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Activity of Hair Tonic Nanoemulsion with Candlenut Oil (Aleurites Moluccana) on Mice (Mus Musculus)

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Abstract.
Hair loss is one of the most common hair problems, which usually happens at about 100 strands every day. It has been shown that candlenut oil can help to overcome the problem of hair loss. This study aimed to determine the effect of a hair tonic nanoemulsion in varying concentrations of candlenut oil on accelerating hair growth in *Mus musculus*. A nanoemulsion hair tonic was created because doing so can increase the solubilization of the oil. In the nanoemulsion form, the penetration of the medicinal ingredients into the skin is accelerated. In this study, nanoemulsions were produced with 5%, 6%, and 7% candlenut oil as formula 1, formula 2, and formula 3. A base without candlenut oil was used as a negative control, and a ginseng hair tonic obtained from the market was used as a positive control. The researchers conducted the hair tonic test by measuring the hair growth and hair density of the *Mus musculus* at 21 days. The hair growth was -0.442 mm for the negative control; 2.255 mm for the positive control; 1.352 mm for formula 1; 1.773 mm for formula 2; and 3.649 mm for formula 3. The hair weight was 3.20 mg for the negative control; 2.22 mg for the positive control; 2.26 mg for formula 1; 4.54 mg for formula 2; and 6.70 mg for formula 3. This study therefore demonstrated that hair tonic nanoemulsion of candlenut oil can accelerate hair growth.

Keywords: candlenut oil, hair growth, hair tonic nanoemulsion

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1. INTRODUCTION

Hair is a symbol for everyone because hair increases a person's confidence which describes the beauty of some parts of the human body. It is a scalp protector against environmental conditions such as cold and sunlight [1]. The problems associated with hair are pigmentation (fading), dandruff, falling of hairs (shedding), and hair loss (balding). The balding type is temporally and permanently baldness (androgenetic baldness). There are three kinds of temporally baldness, alopecia areata, traction alopecia, and telogen effluvium [2]. Alopecia areata is caused by a fungus that arises from the scalp due to the surrounding environment containing bacteria, an unhealthy diet, and stress. Alopecia androgenic is the effect of the hormone dihydrotestosterone, which causes

the hair cycle to shorten and causes hair loss, with hair on the head as much as 80 to 120 strands every day [3].

There is a various herbal oil that cares for the hair and has hair growth-stimulating, and several herbal products acclaimed with hair growth-promoting activity, one of them are the oil of Candlenut (*Aleurites moluccana L. Willd*). Candlenut oil is the content of 50-60% of candlenut seeds. The fatty acids present in candlenut oil were palmitic acid, stearic acid, oleic acid, linoleic acid, and linolenic acid [4]. The laboratory of the Surabaya City Industrial Research and Consultation Institute extracted the oil from the candlenut *(Aleurites moluccana L. Willd) seed* using the maceration method and obtained the results that the candlenut seed oil contained 94.83% triglycerides; 3.05% fatty acids; triterpenoids 1.08%; and 1.03% protein. Triglycerides in cosmetics function as emollients and thickening agents that can affect the characteristics of this cosmetic made. Triterpenoids can also be referred to as ursolic acid as anti-inflammatory, anti-irritating, and antibacterial [5], the protein content in candlenut oil is an essential amino acid that has the function strengthen the roots of the hair [6].

The traditional use of candlenut oil by applying directly to the scalp results in limp and oily hair, increasing its acceptance and efficacy, made into a nanoemulsion hair tonic. Hair tonic is a hair cosmetic in liquid form and is the most effective for dealing with hair loss problems. Ingredients in hair tonics are more effective than shampoos and other care products due to the long-term contact with the hair. Ingredients used for hair tonic are 96% alcohol as an irritant and distilled water [7]. Nanoemulsion is a drug delivery system consisting of water and oil phases stabilized by a combination of surfactant and cosurfactant, its droplet size of <70 nm achieves the optimum effect, it has advantages such as being stable to temperature, translucent, and settling for a long time[8].

Previous research on candlenut essential oil nanoemulsion using 5% content resulted in a positive effect [9], and in this study, candlenut oil nanoemulsion made with a more concentrated and hopes an increase in oil concentration will give better results as a hair tonic.

2. RESEARCH METHODS

In this study, formulations of hair tonic preparations with concentrations of 5%, 6%, and 7% active ingredients of candlenut oil, then the three formulas will be tested for hair growth activity and hair thickness test on Mus musculus. Each group consists of 5 Mus musculus.

Analysis of the data in this study was to find the effect of the concentration of candlenut oil in nanoemulsion on hair growth and hair thickness in mice as hair tonic by ANOVA One-way. Ha used is that there is a significant difference in the hair growth activity test between the three concentrations of hair tonic nanoemulsion preparations, the H0 used is that there is no significant difference in the hair growth activity test between the three concentrations of hair tonic nanoemulsion preparations of candlenut oil.

2.1. TOOL

The tools used in this study are an analytical gram balance with the brand Mettler Toledo: AL-204 Analytical Balance, Stirring Hotplates, Thermo Scientific, magnetic stirrer, Stirring rod, Gillett or shaver.

2.2. INGREDIENTS

Research materials used for the preparation of *Hair tonic* nanoemulsion consisted of candlenut oil, tween 80, span 80, ethanol 96%, distilled water, and also as a positive control used ginseng hair tonic.

Table 1: The Formula of Candlenut Oil Nanoemulsion Hair Tonic .

Ingredients	Function	F1	F2	F3
Candlenut Oil	Active Ingredients	5%	6%	7%
Tween 80	Surfactant	18.4	22.09	25,77
Span 80	Surfactant	1.8	2.15	2.51
Ethanol 96%	Cosurfactant	3.5	3.5	3.5
Distilled water	Solvent	Ad 100	Ad 100	Ad 100

2.2.1. How to Make Hair Tonic Nanoemulsion

Previously, candlenut oil was mixed with 96% ethanol, covered with aluminum foil, heated at a temperature of 60°C, and blended at 350 rpm for 7 minutes (first mixture). Tween 80 and Span 80 mixed in a porcelain dish (second mixture) was soaked into the first mixture slowly at 700 rpm for 15 minutes, then it was transferred to a homogenizer and bled at a speed of 700 rpm. Last, distilled water is soaked slowly, homogenizer for approximately 5-7 minutes.

2.2.2. Hair Growth Activity Test

Testing hair tonic nanoemulsion on hair growth of male mice using the method of Tanaka et.al[10] modified. First, the backs of the mice are shaved using vet cream and numbered using a marker permanently, each shaved in a square shape with a size of 2x2 cm on each area of the back of the mice. The first group was a negative control, the second group was positive control, the third group used Formula 1, the fourth used tosed to Formula 2, and the fifth used Formula 3. Application of nanoemulsion once a day with a volume of approximately 1 ml on each part determined

2.2.3. Hair Thickness Test

The thickness and weight of hair were measured on day 22 by shaving all of the mice in each area or box tested and then weighed using a digital scale, while hair lengths measured using a caliper were taken randomly with as many as five strands in all parts, then measured and calculated the average[11].

3. RESULTS

The resulting evaluation of candlenut nanoemulsion included hair length and hair weight of mice shown in Table 2 and Table 3. The difference between each treatment group from day one to day 21 of negative control (additional ingredients without active ingredients) is -0.44mg; positive control (hair tonic ginseng) is 2.26mg; formula 1 (5%) is 1.35mg; formula 2 (6%) is 1.78mg; and formula 3 (7%) 3.65mg. Revealed that the addition of candlenut oil concentration can increase the activity of the preparation in accelerating hair growth. So, the best nanoemulsion is formula three, which has 7% candlenut oil.

The weight difference between each treatment group from day 0 to day 21 is negative control -3.20mm; positive control (hair tonic ginseng) is 2.22mg; formula 1 (5%) is 2.26mg; formula 2 (6%) is 4.54mg; and formula 3 (7%) is 6.70mg. This result revealed that increasing candlenut oil concentration can increase the activity of the preparation in accelerating the hair density of mice, and the best nanoemulsion is formula 3.

4. DISCUSSION

The effectiveness test of the candlenut oil nanoemulsion of 5%, 6%, and 7% had performed. The result of 7% nanoemulsion exceeds 6%, and the 6% is better than

Table 2: The hair weight of mice.

Treatment Group	time	Average Hair Weight (mg)	Weight difference between day one and day 21 (mg)
Negative Control	Day 0 Day 21	6.24 ± 1.50 3.04 ± 1.20	-3.20
Positive Control (ginseng hair tonic)	Day 0 Day 21	5.02 ±0.91 7.24 ±0.35	2.22
Formula 1 (5%)	Day 0 Day 21	6.22 ± 1.10 8.48 ± 0.40	2.26
Formula 2 (6%)	Day 0 Day 21	5.30 ± 1.60 9.84 ± 0.50	4.54
Formula 3 (7%)	Day 0 Day 21	6.20 ± 2.00 12.90 ± 1.70	6.70

Table 3: The hair length of mice.

Treatment group	time	Average hair length (mm) ± SD	Length difference between day one and day 21 (mm)
Negative Control	Day 0 Day 21	5.78 ± 0.31 5.34 ± 0.41	-0.44
Positive Control (hair tonic of ginseng)	Day 0 Day 21	4.91 ± 0.56 7.16 ± 0.16	2.26
Formula 1 (5%)	Day 0 Day 21	5.88 ± 0.82 7.23 ± 0.17	1.35
Formula 2 (6%)	Day 0 Day 21	6.26 ± 0.43 8.03 ± 0.60	1.77
Formula 3 (7%)	Day 0 Day 21	5.92 ± 0.87 9.57 ± 0.51	3.65

the 5%, that negative control formula contains surfactant, alcohol, and water produces a negative effect on weight (-3.mg) and reduced length (-0.44mm), this could be due to surfactants and alcohol that damage the condition of the hair. Otherwise, in the Group that used candlenut nanoemulsion, all had a positive result, the addition of hair weight of 5%,6%, and 7% nanoemulsion each 2.26mg, 4.54mg, and 6.70mg, respectively. The result of candlenut nanoemulsion 6% and 7% exceeded the positive control (ginseng hair tonic) that had an additional hair weight is 2.22mg. The same results shown from hair lengthening for 21 days, hair elongation due to the use of 5%, 6%, and 7% nanoemulsion, respectively, was 1.35mm, 1.77mm, and 3.65mm, but only nanoemulsion 7% exceeded positive control that has hair elongation is 2.26mm. The result proved that candlenut nanoemulsion has been accelerating hair growth and thickening. Candlenut oil contains polyphenols, oleic acid, and linoleic acid that have antioxidants properties and cause muscle relaxation in the hair follicle area and stimulate hair growth, oleic acid can slow hair loss and accelerate hair growth. Previous studies have shown candlenut oil

nanoemulsion is more effective as a stimulator than pure[11]. The other studying of hair tonic nanoemulsions showed the same result, cendol nanoemulsion significantly improved the pharmacokinetic properties and hairgrowth [3].

5. CONCLUSION

Increasing levels of candlenut oil in nanoemulsion hair tonic preparations gave a better effect in hair growth and hair density.

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