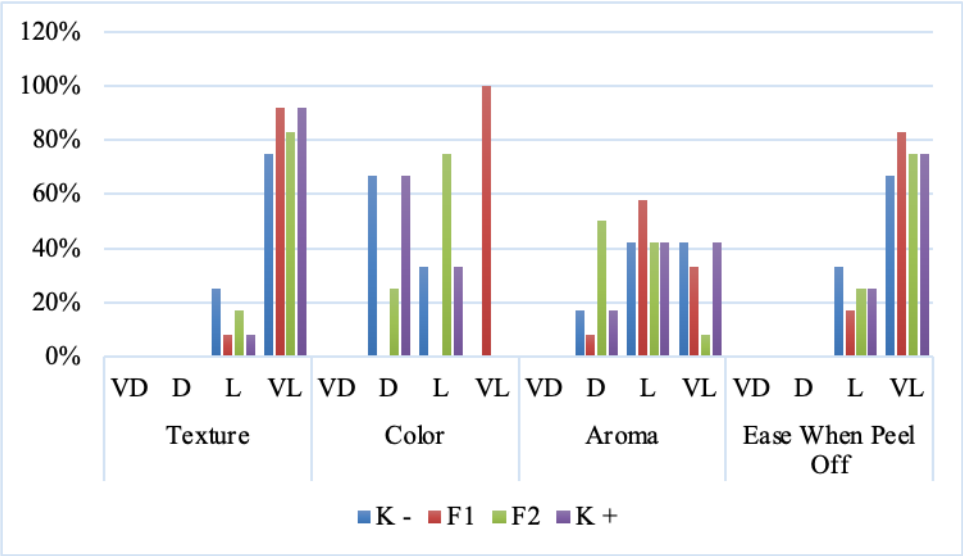

Figure 2. Hedonic test results robusta coffee bean extract PGM

Note:
VD : Very Dislike
D : Dislike
L : Like
VL : Very Like

Spots

The use of four weeks by giving PGM preparations once a week on a regular basis can be seen in Table 4. The percentage decrease in spot size is calculated by subtracting the percentage of spots shown on the LD6021 Magic Mirror Skin Analyzer after using PGM in a particular week from the percentage before using PGM in week 0 (Baseline). The ability of the F2 formula to inhibit melanin production is significantly better than K-, although niacinamide, which is an ingredient in K+, also has a better ability than K-, F1, and F2 (P Value < 0.05). As a competitive enzyme tyrosinase inhibitor that inhibits tyrosine to prevent the melanin in melanocyte cells from increasing, alkaloid substances like caffeine in robusta coffee bean extract found in PGM also have an antioxidant impact that can work to protect the skin from free radicals (Kanokwan et al., 2016). On a different mechanism, Niacinamide can reduce melanin production by inhibiting melanosome transfer (Hakozaki et al., 2002).

Wrinkle

Improvements in facial wrinkles in the fourth week from giving PGM once a week to K-, F1, F2, and K+ can be seen in Table 4. The percentage decrease in wrinkle size is calculated by subtracting the percentage of wrinkles shown on the LD6021 Magic Mirror Skin Analyzer after using PGM in a particular week from the percentage before using PGM in week 0 (Baseline). F2 has an effect on reducing the number of wrinkles in volunteers significantly better than K- and F1. However, K+, which contains niacinamide, is still the best in inhibiting these signs of aging compared to all formulas (P Value < 0.05). Coffee beans contain not only chlorogenic acid and its derivatives but also caffeine, theophylline and theobromine, cafestol, kahweol, tocopherol, and trigonelline, which are very beneficial for skin health (Jeszka-Skowron et al., 2016). Chlorogenic acid has been reported as an antioxidant and anti-inflammatory that can prevent photoaging by inhibiting the increase in MMP levels so as to improve wrinkles (Mariati et al., 2021).

Table 4. Improvement volunteer face percentage compared to baseline (week 0)

Parameter	Formula	Volunteer Face Repair Percentage (Mean ± SD)			
		1st week (%)	2nd week (%)	3rd week (%)	4th week (%)
Pore	K-	1.53 ± 0.23[a]	3.80 ± 0.44[a]	3.01 ± 0.52[a]	4.54 ± 1.10[a]
	F1	2.61 ± 0.54[b]	5.90 ± 0.12[b]	8.58 ± 0.21[b]	9.54 ± 0.45[b]
	F2	5.53 ± 1.21[c]	12.34 ± 2.67[c]	17.79 ± 3.79[c]	21.88 ± 4.22[c]
	K+	6.48 ± 1.33[c]	12.16 ± 3.28[c]	20.80 ± 3.64[c]	28.64 ± 4.02[d]
Spot	K-	1.53 ± 0.37[a]	1.57 ± 0.88[a]	3.10 ± 0.56[a]	3.50 ± 0.38[a]
	F1	3.32 ± 1.23[b]	5.26 ± 1.55[b]	5.99 ± 1.31[b]	5.90 ± 1.42[a]
	F2	6.13 ± 1.49[c]	12.79 ± 1.28[c]	18.17 ± 3.77[c]	21.57 ± 3.25[b]
	K+	5.81 ±1.55[c]	12.09 ± 2.41[c]	19.88 ± 3.16[c]	29.73 ± 2.04[c]
Wrinkles	K-	2.23 ±1.62[a]	2.16 ± 2.22[a]	2.19 ± 1.13[a]	2.23 ± 1.03[a]
	F1	2.02 ±1.32[a]	2.14 ± 1.29[a]	4.16 ± 1.04[b]	5.47 ± 1.78[b]
	F2	5.17 ±1.36[b]	11.48 ± 2.07[b]	13.82 ± 2.19[c]	17.71 ± 2.44[c]
	K+	5.28 ±1.45[b]	12.12 ± 2.65[b]	18.95 ± 3.65[d]	26.53 ± 3.27[d]
Moisture	K-	0.49 ± 1.03[a]	2.96 ±1.45[a]	4.93 ± 1.23[a]	6.89 ±1.63[a]
	F1	-0.80 ± 1.86[b]	2.40 ± 2.25[a]	5.30 ± 1.74[a]	7.10 ± 2.22[a]
	F2	5.10 ± 1.21[c]	10.71 ± 1.54[b]	16.25 ± 2.31[b]	21.25 ± 3.62[b]
	K+	5.22 ± 1.13[c]	10.95 ± 2.41[b]	19.01 ± 2.17[c]	27.71 ± 3.75[c]

Note : The difference in letters (a, b, c, d) in one column indicates that there is a significant difference ($p<0.05$) between the measurement results for the week of testing).

Moisture

Four weeks after the volunteer facial skin treatment, by giving PGM preparations once a week on a regular basis, the condition of improving facial moisture in the fourth week of the K-, F1, F2, and K+ can be seen in Table 4. In the fourth week of the skin moisture testing process, K- and F1 did not have a significant difference in increasing the skin's ability to retain water in the stratum corneum (P value > 0.05). This can be due to the robusta coffee extract content, which is only 0.5%, and the ability of K-, which contains humectants such as glycerin, to be able to be as effective in moisturizing the skin. Robusta coffee extract concentration of 2% in F2 has significantly better performance than K- although 2% niacinamide in the K+ formula is also considerably better than all formulas. The flavonoid epicatechin compound in coffee beans has the potential as a moisturizer with a mechanism to reduce levels of Trans-epidermal Water Loss (TEWL). The flavonoid compounds in green robusta coffee bean extract resulted in an increase in extracellular collagen. Collagen synthesis ultimately leads to an increase in skin moisture and elasticity (Khan et al., 2010). In addition to the effect of the extract used, the peel-off gel mask dosage base also has an effect that can improve the condition of the skin to be more hydrated. The ability of niacinamide to moisturize the skin because niacinamide also increases the biosynthesis of stratum corneum lipids such as ceramide so that the gaps between the stratum corneum become smaller, thereby reducing TEWL (Chen et al., 2016). Glycerin, as an excipient in peel-off gel masks with a concentration of 10%, can increase skin smoothness and moisture because of its ability to attract water from the air (Mitsui, 1997).

CONCLUSION

The phytochemical compounds contained in robusta coffee bean extract (Coffea canephora) are flavonoids, alkaloids, tannins, and saponins. Variations in extract concentrations in PGM preparations had results that met the criteria for physical evaluation and irritation tests. In the hedonic test, preparation F1 has the highest total value compared to K-, F2, and K+. Variations in the concentration of robusta coffee bean extract in PGM provide different anti-aging effectiveness. F1 and F2 have

better anti-aging abilities than K- formula (P Value < 0,05). Based on the test results, F2 with an extract concentration of 2% can be used as an anti-aging preparation in a peel-off gel mask.

ACKNOWLEDGEMENT

This research was funded by LPPM Institut Teknologi Sumatera through the Peneliti Madya grant program.

REFERENCES

Al-Nima, A. (2022). Preparation and evaluation of topical gel containing Aloe Vera exudate. *Iraqi Journal of Pharmacy*, *18*(2), 39–52. https://doi.org/10.33899/iphr.2022.170396.

Ali, S., & Yosipovitch, G. (2013). Skin pH: from basic science to basic skin care. *Acta Dermato Venereologica*, *93*(3), 261–267. https://doi.org/10.2340/00015555-1531.

Boo, Y. C. (2021). Mechanistic basis and clinical evidence for the applications of nicotinamide (Niacinamide) to control skin aging and pigmentation. *Antioxidants*, *10*(8), 1315. https://doi.org/10.3390/antiox10081315.

Chen, A. C., Martin, A. J., Dalziell, R. A., Halliday, G. M., & Damian, D. L. (2016). Oral nicotinamide reduces transepidermal water loss: a randomized controlled trial. *British Journal of Dermatology*, *175*(6), 1363–1365. https://doi.org/10.1111/bjd.14648.

Chillistone, S., & Hardman, J. G. (2017). Factors affecting drug absorption and distribution. *Anaesthesia & Intensive Care Medicine*, *18*(7), 335–339. https://doi.org/10.1016/j.mpaic.2017.04.007.

Del Carmen Velazquez Pereda, M., de Campos Dieamant, G., Eberlin, S., Nogueira, C., Colombi, D., Di Stasi, L. C., & de Souza Queiroz, M. L. (2009). Effect of green Coffea arabica L. seed oil on extracellular matrix components and water-channel expression in in vitro and ex vivo human skin models. *Journal of Cosmetic Dermatology*, *8*(1), 56–62. https://doi.org/10.1111/j.1473-2165.2009.00425.x.

Departemen Kesehatan Republik Indonesia. (1979). *Farmakope edisi III*.

Farah, A., & Donangelo, C. M. (2006). Phenolic compounds in coffee. *Brazilian Journal of Plant Physiology*, *18*(1), 23–36. https://doi.org/10.1590/S1677-04202006000100003.

Fusco, F. J. (2001). The aging face and skin. *Clinics in Plastic Surgery*, *28*(1), 1–12. https://doi.org/10.1016/S0094-1298(20)32336-1.

Guo, C., Zhang, H., Guan, X., & Zhou, Z. (2019). The anti-aging potential of neohesperidin and its synergistic effects with other Citrus flavonoids in extending chronological lifespan of Saccharomyces Cerevisiae BY4742. *Molecules*, *24*(22), 4093. https://doi.org/10.3390/molecules24224093.

Hakozaki, T., Minwalla, L., Zhuang, J., Chhoa, M., Matsubara, A., Miyamoto, K., Greatens, A., Hillebrand, G. G., Bissett, D. L., & Boissy, R. E. (2002). The effect of niacinamide on reducing cutaneous pigmentation and suppression of melanosome transfer. *British Journal of Dermatology*, *147*(1), 20–31. https://doi.org/10.1046/j.1365-2133.2002.04834.x.

Hamid, A. A., Aiyelaagbe, O. O., Usman, L. A., Ameen, O. M., & Lawal, A. (2010). Antioxidants: its medicinal and pharmacological applications. *African Journal of Pure and Applied Chemistry*, *4*(8), 142–151.

Hanum, T. I., Laila, L., Sumaiyah, S., & Syahrina, E. (2019). Macadamia nuts oil in nanocream and conventional cream as skin anti-aging: A comparative study. *Open Access Macedonian Journal of Medical Sciences*, *7*(22), 3917–3920. https://doi.org/10.3889/oamjms.2019.533.

Helal, D. A., El-Rhman, D. A., Abdel-Halim, S. A., & El-Nabarawi, M. A. (2012). Formulation and evaluation of fluconazole topical gel. *International Journal of Pharmacy and Pharmaceutical Sciences*, *4*(5), 176–183.

Jeszka-Skowron, M., Sentkowska, A., Pyrzyńska, K., & De Peña, M. P. (2016). Chlorogenic acids, caffeine content and antioxidant properties of green coffee extracts: influence of green coffee bean

preparation. *European Food Research and Technology*, *242*(8), 1403–1409. https://doi.org/10.1007/s00217-016-2643-y.

Kanokwan, K., Thananya, N., & Pimporn, L. (2016). Evaluation of antioxidant and anti-tyrosinase activities as well as stability of green and roasted coffee bean extracts from Coffea arabica and Coffea canephora grown in Thailand. *Journal of Pharmacognosy and Phytotherapy*, *8*(10), 182–192. https://doi.org/10.5897/JPP2016.0413.

Khan, H. M. shoaib, Naveed, A., Rasool, F., Khan, B. A., Mahmood, T., & Khan, M. S. (2010). In vivo evaluation of stable cream containing flavonoids on hydration and TEWL of human skin. *World Academy of Science, Engineering and Technolo*, *47*, 896–899.

Kim, S.-H., Heo, Y., Choi, S.-J., Kim, Y.-J., Kim, M.-S., Kim, H., Jo, E., Song, C.-W., & Lee, K. (2016). Safety evaluation of zinc oxide nanoparticles in terms of acute dermal toxicity, dermal irritation and corrosion, and skin sensitization. *Molecular & Cellular Toxicology*, *12*(1), 93–99. https://doi.org/10.1007/s13273-016-0012-3.

Maharani, A. (2015). *Penyakit kulit : perawatan, pencegahan, pengobatan* (Mona (Ed.); Cetakan 1). 978-602-167-441-3.

Mariati, D. E., Sudigdoadi, S., Lesmana, R., Khairani, A. F., Gunadi, J. W., Tarawan, V. M., Supratman, U., & Goenawan, H. (2021). Robusta extract cream ameliorated ultraviolet B-induced wrinkle skin of mice by the regulation of epidermal thickness and inhibition of MMP-1. *The Indonesian Biomedical Journal*, *13*(1), 84–90. https://doi.org/10.18585/inabj.v13i1.1428.

Mielke, H., Strickland, J., Jacobs, M. N., & Mehta, J. M. (2017). Biometrical evaluation of the performance of the revised OECD Test Guideline 402 for assessing acute dermal toxicity. *Regulatory Toxicology and Pharmacology*, *89*, 26–39. https://doi.org/10.1016/j.yrtph.2017.07.007

Mitsui, T. (Ed.). (1997). *New cosmetic science.* Elsevier.

Ningrum, W. A. (2018). Pembuatan dan evaluasi fisik sediaan masker gel peel-off ekstrak etanol daun teh (Camellia sinensis L.). *Jurnal Farmasi Sains Dan Praktis*, *4*(2), 57–61. https://doi.org/10.31603/pharmacy.v4i2.2323.

Rahmawanty, D., Yulianti, N., & Fitriana, M. (2015). Formulasi dan evaluasi masker wajah peel-off mengandung kuersetin dengan variasi konsentrasi gelatin dan gliserin. *Media Farmasi: Jurnal Ilmu Farmasi*, *12*(1), 17. https://doi.org/10.12928/mf.v12i1.3019.

Riedl, K. M., Carando, S., Alessio, H. M., McCarthy, M., & Hagerman, A. E. (2002). Antioxidant activity of Tannins and Tannin-Protein complexes: assessment in vitro and in vivo. In M Morello (Ed.), *Free Radicals in Food* (pp. 188–200). American Chemical Society. https://doi.org/10.1021/bk-2002-0807.ch014.

Shai, A., Maibach, H. I., & Baran, R. (2009). *Handbook of cosmetic skin care* (A. Shai, H. I. Maibach, & R. Baran (Eds.)). Informa Healthcare. https://doi.org/10.3109/9781616310004.

Sjerobabski-Masnec, I., & Situm, M. (2010). Skin aging. *Acta Clinica Croatica*, *49*(4), 515–518.

Sulastomo, E. (2013). *Kulit cantik & sehat mengenal dan merawat kulit*. Jakarta : Kompas.

Vaghasiya, Y., Dave, R., & Chanda, S. (2011). Phytochemical analysis of some medicinal plants from western region of India. *Research Journal of Medicinal Plant*, *5*(5), 567–576. https://doi.org/10.3923/rjmp.2011.567.576.

Vieira, R. P., Fernandes, A. R., Kaneko, T. M., Consiglieri, V. O., Pinto, C. A. S. D. O., Pereira, C. S. C., Baby, A. R., & Velasco, M. V. R. (2009). Physical and physicochemical stability evaluation of cosmetic formulations containing soybean extract fermented by Bifidobacterium animalis. *Brazilian Journal of Pharmaceutical Sciences*, *45*(3), 515–525. https://doi.org/10.1590/S1984-82502009000300018.

Wigati, E. I., Pratiwi, E., Trisni Fatwatun Nissa, & Utami, N. F. (2018). Uji karakteristik fitokimia dan aktivitas antioksidan biji kopi robusta (coffea canephora pierre) dari Bogor, Bandung dan Garut dengan metode DPPH (1, 1-diphenyl-2-picrylhydrazyl). *Fitofarmaka Jurnal Ilmiah Farmasi*, *8*(1), 59–66. https://doi.org/10.33751/jf.v8i1.1172.

Wulandari, A., Rustiani, E., Noorlaela, E., & Agustina, P. (2019). Formulasi ekstrak dan biji kopi

robusta dalam sediaan masker gel peel-off untuk meningkatkan kelembaban dan kehalusan kulit. *Fitofarmaka: Jurnal Ilmiah Farmasi*, *9*(2), 77–85. https://doi.org/10.33751/jf.v9i2.1607.

Yasir, A. S., Suryaneta, S., Fahmi, A. G., Saputra, I. S., Hermawan, D., & Berliyanti, R. T. (2022). Formulasi masker gel peel-off berbahan ekstrak biji Kopi Robusta (Coffea canephora) Khas Lampung. *Majalah Farmasetika*, *7*(2), 153–164. https://doi.org/10.24198/mfarmasetika.v7i2.37312