Formulation of Edible Bird’s Nest (*Aerodramus fuciphagus*) from Central Kalimantan as Skin Whitening and Moisturizing Cream

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**Context:** Indonesia is the largest producer of edible bird’s nest (EBN) in the world. Previous research proved that epidermal growth factor (EGF) was detected from edible bird’s nest extract. EGF will increase the metabolism of skin cells and can lighten the skin EGF will increase the metabolism of skin cells and can lighten the skin. **Aims:** This research aimed to formulate and prove the lightening and the moisturizing effect of EBN cream on white mice. **Materials and Methods:** The 28 mice were divided into four group treatment. EBN 40% were formulated into cream with two formula types: water in oil (W/O) and oil in water (O/W). Before the treatment, white mice were exposed to UVA radiation until skin color level was 4. For 14 days, white mice were treated and observed skin color level and moisture content by skin analyzer. **Results:** The skin color level was 1 on day 8 (O/W), on day 9 (W/O), on day 8 (positive control), and showed skin color level was 4 on day 14 (negative control). The average water content on day 14 was 53.70 ± 1.21 (O/W), 50.13 ± 1.39 (W/O), 53.88 ± 0.88 (positive control), and 21.48 ± 2.90 (negative control). **Conclusion:** No significant difference was observed in lightening effect (Sig. 0.495) and moisturizing effect (Sig. 0.564) between O/W cream and W/O creams. W/O cream has good adhesion and O/W cream has good dispersion.

**Keywords:** Cream, edible bird’s nest, formulation, lightening effect, moisturizing effect

**Introduction**

Indonesia has rich natural resources, including edible bird’s nest (EBN). Indonesia is one of the largest producers of EBN in the worlds, average production of 500–600 tons. EBN has been proved to have a stimulant effect and wound-healing effect in alloxan-induced male rats.[1,2] In China, EBN is widely used for skin beauty because of its content such as carbohydrates, protein, fat, calcium, phosphorus, iron, and water.[3,4] Kong et al.[5] proved that epidermal growth factor (EGF) activity was detected and partially purified from EBN extract. EGF increases the metabolism of skin cells and cell proliferation; it improves skin texture and rejuvenates skin cells, and can lighten the skin. Chan[6] showed the effects of EBN for skin lightening. Three main fractions were isolated from extracts of EBN from Hong Kong. Only the isolated fraction with higher content of N-acetylneuraminic acid showed the best lightening effect.[7] EBN (*Aerodramus fuciphagus*) from Indonesia contains greater N-acetylneuraminic acid (a component of sialic acid) than the others from Thailand and Vietnam.[8]

This research aimed to formulate and prove the lightening and the moisturizing effect of EBN cream on white mice. Many cosmetics contain EBN, which...
are claimed to lightening and moisturizing the skin in Indonesia.[9] This research can provide efficacy guarantees for the use of EBN as cosmetics for the public. Cream was chosen because they are a general choice of society as cosmetics that are applied to the face. Cream has the advantage of being easily washed and can absorb quickly into the skin.

**Subjects and Methods**

**Edible bird’s nest preparation**

EBN was used from Buntok, Central Kalimantan. EBN (*A. fuciphagus*) was chosen intact and was cleaned of dirt. EBN (*A. fuciphagus*) was soaked with distilled water for 10 min, then it was steamed at a low temperature of 34°C (maximum 72°C for 10–15 min).[2,10]

**Edible bird’s nest cream preparation**

Ingredient in Table 1 was formulated into water in oil (W/O) and oil in water (O/W) creams, then a test was performed to check the physical properties, that is, organoleptic, homogeneity, pH (pH meter ATC RoHS), viscosity (Viscometer Stromer; NDJ-SS), spreadability, and stickiness. Two different cream formulations were prepared by test for identification of emulsion types, that is, dilution test, electrical conductivity test, and dye solubility test.

**Lightening effect test**

Male white mice were adapted for 2 weeks. 28 mice were divided into four group treatment [Table 2]. Before treatment, mice back’s hair was shaved and then was exposed to UVA (360 nm) radiation for 30 min per day. Mice were treated and observed skin color level for 14 days.

**Moisturizing effect test**

Male white mice were adapted for 2 weeks. 28 mice were divided into four group treatment [Table 2]. Before treatment, mice back’s hair was shaved and then was exposed to UV A (360 nm) radiation for 30 min per day until skin color level was 4. Mice were treated and observed skin color level for 14 days.

| Table 1: Edible bird’s nest cream formulations |
|-----------------------------------------------|
| **Bahan** | **Cream formulations (%)** |
| | **O/W cream** | **W/O cream** |
| Edible bird’s nest | 40 | 40 |
| Cera alba | – | 7 |
| Cetaceum | – | 7 |
| Paraffin liquid | – | 32.5 |
| Prophylparabean | 0.02 | 0.02 |
| Methyl parabean | 0.18 | 0.18 |
| Glycerin | 9 | – |
| Stearic acid | 6 | – |
| TEA | 3 | – |
| Aquadest | Ad 100 | Ad 100 |

Source: Original data

**Results**

**Physical properties cream of EBN**

It was formulated two type creams of edible bird’s nest that were tested to check the physical properties of cream, that is organoleptic, homogeneity, pH, viscosity, spreadability and stickiness. The result of organoleptic test showed O/W and W/O creams of edible bird’s nest had a semi solid form, white bone color, and odorless [Figure 2; Table 3]. Both of types of cream were prepared by test for identification of emulsion types [Table 4].

The result of physical tested of O/W and W/O creams of edible bird’s nest showed pH value 5.9 and 5.8; viscosity value 13.183 ± 28.87 and 24.433 ± 28.68; spreadability value 6.6 cm and 3.7 cm; and stickiness value 0.88 ± 0.49 and 1.03 ± 0.13 [Table 5].

**Lightening effect test**

The lightening effect test of EBN cream was showed there was no significant difference lightening effect between O/W and W/O cream, also between O/W and W/O creams with positive control. The result of skin colour level showed W/O and O/W cream were showed skin colour level was 1 on day 9; positive control showed skin colour level was 1 on day 8 and negative control showed skin colour level was 4 on day 14 [Table 6].

**Moisturizing effect test**

The moisturizing effect of two types of EBN creams can be explained by percentage recovery, that is, percentage of ratio of different in moisture content and moisture content on day 0. Percentage recovery of W/O cream, O/W cream, positive control and negative control showed 94.68%; 113.61%; 136.40% and -18.98% [Table 7]. There was no significant difference percentage recovery between O/W and W/O cream, also between O/W and W/O creams with positive control.

The result of moisture content of skin mice on day 0 showed dehydration level on all group treatment (moisture content <29). Moisture content of skin mice

| Table 2: Group treatment |
|--------------------------|
| **Group** | **Treatment** |
| 1 | O/W cream of EBN |
| 2 | W/O cream of EBN |
| 3 | Negative control (glycerin) |
| 4 | Positive control |

Source: Original data
on day 14 showed hydration level on W/O cream, OW cream and positive control, that is 50.13 ± 1.39; 53.70 ± 1.21; and 53.88 ± 0.83, while moisture content of skin mice on negative control showed dehydration, that is 21.48 ± 2.90 [Table 7].

**DISCUSSION**

**Edible bird’s nest cream preparation and physical properties**

EBN was formulated into two types of creams, that is, water in oil (W/O) creams and oil in water (O/W) creams.

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**Figure 1:** (A) Result of dilution test for identification O/W type cream. (B) Result of conductivity electrical test for identification O/W cream. (C) Result of dye solubility test for identification O/W cream. (D) Result of dilution test for identification W/O cream. (E) Result of conductivity electrical test for identification W/O cream. (F) Result of dye solubility test for identification W/O cream
Glycerin in O/W cream formulation is used primarily for humectant and emollient (9%; concentration <30%).\textsuperscript{[11]} In vitro studies have shown glycerin to prevent crystallization of stratum corneum model lipid mixture at low room humidity. Ten days of treatment of normal skin with 20% glycerin significantly increased skin corneometer values, indicating an increased hydration.\textsuperscript{[12]} Stearic acid is used as an emulsifying and solubilizing agent (6%; concentration <30%). When partially neutralized with triethanolamine (TEA), TEA stearic is used in the preparation of creams. When mixed with stearic acid, TEA forms an anionic soap with a pH of about 8, which may be used as an emulsifying agent to produce fine-grained, stable oil-in-water emulsions.\textsuperscript{[11]} TEA stearic was used at concentrations of 10% or lower in skin-cleansing products, moisturizing products, and other skincare preparations.\textsuperscript{[13]} Cera alba in W/O cream formulation is used to stabilize water-in-oil emulsions. Cetaceum and paraffin liquid is used primarily for emollient on this cream formulation.\textsuperscript{[11]}

Based on organoleptic test, both types of creams had a white bone color and odorless [Figure 2; Table 3]. Both of types of cream were prepared by test for identification of emulsion types [Table 4].

EBN cream in two types had a suitable skin’s pH criteria which were 4.5–6.5 [Table 5]. Therefore, EBN cream in two types is safe to use. An acidic pH cream can irritate the skin, whereas an alkaline pH cream can make scaly skin.

The spreadability test aimed to determine the ability of the cream to spread on the surface of the skin, good spreadability causes contact between the drug with the skin to be wide, so quickly absorption of the drug to the skin. The good spreadability of topical preparations is having diameter of approximately 5–7 cm.\textsuperscript{[14]} The results of the diameter of spreadability EBN creams were 6.6 cm on O/W cream and 3.7 on W/O cream [Table 5]. O/W cream had a better spreadability than W/O cream.

The stickiness test aimed to determine the ability of the cream to stick on the skin. The good stickiness of cream is more than 4 s.\textsuperscript{[15]} The results of the stickiness of EBN creams were 0.88 ± 0.49 on O/W cream and 1.03 ± 0.13 on W/O cream.

The viscosity test aimed to determine the thickness of a cream. The lower viscosity of the preparation, the greater spreadability, then the drug and the skin contact becomes wider and the absorption will be faster. The good viscosity of moisturizing cream is 2,000–50,000

| Table 3: Organoleptic and homogeneity properties of cream |
| Cream types         | Form          | Smell      | Color | Homogeneity |
|---------------------|---------------|------------|-------|-------------|
| Oil in water        | Semi solid (++++) | Nothing | White | Homogenous |
| Water in oil        | Semi solid (+)   | Nothing | White | Homogenous |

Source: original data

| Table 4: Result of test for identification of emulsion types |
| Cream types         | Dilution test              | Electrical conductivity test | Dye solubility test (with methylene blue)                      |
|---------------------|---------------------------|-------------------------------|---------------------------------------------------------------|
| Oil in water        | Can be diluted with water  | Conduct good electricity     | methylene blue was good dispersed [Figure 1C]                |
|                     | [Figure 1A]               | [Figure 1B]                  |                                                               |
| Water in oil        | Cannot be diluted with water | Conduct less electricity      | methylene blue was not dispersed [Figure 1F]                 |
|                     | [Figure 1D]               | [Figure 1E]                  |                                                               |

Source: Original data

| Table 5: pH, viscosity, spreadability, and stickiness properties of cream |
| Cream types         | pH*           | Viscosity** (12rpm) | Spreadability (K + 150g) | Stickiness       |
|---------------------|---------------|---------------------|--------------------------|------------------|
| Oil in water        | 5.9           | 13.183 ± 28.87      | 6.6 cm                   | 0.88 ± 0.49      |
| Water in oil        | 5.8           | 24.433 ± 288.68     | 3.7 cm                   | 1.03 ± 0.13      |

Source: Original data

*pH of all formulas was determined by pH meter ATC RoHS
**Viscosities of all formulas were determined by viscometer stromer (NDJ – SS)
Ps. The results of viscosity EBN creams were 13.183 ± 28.87 on O/W cream and 24.433 ± 288.68 on W/O cream [Table 5]. Both creams had a good viscosity.

**Lightening and moisturizing effect**

Lightening and moisturizing effect test was taken male white mice based on Ethical Clearance from The ethical committee of medical research, Medical Faculty, University of Lambung Mangkurat, Indonesia number 614/KEPK-FK UNLAM/EC/II/2018.

[Table 6] shows that the results of skin color level were 1 on day 9 for O/W cream, on day 9 for W/O cream, on day 8 for positive control, and 4 on day 14 (negative control) [Figure 3].

Kruskal–Wallis test showed that there were significant differences in the lightening effect between the four treatment groups (Sig. 0.007). Mann–Whitney test showed that there was significant differences in lightening effect between W/O cream of EBN and negative control (Sig. 0.011), also between O/W cream of EBN and negative control (Sig. 0.013); that is, the lightening effect of O/W cream and W/O cream showed better than lightening effect of negative control. Between W/O cream and positive control, there was no significant difference lightening effect (Sig. 0.057); also between O/W cream and positive control there was no significant difference lightening effect (Sig. 0.096). But there was no significant difference lightening effect between O/W and W/O creams of EBN (Sig. 0.495).

The results show that EBN has a potential lightening effect if compared with positive control. Kong et al.[9] proved that EGF activity was detected and partially purified from EBN extract. EGF will increase the metabolism of skin cells and cell proliferation, so it will to improve skin texture and rejuvenate skin cells and

| Days | W/O cream of EBN (40%) | O/W cream of EBN (40%) | Negative control | Positive control |
|------|------------------------|------------------------|------------------|------------------|
| 0    | 4 ± 0                  | 4 ± 0                  | 4 ± 0            | 4 ± 0            |
| 1    | 4 ± 0                  | 4 ± 0                  | 4 ± 0            | 4 ± 0            |
| 2    | 4 ± 0                  | 4 ± 0                  | 4 ± 0            | 3 ± 0            |
| 3    | 3 ± 0                  | 3.25 ± 0.5             | 4 ± 0            | 3 ± 0            |
| 4    | 3 ± 0                  | 3 ± 0                  | 4 ± 0            | 3 ± 0            |
| 5    | 2.5 ± 0.5              | 2.5 ± 0.5              | 4 ± 0            | 2 ± 0            |
| 6    | 2 ± 0                  | 2 ± 0                  | 4 ± 0            | 2 ± 0            |
| 7    | 2 ± 0                  | 2 ± 0                  | 4 ± 0            | 1.75 ± 0.4       |
| 8    | 1.75 ± 0.4             | 1.5 ± 0.5              | 4 ± 0            | 1 ± 0            |
| 9    | 1 ± 0                  | 1 ± 0                  | 4 ± 0            | 1 ± 0            |
| 10   | 1 ± 0                  | 1 ± 0                  | 4 ± 0            | 1 ± 0            |
| 11   | 1 ± 0                  | 1 ± 0                  | 4 ± 0            | 1 ± 0            |
| 12   | 1 ± 0                  | 1 ± 0                  | 4 ± 0            | 1 ± 0            |
| 13   | 1 ± 0                  | 1 ± 0                  | 4 ± 0            | 1 ± 0            |
| 14   | 1 ± 0                  | 1 ± 0                  | 4 ± 0            | 1 ± 0            |

Source: Original data

![Figure 3: Result of skin color level](image_url)
can lighten the skin. The content of N-acetylneuraminic acid showed a promising skin lightening function.

Table 7 shows that the results of moisture content were on day 0 26.50 ± 1.28 (negative control), 25.75 ± 1.89 (W/O cream), 25.90 ± 3.32 (O/W cream), and 22.78 ± 3.73 (positive control). After 14 days treated with O/W and W/O creams of EBN, negative control, and positive control, the result of moisture content was 21.48 ± 2.90 (negative control), 50.13 ± 1.39 (W/O cream), 53.70 ± 1.21 (O/W cream), and 53.88 ± 0.83 (positive control) [Figure 4]. At day 0, skin mice showed that moisture content was dehydration (0–29) on all the groups. At day 14, skin mice showed that moisture content was normal-hydration (30–100) on W/O and W/O creams of EBN, also on positive control. For the negative control, at day 0, skin mice showed that moisture content was dehydration (0–29), the same after 14 days skin mice showed that moisture content was dehydration (0–29).

Percentage recovery was –18.98% (negative control), 94.68% (W/O cream), 113.61% (O/W cream), and 136.40% (positive control). There was no significant difference in moisturizing effect between O/W and W/O creams of EBN (Sig. 0.564). W/O and O/W creams of EBN have the same moisturizing effect.

Kruskal–Wallis test showed that there were significant differences in moisturizing effect between the four treatment groups (Sig. 0.016). Mann–Whitney test showed that there was significant differences in moisturizing effect between W/O cream of EBN and negative control (Sig. 0.021), also between O/W cream of EBN and negative control (Sig. 0.021); that is, the moisturizing effect of O/W cream and W/O cream showed better than the moisturizing effect of the negative control. Between W/O cream and positive control there was no significant difference moisturizing effect (Sig. 0.083); also between O/W cream and positive control, there was no significant difference moisturizing effect (Sig. 0.248).

The results show that EBN also has a potential moisturizing effect if compared with positive control. Kong et al. [5] proved that EGF activity was detected and partially purified from EBN extract. EGF will increase the metabolism of skin cells and cell proliferation. Aldag et al. (2016) [16] explained in their review, the studies performed so far suggest that the EGF with combination cytokines in several cosmetic products reduce the appearance of skin aging, including fine lines and wrinkles. Investigators assessed, after 6 months, participants reported improved facial lines and wrinkles, 64% reported improved facial skin texture, and 73% reported improved skin hydration.

W/O and O/W creams of EBN have the same lightening (Sig. 0.495) and moisturizing effect (Sig. 0.564). O/W cream of EBN has a better spreadibility compared to W/O cream [Table 5]. A good spreadability causes extensive contact of the skin, so the absorption of the EBN to the skin is fast. However, in the stickiness test, W/O cream has a better than O/W cream [Table 5]. Good stickiness allows the formulation to be easily separated and longer to stick the skin.

The conclusion of this research is that there were significant differences in lightening effect and
moisturizing effect between the four treatment groups (Sig. 0.007), but there was no significant difference in lightening effect (Sig. 0.495) and moisturizing effect (Sig. 0.564) between O/W and W/O type of creams. EBN cream has a potential lightening effect and moisturizing effect if compared with the positive control, because there was no significant difference lightening effect and moisturizing effect between positive control and O/W or W/O creams of EBN. W/O and O/W type of creams have the same lightening effect and moisturizing effect. W/O type of cream has good adhesion and O/W type of creams has a good dispersion. So, W/O cream of EBN has a potential for development to skin products for lightening and moisturizing skin as a night cream.

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Conflicts of interest
There are no conflicts of interest.

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