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Research Article

Preparation and evaluation of moisturizing sheet mask of Lady Finger (*Abelmoschus esculentus* (L.) Moench) extract

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Abstract

Lady finger (*Abelmoschus esculentus* (L.) Moench) pod contain polyphenolic compounds, carotene, folic acid, thiamine, riboflavin, niacin, vitamin C, oxalic acid, and amino acids. Lady finger seed contain polyphenolic compounds, mainly oligomeric catechins and flavonol derivatives, protein (i.e., high lysine levels) and oil fraction (in particular, its derived oil is rich in palmitic, oleic, and linoleic acids). This study aimed to formulate a sheet mask of Lady Finger extract, and examining its moisturizing effect on volunteers' skin. This was an experimental study, which conducted by maceration of Lady Finger simplicia, then formulated the essence into sheet mask sheet preparation. Lady Finger extract was varied in 3%, 5% and 7% concentration. Evaluation of preparation include of the quality of the preparation (organoleptic, homogeneity, pH value, and stability). Sheet mask was then examined for its irritation test and effectiveness as moisturizer on volunteers skin. Moisturizing effect was seen each week for 4 weeks treatment by using it twice a week. The results showed that all sheet masks were homogeneous, had pH of 5.6-6.1, stable for 12 days of storage by using cycling test method, and did not irritate the skin. Moisturizing effect of Lady Finger extract sheet mask at 7% concentration was more effective than other concentrations in terms of increasing the water content by 37.36% and smoothness by 40.02%. It can be concluded that Lady Finger (*Abelmoschus esculentus* (L.) Moench) extract can be formulated as an moisturizing sheet mask and 7% concentration of Lady Finger extract sheet mask preparation showed the best moisturizing activity.

Keywords: Moisturizing, Sheet Mask, Lady Finger, Extract

INTRODUCTION

Healthy skin appearance is essential, as flawed presentation may result in reduced self-esteem. Moisturizers are commonly used to reduce fine lines, smoothen and hydrate skin which may improve a patient's social life, psychological satisfaction[1]. Impression of skin dryness consist of visible and tactile changes of the skin as well as alteration in skin's sensory components, which present as dry skin symptoms. These symptoms include dryness feeling and discomforts such as tightness, pain, itch, stinging, and tingling. Moisturizers work effectively to overcome dry skin underlying dermatoses, interrupting dry skin cycle while maintaining skin smoothness[2]. The compounds contained in plants that have antioxidant activity are vitamins C, E, A, carotenoids, polyphenols, phenolic acids, flavonoids, tannins, and these compounds are found in one of the plants, namely the Lady Finger (*Abelmoschus esculentus* (L.) Moench)[3]. Lady Finger contains phenolic compounds which are natural antioxidants that are safer than synthetic antioxidants because they are able to reduce free radicals in the human body, thereby preventing degenerative diseases[4]. Lady Finger (*Abelmoschus esculentus* (L.) Moench) has strong antioxidant activity where the DPPH method obtained an IC50 value of 27.15 ppm and the ABTS method obtained an IC50 value of 24.50 ppm[5]. The aims of this study were to determine whether the Lady Finger (*Abelmoschus esculentus* (L.) Moench) extract can be formulated in sheet mask preparations and to determine whether the Lady Finger (*Abelmoschus esculentus* (L.) Moench) extract preparation showed effectiveness as a moisturizing sheet mask.

MATERIALS AND METHODS

The tools used in this research include laboratory glassware, stirring rod, foil bag, mortar and pestle, oven, evaporating dish, watch glass, porcelain cup/crucible, non woven sheet mask (Liuli), object glass, pH meter (Hanna Instruments), waterbath, dropper, syringe, skin analyzer (Aramo-SG), moisture checker, analytical balance (Boeco), and positive control (Pond's Age Miracle Serum Sheet Mask).

The ingredients used in this study were Lady Finger (*Abelmoschus esculentus* (L.) Moench), 96% ethanol, glycerin, butylene glycol, xanthan gum, nipagin, aquadest, parfum, PEG 40 Hydrogenated Castor Oil, pH buffer solution.

Procedure

Simplicia Characterization

1. Determination of Moisture Content

About 1-2 g of Lady Finger simplicia powder was put inside crucible, then dried inside oven at 105°C for 30 minutes. Then place it in a desiccator for 15 minutes, after it cools down, the

weight obtained is weighed and the moisture content is calculated using the formula:

$$water\ content = \frac{W1 - W2}{W1} x\ 100\%$$

Description:

W1 = weight of the cup + simplicia before drying, in grams

W2 = weight of the cup + simplicia after drying, in grams[6,7]

2. Determination of Ash Content

About 2 g of Lady Finger simplicia was placed into a dried/ pre-weighed porcelain crucible, burning away the simplicia in an air atmosphere at temperatures about 500°C, and weighing the crucible after it is has been cooled to room temperature in a desiccator. and put inside a porcelain cup then being weighed again.

$$ash\ content = \frac{W1 - W2}{W} x\ 100\%$$

Description:

W = weight of simplicia before ashing, in grams

W1 = weight of the cup + simplicia after ashing, in grams

W2 = weight of empty cup, in grams[6,7]

3. Determination of Acid Insoluble Ash Content

The ash obtained from the determination of total ash content, was boiled with dilute hydrochloric acid for 2 minutes. The part that insoluble was collected, filtered through ash-free filter paper, then washed with hot water, burn until constant weight, then weighed. Calculate the ash content that is not soluble in acid that has dried in the air with formula:

$$acid\ insoluble\ ash\ content = \frac{W1 - W2}{W} x\ 100\%$$

Description:

W = weight of sample (gram)

W1 = weight of the cup + ash (gram)

W2 = weight of empty cup (gram)[6,7]

4. Determination of Water Soluble Extract Content

Weighed 5 grams of simplicia powder and macerated for 24 hours with 100 ml of a mixture of water and chloroform (0.25 mL of chloroform in 97.5 mL of distilled water) in a closed container for the first 6 hours. Shake periodically and leave it for 18 hours then filtered to obtain 20 ml of filtrate. Evaporated over a water bath until dry, the remaining filtrate was heated in an oven at 105°C until a constant weight was obtained. The water soluble extract content is calculated by the formula:

$$\frac{W1 - W2\ (g)}{W1 - W0\ (g)} x\ \frac{100}{20} x\ 100\%$$

Description:

W0 = weight of empty cup

W1 = weight of the cup + extract before drying

W2 = weight of the cup + extract after drying[6,7]

5. Determination of Ethanol Soluble Extract Content

Simplicia powder as much as 5 grams was macerated with 100 ml of 96% ethanol for 24 hours using a stoppered flask while being shaken repeatedly for the first 6 hours, let it stand for 18 hours. Filtered quickly to avoid ethanol evaporation, 20 ml of the filtrate was evaporated on a waterbath below 78°C until a constant weight was obtained. Ethanol soluble extract content is calculated by the formula:

$$\frac{W1 - W2\ (g)}{W1 - W0\ (g)} x\ \frac{100}{20} x\ 100\%$$

Description:

W0 = weight of empty cup

W1 = weight of the cup + extract before drying

W2 = weight of the cup + extract after drying[6,7]

Extract Making

The extraction method used the maceration method with a ratio of 1:10 for 7 days with 70% ethanol solvent. During maceration, sample was stirred occasionally, then the filtrate was filtered and evaporated using a rotary evaporator at 40°C until a crude extract of Lady Finger (*Abelmoschus esculentus* (L.) Moench) was obtained[8,9].

Making Lady Finger Extract Essence

Xanthan gum dissolved with aquadest in a mortar. Added with butylene glycol and glycerin then ground until homogeneous (mixture I). Nipagin is dissolved in some hot water (mixture II). Lady Finger extract and PEG-40 Hydrogenated castor oil were dissolved with some aquadest (mixture III). Mixture II is added into mixture I until it forms a homogeneous mass. Then the mixture III is added and crushed until homogeneous. Added 70% ethanol and 3 drops of perfume into the mixture and stirred until homogeneous[10,11].

Table 1: Essence Formulation Table Sheet Mask Preparation

No	Ingredient	F0 (g)	F1 (g)	F2 (g)	F3 (g)
1	Lady Finger extract	-	3	5	7
2	Glycerin	5	5	5	5
3	Butylene Glycol	5	5	5	5
4	PEG 40 hydrogenate castor oil	0.5	0.5	0.5	0.5
5	Xanthan gum	0.3	0.3	0, 3	0.3
6	Nipagin	0.18	0.18	0.18	0.18
7	Ethanol 96%	3	3	3	3
8	Perfume	qs	qs	qs	qs
9	Aquadest ad	100 ml	100 ml	100 ml	100 ml

Evaluation of Preparation Characteristics

The evaluation test for the quality of the preparations includes:

1. Organoleptic Test

The organoleptic test is carried out to see the physical appearance of the essence by observing changes in the shape, smell and color of the essence that has been made before and during cycling test[10,11,12].

2. Homogeneity Test

This test was carried out using 2 object glass, 2-3 drops of the preparation are smeared on a piece of object glass covered by another glass. The preparation must show a homogeneous arrangement and no coarse grains are visible. This homogeneity test was carried out before and during cycling test[10,11,12].

3. pH Test

Determination of the pH of the preparation is done using a pH meter. The instrument was first calibrated using a standard neutral pH buffer solution (pH 7.01) and an acid buffer solution (pH 4.01) until the instrument showed the pH value. Then the electrodes were washed with distilled water, then dried with a tissue. Samples were made with a tconcentration of 1%, 1 g essence was dissolved in distilled water up to 100 ml. The pH test was carried out before and during cycling test[12,13].

4. Stability Test

Stability test was carried out by the cycling test method (accelerated stability). The cycling test method was carried out in one cycle when the preparation was stored at 4°C for 24 hours and then removed and placed at 40±2°C for 24 hours. After two storage in different temperature (48 hours), this is recognized as 1 cycle. This experiment was repeated for 6 cycles for 12 days. Each cycle was tested for its homogeneity, pH, and organoleptic[10,13].

Irritation Test

This experiment was conducted on 12 volunteers to find out whether the preparations made can cause itching, redness and swell on skin. Sheet mask that has been cut ± 2.5 cm and was placed behind the ear for 24 hours. Irritation is characterized by redness, itching and swelling. The irritation test is carried out every week for four weeks. The irritation test was carried out on the sheet mask preparation of black soybean extract on 12 volunteers with a view to knowing that the sheet mask made could cause irritation to the skin or not[14].

Moisturizing Activity

Moisturizing activity was done on 15 volunteers which divided into 5 groups: blank group/negative control, F1, F2, F3, positive control. Each group consisted of 3 volunteers. The initial condition of volunteers' face skin was measured, by 2 parameters including moisture and evenness using a skin analyzer and moisture checker. Sheet masks were given to volunteers and applied twice a week for 1 months. Skin were checked for its moisture and evenness in each week observation until full month of usage. The result between every week of treatment were compared and analyzed by statistic[14,12].

RESULTS AND DISCUSSION

Simplicia Characterization

Table 2: The results of the characterization of Lady Finger simplicia powder

No	Determination	Results
1	Moisture Content	5.5%
2	Water Soluble Extract Content	18%
3	Ethanol Soluble Extract Content	15.7%
4	Total Ash Content	7.6%
5	Acid Insoluble Ash Content	0.7%

The moisture content in the simplicia powder of Lady Finger is 5.5% and this shows that the water content contained in the simplicia of Lady Finger has met the quality standard which is below 10%. The result of the total ash content is 7.6% and fulfil the quality requirements which is below than 8%. The small amount of total ash produced in simplicia shows that simplicia does not contain many metal contamination. The levels of water-soluble and ethanol-soluble compounds of Lady Finger were 18% and 15.7%, respectively. The results obtained showed that compounds from Lady Finger were more soluble in water. This shows that there are more polar compounds than semi-polar-non-polar compounds[15].

Quality Evaluation Essence Sheet Mask

Organoleptic Test

Organoleptic test were carried out by describing the shape, smell and color.

Table 3: Organoleptic Results

Formula	Organoleptic Test		
	Shape	Smell	Color
F0	Viscous liquid	No smell	Colorless
F1	Viscous liquid	Typical extract smell	Light brown
F2	Viscous liquid	Typical extract smell	Dark brown
F3	Viscous liquid	Typical extract smell	Dark brown

Homogeneity test

In the sheet mask preparation that has been formulated, no coarse granules in all essences preparation. So it can be concluded that all Lady Finger (*Abelmoschus esculentus* (L.) Moench) extract sheet mask preparation were homogeneous[10].

pH test

pH of the preparation was measured before and during cycling test (accelerated stability) with 3 repetitions in each cycle[16]. Result can be seen in table 5.

Table 4: pH value measurement results

Formula	pH during cycle-						
	0	1	2	3	4	5	6
F0	6.16	6.18	6.13	6.12	6.09	5.99	5.94
F1	6.04	6.08	5.93	5.87	5.83	5.82	5.79
F2	5.86	5.86	5.70	5.69	5.63	5.63	5.64
F3	5.65	5.66	5.50	5.47	5.51	5.43	5.42

In pH examination, formulas F0-F3 have a ranging pH of 5.42-6.18. Therefore, all formulas are in accordance with the pH requirements of the skin, so that sheet mask preparations are safe to be used on skin. Standard pH requirements for sheet mask preparations are pH 5-8. Based on the results of pH determination, it was found that the higher the concentration of the added Lady Finger extract, the lower the pH of the preparation. High content of vitamin C in Lady Finger can decrease the preparations' pH. If the essence of the sheet mask preparation is too acidic from the pH of the skin, it will irritate the skin, and if it is too alkaline, it will dried the skin. The pH value of the four essence formulas for sheet mask preparations meets the skin pH criteria, which is between 4.5-6.5[11,12].

Stability test

The stability of essence can be seen from the changes in shape, smell and color during storage. Changes can occur if the compound contained in the extract were oxidized[10,12,14]. Essence that has been stored at 4°C and 40°C for 12 days, was not change in any of those parameters. It can be seen that the blank sheet mask essence preparations, sheet masks with Lady Finger extract of 3%, 5% and 7% were stable during 6 cycles of storage.

Irritation Test on Volunteers

The results of the observation of the irritation test of the Lady Finger extract sheet mask on volunteers' skin.

Table 5: Irritation test results

Formula	Observation	Volunteer											
		1	2	3	4	5	6	7	8	9	10	11	12
F0	Redness	-	-	-	-	-	-	-	-	-	-	-	-
	Itchy	-	-	-	-	-	-	-	-	-	-	-	-
	Swollen	-	-	-	-	-	-	-	-	-	-	-	-
F1	Redness	-	-	-	-	-	-	-	-	-	-	-	-
	Itchy	-	-	-	-	-	-	-	-	-	-	-	-
	Swollen	-	-	-	-	-	-	-	-	-	-	-	-
F2	Redness	-	-	-	-	-	-	-	-	-	-	-	-
	Itchy	-	-	-	-	-	-	-	-	-	-	-	-
	Swollen	-	-	-	-	-	-	-	-	-	-	-	-
F3	Redness	-	-	-	-	-	-	-	-	-	-	-	-
	Itchy	-	-	-	-	-	-	-	-	-	-	-	-
	Swollen	-	-	-	-	-	-	-	-	-	-	-	-

The irritation test on volunteers carried out on the sheet mask preparation of Lady Finger extract can be seen in Table 6, there are no visible irritation reaction such as redness, itching, and swelling of the skin. Therefore it can be concluded that the sheet mask formula of F0 which is only contain the essence without Lady Finger extract is safe to be develop with another active ingredients. Besides, sheet mask containing the Lady Finger extract of 3%, 5%, and 7%, also do not cause irritation on the skin. All preparations can be said that safe for skin[13,14].

Moisturizing Activity Test

Moisturizing activity testing using the Aramo skin analyzer and moisture checker can be seen in table 6 and 7.

Table 6: Moisture measurement

Formula	Moisture					Increased Moisture Content (%)
	Before usage	Treatment week-				
		I	II	III	IV	
F0	25.6	26.3	27.3	28	28.6	10.42%
F1	21.6	23.3	25.3	28	29.6	26.97%
F2	21	23.6	27	29.3	31	32.31%
F3	20.6	24.3	28.6	30.6	33	37.36%
F4	20.3	25	28.6	31	36	47.03%

The water content measurement results showed that the skin moisture content of all groups of volunteers before using sheet mask was dehydrated (0-29%). After using sheet masks for 4 weeks, all volunteers' skin showed an increasing in water content to normal category (30-50%)[17,18]. Volunteers who used the F4 (Pond's Age Miracle) formula had a higher percentage increase in water content than F0, F1, F2, F3 formulas. Formula F4 is more effective in moisturizing skin compared to formula F0, F1, F2 and F3 with a significant difference ($p \leq 0.05$). But F1,F2 and F3 showed a significant increased in moisture compared to negative control with ($p \leq 0.05$) but not as strong as postive control. F2 and F3 showed a non significant difference in increasing moisture ($p > 0.05$).

Extracts of young Lady Finger pods have also been reported to display moisturizing and diuretic properties, whereas the seeds of this plant have been reported to possess anticancer and

fungicidal properties. Recently, Lady Finger has been used not only for its nutritional values but, also, for its nutraceutical and therapeutic properties, owing to the presence of various important bioactive compounds and their associated bioactivities. This review presents a summary of the nutritional significance of Lady Finger, as well as the possible pharmacological applications of Lady Finger bioactive components, and to explore the possible characteristics forthe development and formulation of nutraceuticals andfunctional food. In addition, this review also focuses on the nutraceutical potential of Abelmoschus esculentus for various therapeutic purposes, as well as to demonstrate the benefit of Lady Finger-based nutraceuticals and their consumption[19].

Table 7: Evenness measurement

Formula	Evenness					Improvement of Evenness (%)
	Before usage	Treatment week-				
		I	II	III	IV	
F0	50	49	48	47.3	46.6	6.6%
F1	54	51.3	48.6	47	46	15.15%
F2	52.3	49.6	47	45.6	43.6	16.54%
F3	54.6	49.6	45.6	40	36.6	32.91%
F4	54	49.6	42.6	38.6	31.3	41.97%

The measurement results showed that the skin evenness of all groups of volunteers before using sheet mask was in normal to rough category (32-51) and (52-100) respectively. After using sheet mask for 4 weeks, the evenness of the volunteers increased from rough to normal (32-51) and smooth skin (0-31)[16,17]. Formula F4 is more effective in smoothing skin compared to formulas F0, F1, F2 and F3 with a significant difference ($p \leq 0.05$). F1,F2 and F3 showed a significant improvement of evenness compared to negative control with ($p \leq 0.05$) but not as strong as positive control.

The seeds of the Lady Finger plant represent a rich source of oil, constituting 20 to 40% of the total composition, which varies with the extraction procedure. Linoleic acid, a well-known representative of polyunsaturated fatty acids (PUFA), is the dominant constituent of the oil content (47.4%) of Lady Finger seeds. Other important dietary constituents essential for human growth are the amino acids and their polymers, proteins[20]. Lady Finger seeds have been reported to have different protein compositions from cereals and pulses, as their protein ingredients are modified to bear a balance of characteristic amino acids, namely lysine and tryptophan. Thus, owing to their rich content of essential amino acids, Lady Finger seeds represent an important constituent of the human diet. Lady Finger also serves as a potentially rich source of vitamins[20].

CONCLUSION

Lady Finger extract (*Abelmoschus esculentus* (L.) Moench) can be formulated in the form of a sheet mask that is homogeneous with a pH that meets the requirements, does not cause skin irritation and is stable on storage for 12 days of the cycling test. The sheet mask preparation of Lady Finger extract (*Abelmoschus esculentus* (L.) Moench) with a concentration of 7% showed the best moisturizing activity compared to F0, F1 and F2, which can increase water content until 37.36% and improve evenness until 32.91%.

CONFLICT OF INTEREST

All authors have nothing to declare.

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