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Effectiveness of an Organic Mask of Moringa Leaves (*Moringa oleifera*) and Turmeric (*Curcuma longa*) for Facial Care

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ABSTRACT

Facial masks are cosmetic products for topical use on facial skin. Using organic components from nature can prevent irritation and skin pigment damage due to the side effects of harmful chemicals in cosmetic products in the global market. This study aims to develop a combination organic mask formulation from Moringa leaves and turmeric and test its effectiveness. This experimental study, which had a one-shot case study design, was conducted at the Pharmaceutical Technology Laboratory and Phytochemical Laboratory, Pharmacy Department, Health Polytechnic, Ministry of Health, Jambi. The formulation consisted of Moringa leaf powder and turmeric with formulas F1 (40%, 30%), F2 (50%, 25%) and F3 (60%, 20%). Further data analysis used the paired t-test. The evaluation consists of phytochemical screening, characteristic tests of the organic mask (organoleptic, pH, drying time, and homogeneity), stability tests (organoleptic, fungal growth), effectiveness tests of mask preparations (skin moisture), and antioxidant activity tests. Based on the results, formula 3 showed the best results as an organic mask preparation with moisture test results of 58.87 ± 6.24 (mean ± SD), $p < 0.001$. The antioxidant activity results showed IC_{50} values of each formula were F1 (73.43 µg/ml), F2 (56.33 µg/ml), and F3 (182.11 µg/ml). This study recommends that Moringa leaves and turmeric have potential and effectiveness as antioxidant compounds that can be developed as organic mask preparations.

Keywords: *Curcuma longa*; Effectiveness; Facial care; *Moringa oleifera*; Organic mask

INTRODUCTION

The skin is the largest and most versatile organ that acts as a barrier against the entry of microbes into the body.[1] Recent study by Nilforoushzadeh et al[2] reported that there is no standard classification of facial skin types based on two previous studies reported by Rubinstein and Baumann by this time. Internal factors such as water content and oil production in the skin, the speed of turnover of horn layer cells, as well as external factors, namely the environment, cause each individual to have a different type of facial skin. A study conducted by Fan (2018) reported that skin type may vary throughout life due to variations in sebum secretion which causes non-uniformity on all facial surfaces such as the forehead, nose, cheeks, and chin.[2] Cosmetic products are ingredients or preparations that are used on the surface of the skin/outer part of the human body

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(epidermis, hair, nails, lips and external genital organs) or teeth and mucous membranes of the oral cavity to increase attractiveness or cleaning, fragrant, changing appearance and/or improve body odour and/or protect or maintain it in good condition.[3]Therefore, the ingredients used for this skin cosmetic product are formulated according to skin types.[2]

One of the cosmetic products which applied to the surface of human skin is a facial mask.[2,4] This facial mask product is top-rated among all ages, both men and women.[5] The results of studies by Bonadeo (1982), Draelos (1999) and Poucher (1991) reported that the development of various types needs to obtain a variety of effects, such as moisturizing and tensor effects.[6] This facial mask product is easy to apply and adequate to moisturize facial skin, remove sebum, and rejuvenate the skin.[2] Based on the composition of the ingredients, masks are divided into organic and non-organic (chemical) masks. Organic masks are fit to nourish the skin with natural antioxidant compounds originating from fruit, vegetables, and spices.[7]

Natural compounds in Indonesia known to have high antioxidant content are Moringa and turmeric plants. Moringa leaves contain antioxidant compounds, namely tannins, flavonoids, steroids, alkaloids and quercetin.[4] Moringa leaves also contains other compounds that are useful as essential vitamins, minerals, amino acids, anti-ageing and anti-inflammatory and can prevent more than 300 types of diseases in traditional medicine in Africa and India.[8] In addition to Moringa, a medicinal plant commonly used by Indonesians in traditional medicine, beauty care, and skin beauty, is turmeric (*Curcuma domestica Val*) especially the rhizome. Turmeric rhizome is used as an anti-inflammatory, anti-diarrheal, cold symptoms, itching, wounds, and shortness of breath.[9] The antioxidant activity of turmeric is applied in various applications, especially in making cosmetics. Turmeric compounds that have the potential to act as natural antioxidants are the curcuminoid components, which are included in the phenol group and consist of curcumin, demethoxycurcumin, and bis-demethoxycurcumin.[10]

This study aims to develop an organic mask formulation combining Moringa leaves and turmeric, assess its effectiveness in producing facial mask products with high antioxidant content, and elevate the effectiveness of organic masks, especially in facial health care for users. To the best of our knowledge, combining organic mask formulations from Moringa leaves and turmeric has limitations. A few studies only reported the composition of organic masks from one organic ingredient alone or with different plant variants. Meanwhile, this is a breakthrough product innovation for face masks, which is essential for the healthy face of Indonesians.

METHODS

This study was an experimental study with a one-shot case study design, in which the first evaluation was performed by intervention, and then the second evaluation was performed by observation without using a comparison. This study was conducted at the Pharmaceutical Technology Laboratory and Phytochemical Laboratory, Pharmacy Department, Health Polytechnic, Ministry of Health, Jambi. The research was conducted from February 2023 to October 2023. This research has obtained ethical permission from the Health Research Ethics Committee of the Ministry of Health Jambi Health Polytechnic No. LB.02.06/2/325/2023.

Equipment and Materials

The equipments needed in this study are digital scale, measuring glass (*PYREX*®), Beaker Glass, (*PYREX*®), pH indicator paper, blender, spectrophotometer (Shimadzu®), *skin analyzer* HL-611 (*Beautistyle International Corporation*®).

The materials used in this study were Moringa leaves, turmeric rhizome and rice flour, DPPH (*SMART LAB*®), Etanol PA

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(*SMART LAB*®), Chloroform (*SMART LAB*®), Aqua distillate (*SMART LAB*®), HCL PA (*Merck*®), Ammonia PA (*SMART LAB*®), Burchard LP (*Merck Supelco*®), Anhydrous Sodium Sulfate (*Merck Supelco*®), Anhydrous acetic acid (*SMART LAB*®), Aluminium Foil (*Klin Pak*®), Methanol 70% (*SMART LAB*®), Folin (*Merck*®), Carbonic acid (H_2CO_3) (*Podak Scientific*®), Acetic Pb (*SMART LAB*®).

These plant materials have been identified and authenticated by the Plant Taxonomy Laboratory, Department of Biology, FMIPA-UNPAD: Moringa leaves (ID No. 55/HB/12/2023), turmeric rhizomes (ID No. 56/HB/12/2023), and rice flour (ID No. 57/HB/12/2023).

Procedures

1. Producing simplicia powder

The ingredients used to make dry simplicia must be fresh.[11,12] The Moringa leaves used are the young leaves of *Moringa oleifera* Lam., (Family: *Moringaceae*).[13] The Moringa leaves must not have mould, be eaten by insects, or be exposed to animal waste. Before sun-drying, Moringa leaves and turmeric rhizomes must be cleaned first and washed with clean running water.[12,14] Two thousand grams of fresh Moringa leaves and 3000 grams of turmeric rhizome were weighed and washed with clean running water. After washing, the leaves and rhizomes are drained or aired to speed up the drying process, then the chopping process is carried out, and the drying process continues using sunlight for 3-4 days until a constant weight is obtained.[4] The next stage is grinding using a blender until a fine powder is obtained and sieving using a 100-mesh sieve.

2. Formulation of the organic mask of Moringa leaves and Turmeric

The mask formulation is made in the form of 3 types of formula with various concentration ratios (F1, F2, and F3) from Moringa leaf powder, turmeric, and rice flour. Rice flour is a basic ingredient for masks that exfoliate the skin. As seen in Table 1 as follows:

Table 1. Organic Mask Formula

Compounds	F1 (%)	F2 (%)	F3 (%)
Moringa powder	40	50	60
Turmeric powder	30	25	20
Rice Flour	30	25	20
Rose-scented oil	qs	qs	qs
Total	100	100	100

3. Preparation of organic mask

The essential ingredients are Moringa leaf powder and turmeric powder, with rice flour and rose-scented oil as additional. The core ingredients (moringa powder and turmeric) are added to the mortar and stirred until homogeneous. Then, add rice flour according to each formula and stir until homogeneous. Finally, add rose-scented oil as a fragrance. This formulation is made so the resulting mask can form a cream-like structure that can be used immediately in 15 – 20 minutes.

4. Phytochemical screening of organic mask

Phytochemical screening of secondary metabolites contained in an organic mask was conducted qualitatively by adding a reagent to a test tube containing a mixture of Moringa leaf simplicia powder, turmeric, and rice flour.[14]

5. Evaluation of physical properties of the organic mask

Organoleptic test

The organoleptic test was conducted by observing the color, odor, and shape of the mask preparation of Moringa leaf powder, turmeric, and rice flour.[14]

pH test

The pH value was measured by dipping into the Moringa leaf and turmeric powder mask preparation. One gram of the preparation was dissolved in water with a volume of 10 mL; then, the pH was measured using a pH meter. The pH of the mask preparation must match the skin's pH, namely 4.5–8.0.[15]. The results recorded

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by the pH meter electrode are defined as the pH value.[16]

Drying Time Test

The drying time test is conducted by applying several mask preparations to the back of the hand. Then, calculate the drying time using a stopwatch.[17]

Homogeneity test

The homogeneity test based on the Ansel method was conducted by taking 1 gram of the mask preparation and smearing it on a clean, dry glass object to form a thin layer. The mask preparation shows a homogeneous composition. If no coarse grains are visible, the texture appears even and does not aggregate.[18]

Stability test

The stability test is conducted by observing changes in the organoleptic test of the preparation for 21 days, namely days 1, 7, 14, and 21, including color, odor, and shape. The test was performed under both cold and room temperatures.[17] The pH of the preparation and the humidity can also affect the stability results.[19]

6. Evaluation of the effectiveness of the organic mask

Moisture test

The HL-611 skin analyzer (*Beautistyle International Corporation*) is the instrument for evaluating facial skin moisture. Put it directly on the face skin, and the moisture value will be visible on the HL-611 skin analyzer after 4-5 seconds. This value is used as control data (week 0). The skin type of each panelist was observed and valued by the visible features and characteristics. Then, the skin moisture value was measured. Data was obtained after the panelists used a facial mask once.

7. Antioxidant activity test of organic mask

The antioxidant activity was tested using the DPPH (1,1-diphenyl-2-picrylhydrazyl) method using visible light spectrophotometry.

Preparation of DPPH 50 µg/ml solution

4.6 mg DPPH powder is put into a 500 ml beaker and then dissolved in 150 ml methanol. Stir until homogeneous to obtain a 50 ppm DPPH solution. Store the DPPH solution in a light-protected container by wrapping it in aluminum foil.

Preparation of sample solution

Ten grams of mask powder are put into a beaker glass, and then 100 ml of water is put in a beaker containing mask powder. Stir until dissolved. Filter the mask solution into a new beaker using filter paper.

Preparation of blank solution

0.2 ml of methanol was added to the vial with 3.8 ml of DPPH. Prepare 4 ml methanol solvent in another vial. Measure the absorbance at a wavelength of 517 nm.

The evaluation of the antioxidant activity of organic mask

0.2 ml sample from each formula was put into the vial and wrapped in aluminum foil. Then, add 3.8 ml DPPH. Incubate in a dark place for 30 minutes. Measure the absorbance of the sample at a wavelength of 517 nm..

The formula for calculating antioxidant activity is as follows:[20]

$$\%\ inhibition = \frac{Abs\ control - Abs\ sample}{Abs\ control}\ x\ 100\%$$

Data Analysis

The data analysis was done by Microsoft Excel 16.75.2 for Mac. The humidity test results were subjected to paired t-test statistical analysis using SPSS version 28.

RESULTS AND DISCUSSION

The natural ingredients used in this study were Moringa leaves, turmeric rhizomes, and rice flour as additional ingredients obtained from Jambi Province. This study aims to determine the effectiveness of an organic mask of Moringa leaves (*M. oleifera*), turmeric (*C. longa*) and rice flour in maintaining healthy skin face. Moringa leaves (*M. oleifera*) contain antioxidants, vitamins, minerals and antibacterials, which are needed as a facial treatment to help form natural

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collagen in the skin, anti-ageing, overcome acne, ward off free radicals/antioxidants, shrink pores and increase skin moisture face. This study begins with collecting materials and then carrying out a sun-drying process (*sun-dried*).[21] The drying method chosen for Moringa leaf powder affects the content of phenolic and flavonoid compounds. Next, prepare the simplicia powder.

1. Formulation of the organic mask

The simplicia powder was formulated with various types of concentration ratios of F1, F2, and F3, with a composition of moringa powder and turmeric powder, which functioned as active substances, rice flour as an additional ingredient, as well as aromatic fragrances to add aromatic sense to the organic mask preparation (Table 2). The resulting powder was then sieved using a 100-mesh sieve. Thus, the powder obtained included fine criteria.[22]

Table 2. Formulation of organic mask

Compounds	F1 (%)	F2 (%)	F3 (%)	Function
Moringa powder	40	50	60	Active ingredients
Turmeric flavour	30	25	20	Active ingredients
Rice flavour	30	25	20	Filler
Rose-scented oil	qs	qs	qs	Flavoring Agent
Total	100	100	100	

2. Phytochemical screening of organic mask

Secondary metabolite tests were conducted on the masks of Moringa leaves, turmeric leaves, and rice flour at various concentrations as shown in Table 3 below.

3. Evaluation of physical properties of the organic mask

Based on the results of the examination of the physical properties of the mask preparation, which includes organoleptic tests, pH, drying time, and homogeneity tests (Table 4).

Table 3. Results of phytochemical screening of organic masks

Phytochemical test	Reagents	F1	F2	F3
Phenolics	FeCl3 +ethanol	+	+	+
Terpenoids	Liebermann Burchard + H_2SO_4 concentrated	+	+	+
Triterpenoids	Liebermann Burchard +anhydrous acetic acid + H_2SO_4 pekat	+	+	+
Saponin	Add hot water, then cool, then shake vigorously for 10 seconds	+	+	+
Steroids	Liebermann Burchard + anhydrous acetic acid + H_2SO_4 concentrated	+	+	+

It is known that organoleptically, the three formulas have the same form, namely powder, with different color variants in each formula. The odor of the mask preparations for the three formulas is different due to the different concentrations of Moringa leaves and turmeric. The results of testing the pH of the mask preparation using pH meter showed that the mask preparation pH was appropriate with the skin pH, which is 4.5 – 8.0.[15] These function to avoid irritating the skin.

Furthermore, the drying time test results for each mask preparation formulation showed better results and met the

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requirements for a good mask preparation drying time of 15 - 30 minutes. According to Slavtcheff, differences in drying time test results are affected by various factors, one of which is the addition of distilled water to the mask preparation formula. Less distilled water is added, and the mask will dry faster.[23] This drying time test was carried out to determine the time needed for the preparation to dry when applied to the skin and is related to the comfort of its use for consumers/users of the mask preparation.[24] The homogeneity testing determines the distribution of active substances from the mask preparation. The homogeneity test showed homogeneous results; finally, there were no coarse grains, which means that the preparation was well dispersed, which indicated that the preparation was homogeneous with no secondary particle aggregation (Table 4; Figure 1).[15,24]

Stability Test

The results of testing the stability of organic mask preparations by observing changes in the organoleptic tests of the preparations for 21 days, namely on days 1, 7, 14, and 21, include odor, color, shape/texture, and fungal growth. This test was done during cold and room temperatures (Table 5). The results showed no significant change in the organoleptic examination of organic mask preparations for 21 days. This indicates that the mask preparation produced meets the criteria or requirements for a good mask preparation. Meanwhile, based on the results of observations, there was no fungal growth from day 1 to day 21 of observation.

Figure 1. Homogeneity test results

Table 4. Physical evaluation results of the organic mask

No	Evaluation	F1	F2	F3
1	Organoleptic			
	a. Color	Yellowish green	Yellowish green	Greenish-yellow
	b. Odor	Moringa odor	Moringa odor	Both Moringa and turmeric odor
	c. Shape/texture	Powder	Powder	Powder
2	pH	6	6	6
3	Drying test time	19.20 minutes	17.30 minutes	16.25 minutes
4	Homogeneity	Homogenous	Homogenous	Homogenous

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Table 5. Stability test results of the organic mask

No	Evaluation	F1 (Days)				F2 (Days)				F3 (Days)			
		1	7	14	21	1	7	14	21	1	7	14	21
1	Organoleptic	-	-	-	-	-	-	-	-	-	-	-	-
	a. Colour	-	-	-	-	-	-	-	-	-	-	-	-
	b. Odour	-	-	-	-	-	-	-	-	-	-	-	-
	c. Shape	-	-	-	-	-	-	-	-	-	-	-	-
2	Fungal Growth	-	-	-	-	-	-	-	-	-	-	-	-

(-) : no activity
(+) : activity

4. Evaluation of the effectiveness of the organic masks

Moisture test

Moisture tests were carried out on 30 panelists. Each formula was tested for every 10 panelists with the following results (Table 6):

Table 6. Moisture test results

Formula	Pre-test	Post test	*p-value*
	Mean ± SD	Mean ± SD	
F1	41.21 ± 6.62	57.13 ± 5.57	<0.001*
F2	34.32 ± 5.41	51.71 ± 6.50	<0.001*
F3	38.58 ± 6.03	58.87 ± 6.24	<0.001*

**paired t-test statistical analysis.*

First, a normality test was conducted to determine the deviation between the moisture values of the panelists who applied the organic moringa mask preparation. Due to the amount of data, less than 50 samples, the Shapiro-Wilk data normality test was used with F1 (p=0.293), F2 (p=0.070), and F3 (p=0.987). These results show that all formulas meet the criteria for data normality with a p-value> 0.05. Then, further statistical analysis proceeds using the paired t-test for each formula to determine the difference in the moisture value of the panelists' skin before and after applying the organic mask.

The paired t-test analysis showed a significant value of all formulas, p <0.001. It showed the difference in the moisture value before and after applying the organic mask to the panelists' skin. It states that the effectiveness of the organic Moringa leaf mask preparation, especially in F3, shows the highest mean value in the post-test treatment compared to other formulas, 58.87 ± 6.24 (mean ± SD). Additionally, F1 and F2 also performed well in the moisture test, showing a significant value (p <0.001).

5. Antioxidant activity test results of organic mask

The initial level of testing the antioxidant activity of organic mask preparation was to collect data on general absorbance values from each formula. Evaluations were conducted in three repetitions (triplo) to obtain an average absorbance value. The antioxidant activity of the three formulas is shown as follows (Table 7).

Table 7. Antioxidant activity results

Formula	IC_{50} (µg/ml)	Criteria
F1	73.43	Strong
F2	56.33	Strong
F3	182.11	Moderate

Antioxidant activity is better if the IC_{50} value is smaller because only a low concentration is needed to inhibit free radical activity by 50%

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Based on the classification from previous studies the IC_{50} value of a substance or component consists of several criteria: "very strong" if the IC_{50} value less than 50 µg/ml; "strong" if the IC_{50} value is between 50 - 100 µg/ml; "moderate" if the IC_{50} value greater than 100 - 250 µg/ml; "weak" if the IC_{50} value greater than 250 – 500 µg/ml; "inactive" if the IC_{50} value is greater than 500 µg/ml.[20,25]

The antioxidant activity of F1 and F2 falls into the strong category, while F3 is in the moderate category. This indicates that increasing the amount of moringa leaves and decreasing the amount of turmeric and other ingredients reduces antioxidant activity. This may occur due to interactions between the mask ingredients. Previous studies on coffee and turmeric plants as the main components of mask formulations also showed strong antioxidant activity with high IC_{50} values at a 50:50 ratio of coffee to turmeric.[26]

It is considerable that F2 has the highest IC_{50} compared to other formulas at 56.33 µg/ml. It means that the free radicals scavenging percentages of F2 significantly elevate the effectiveness of organic Moringa leaf mask preparations, which have the potential for anti-aging.

Antioxidant compounds can inhibit oxidation by reacting with compounds containing reactive free radicals to form relatively stable, unreactive free radicals. It works through a color absorption mechanism by changing purple to yellow. At a wavelength of 515 nm.[25] This research uses a wavelength of 517 nm; a maximum shift in wavelength of 2 nm is still allowed.[22] Furthermore, the DPPH method is a simple, fast, and sensitive method for assessing the antioxidant activity of particular compounds or plant extracts. In addition, the DPPH method can evaluate an antioxidant compound's ability to capture free radicals. Antioxidant compounds are currently applicable in various fields, such as the food sector, textile industry, petroleum, dyes, etc.

This study provides innovations in utilizing natural ingredients in cosmetic preparations, like organic mask. These are very useful, especially for women who need natural cosmetics made from natural ingredients with minimal side effects. Meanwhile, the limitations of this research were that several evaluations of the effectiveness of the preparation, such as irritation tests, have yet to be done. However, in general, from antioxidant testing, it is known that F2 is the formula that provides the highest percentage of inhibition. Moreover, it means that the antioxidant activity is strong and better.

CONCLUSION

This study provides information regarding using Moringa leaves and turmeric rhizomes as organic mask preparations. Based on the formulation and evaluation results of organic mask preparations, including moisture and antioxidant tests with various concentration compositions. Knownly, the best formula is formula II, with a moringa concentration of 50%. Further studies are needed to improve the best formulation that can compete with other preparations.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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