E-ISSN : 2774-4655
FORTE JOURNAL
Universitas Haji Sumatera Utara
FJ | https://www.ojs.unhaj.ac.id/index.php/fj | Volume 04 | Nomor 01 | Januari| 2024 | Halaman 211-216

FORMULATION AND PHYSICAL QUALITY TESTS HAIR FERTILIZER PREPARATIONS FROM LEMONGRASS (*Chrysopogon zizanioides* L.) AND VCO *(VIRGIN COCONUT OIL)*

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ABSTRACT

Hair loss is the shedding of hair from the skin. The factor that causes hair loss is a lack of nutrition for hair growth. Pure coconut oil (VCO) and citronella oil contain saturated fatty acids with short and medium chains of carbon atoms, especially octanoic acid and decanoic acid and essential oils which can be used to nourish hair. The aim of this research is to determine the effectiveness of the combination of citronella oil and VCO oil as a hair-fertilizing oil. This research was carried out using experimental methods including collecting and identifying samples, evaluating oil preparations, then testing hair-fertilizing oil preparations on 3 rabbits which were divided into 6 groups, namely positive control, negative control, formula 1, formula 2, formula 3 and formula 4. Data on the percentage of hair growth length were analyzed using the ANOVA (Analysis of Variance) method using the SPSS (Statistical Program for the Social Sciences) program. The results of the preparation evaluation showed that the oil preparation was stable during storage. The results showed that hair growth on day 28 with the positive control was 8.3 mm, negative control 4.17 mm, F1 4.83 mm, F2 5.17 mm, F3 6.33 mm and F4 7.83 mm. Duncan's test on day 28 showed that the positive control was not significantly different from formula 4, but was significantly different from formula 1, formula 2 and formula 3.

Keywords: *Hair fertilizer, VCO oil, citronella oil*

INTRODUCTION

Hair in humans has an important role, especially in appearance. It is not uncommon for a person's self-confidence to increase with beautiful hair. A person's level of self-confidence can be disturbed due to various problems that occur with their hair, one of the hair problems that is often experienced by men and women is hair loss. Things that influence hair loss include a lack of nutrients for hair growth such as water, protein, vitamin A, vitamin C, vitamin B, vitamin E and iron. Nowadays, health problems are increasing along with the development of disease. Solving the problem of hair loss has been done by using various products derived from synthetic substances such as Minoxidil. However, the use of Minoxidil may cause side effects such as skin allergies, headaches, vertigo, edema and even hypotension (Septiantin, E., 2008; Chandra, et al., 2023).

Pure coconut oil (VCO) is a processed product from coconuts (Cocos nucifera). Coconut oil contains medium and short chain saturated fats. Pure coconut oil (VCO) is made from fresh coconut milk using a process that does not use high heat and without the use of chemical solvents. This process can maintain the natural properties of coconut oil. Apart from that, the oil produced will be clear in color, feel soft and have the aroma of fresh coconut (Septiantin, E., 2008; Ginting, et al., 2022).

Pure coconut oil (VCO) is also useful as a natural softener, moisturizer and contains antioxidants to prevent skin aging (Rozaline and Sutarmi, 2005). Based on the background above, a formula was created by combining lemongrass oil and pure coconut oil (VCO) as hair nourishing oil.

RESEARCH METHODS

The method used was experimental on rabbits by administering oil for hair growth. The tools used in this research are a set of water distillation tools, magnetic stirrer, digital scales, watch glass, pH meter, evaporator , measuring cup, glass beaker, Erlenmeyer, funnel, glass bottle. Measurements are made by pulling out several strands of rabbit hair and measuring with a caliper. From the data from hair growth measurements in all groups of experimental animals, it was tested statistically using the *one way ANOVA method* with the SPSS (*Statistical Product and Service Solution*) program and continued with the Duncan test to determine which groups had the same effect and which were different from each other. The sample used was coconut (*Cocos nucifera)* . The sampling method was carried out purposively, that is, without comparing similar plants from other areas. Samples were taken from the city of Medan, North Sumatra.

a. The old coconut is split with a machete, the coconut water is separated and the ketos is discarded
b. The coconut is grated using a coconut grater machine, the grated coconut is collected in a basin
c. The grated coconut is weighed on a scale
d. Grated coconut is added with distilled water in a ratio of 1:1
e. Grated coconut with distilled water is mixed well and squeezed to obtain coconut milk. The coconut milk is collected in a bowl.
f. The coconut milk is filtered using a filter cloth and the volume is measured using a measuring cup
g. The separating funnel is assembled with a stand and clamps, the lid and faucet are smeared with Vaseline
h. Put the coconut milk into a separating funnel with the help of a funnel
i. Leave the coconut milk in a separating funnel for 30 minutes to remove the skim layer. Meanwhile, the other solutions (water and dirt layers) are separated and discarded

Fermentation Working Procedure

a. Tempeh yeast is weighed at 2.5 grams with a ratio of 1 liter of coconut milk to 2.5 grams of yeast
b. The tempeh yeast is put into a separating funnel containing skim and then homogenized
c. Skim with tempeh yeast is fermented for 24 hours
d. Skimmed fermentation with tempeh yeast produces 5 layers, the oil layer contained in the second
e. layer is taken and placed into a glass beaker, while the other layers are separated and discarded.

Centrifugation Working Procedure

- The oil which is still mixed with the skim is put into a centrifuge tube
- The centrifuge is turned on and set at a speed of 4500 rpm with a centrifuge time of 5 minutes
- The lid of the centrifuge is opened then the tubes are inserted into the device and closed again
- The start button is pressed, when finished, the lid is opened again then the tube is taken with the VCO and inserted into the measuring cup
- The volume of the VCO is measured then put into the bottle
-

RESULTS AND DISCUSSION

1. Isolation Results of Pure Coconut Oil (VCO)

Isolation of pure coconut oil (VCO) was carried out at the Medan Industrial Chemical Technology Polytechnic. Isolation was carried out using 1 liter of coconut milk to produce 200 ml of pure coconut oil (VCO).

2. Evaluation Results of Supplies

a. Organoleptic Examination and Homogeneity of Preparations

Organoleptic testing and homogeneity of hair fertilizer oil preparations can be seen in table 1 below.

Table 1. Data from Organoleptic Observations and Homogeneity of Hair Fertilizing Oil Preparations, Lemongrass Oil and VCO Oil

Inspection	F	Week 2 Observations											
		1	2	3	4	5	6	7	8	9	10	11	12
Homogeneity	1	H	H	H	H	H	H	H	H	H	H	H	H
	2	H	H	H	H	H	H	H	H	H	H	H	H
	3	H	H	H	H	H	H	H	H	H	H	H	H
	4	H	H	H	H	H	H	H	H	H	H	H	H
Colour	1	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk
	2	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk
	3	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk
	4	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk	Kk
Form	1	C	C	C	C	C	C	C	C	C	C	C	C
	2	C	C	C	C	C	C	C	C	C	C	C	C
	3	C	C	C	C	C	C	C	C	C	C	C	C
	4	C	C	C	C	C	C	C	C	C	C	C	C
Smell	1	K	K	K	K	K	K	K	K	K	K	K	K
	2	K	K	K	K	K	K	K	K	K	K	K	K
	3	K	K	K	K	K	K	K	K	K	K	K	K
	4	K	K	K	K	K	K	K	K	K	K	K	K

Information:

F1 : Oil preparation with 10 ml lemongrass oil and 15 ml VCO
F2 : Oil preparation with 15 ml lemongrass oil and 20 ml VCO
F3 : Oil preparation with 20 ml lemongrass oil and 25 ml VCO
F4 : Oil preparation with 25 ml lemongrass oil and 30 ml VCO
H : Homogeneous
Kk : Yellowish
C : Liquid
K : Typical

b. Checking the pH of the Preparation

Checking the pH of the preparation is determined using a pH meter. The measurement results can be seen in Table 2 below.

Table 2. Data from examination results of the average pH of hair fertilizer oil preparations, citronella oil and VCO oil

Time	F1	F2	F3	F4
1	5,6	5,6	5,6	5.7
2	5,6	5,6	5,6	5.7
3	5,6	5,6	5.7	5.7
4	5.7	5.7	5.7	5.8
5	5.7	5.7	5.7	5.8
6	5.7	5.7	5.7	5.8
7	5.7	5.7	5.7	5.8
8	5.8	5.8	5.8	5.9
9	5.8	5.8	5.8	5.9
10	5.8	5.8	5.8	5.9
11	5.9	5.9	5.9	5.9
12	5.9	5.9	6	6
Average	**5.73**	**5.73**	**5.75**	**5.82**

Based on examination of F1, F2, F3 and F4 preparations from week 1 to week 12, the pH was in the range 5.73 – 5.82. This is in accordance with the pH of the skin so it can be used safely. pH measurements for hair oil preparations used on the scalp must meet the requirements, namely 5.0-9.0 because if it is outside this pH range then the oil preparation can irritate the scalp.

3. Test Results of Hair Fertilizing Oil Preparations for Rabbits

The results of hair growth activity testing in rabbits were shown in hair growth measured on days 7, 14, 21 and 28. The results of measuring the average hair length growth can be seen in Table 3 below.

Table 3. Results of measuring average hair length growth

Days to-	Average Measurement Results (mm)					
	KP	KN	F1	F2	F3	F4
7	3.67	1.17	1.83	2.17	2.17	3.67
14	5.83	2.17	2.67	2.67	3.33	4.83
21	7.67	3.17	4.17	3.67	4.83	6.33
28	8.33	4.17	4.83	5.17	6.33	7.83

Based on the results of the analysis in table 4.1 using the *Duncan test* on day 7, it shows that there are no significant differences in each treatment group. Meanwhile, on the 14th day, significant differences were seen in the Formula 2, 3 and positive control treatments.

And on the 28th day, there was an insignificant difference between formula 4 and the positive control, so that the ability of formula 4 to grow hair in rabbits was almost close to the positive control. These differences can be seen in Figure 1 below.

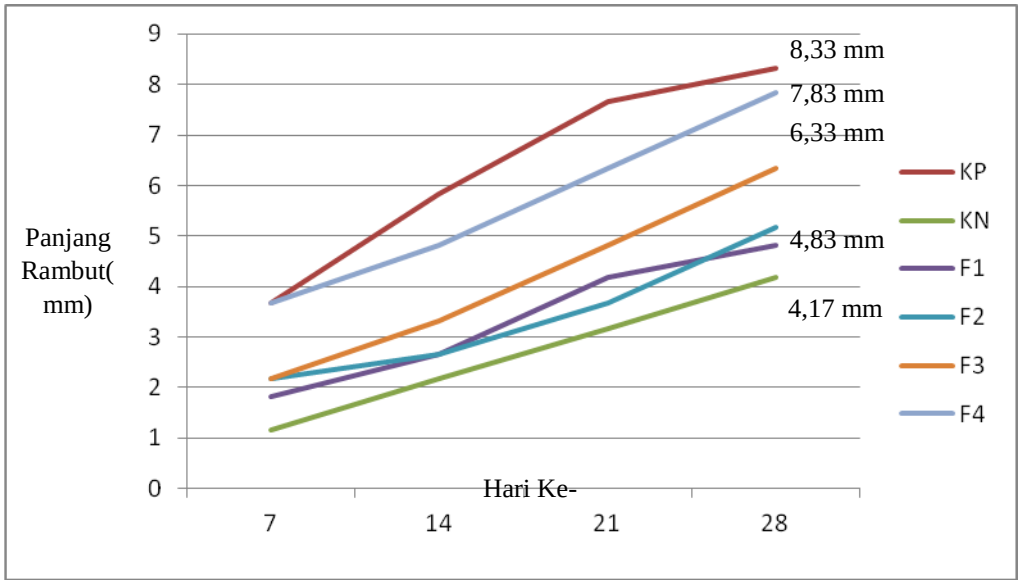

Figure 1. insignificant difference between formula 4 and the positive control

Information:

KP	: Positive Control	F2: Formula 2
KN	: Negative Control	F3: Formula 3
F1	: Formula 1	F4: Formula 4

From the graph above, it can be seen that hair growth by the Formula 4 preparation shows results that are closest to the positive control, formula 4 shows hair growth of 7.83 mmon day 28, while the positive control shows hair growth of 8.33 mmon day 28. Formula 1 shows hair growth of 4.83 mm on day 28, formula 2 shows hair growth of 5.17 mm, and formula 3 shows hair growth of 6.33 mm on day 28.

Pure coconut oil (VCO) has a high lauric acid content of 45-55% and 7% capyric acid. Both of these acids are saturated chain fatty acids that are easily metabolized and have antimicrobial properties so they can increase the body's immunity and can reduce protein loss in damaged and undamaged hair, thus providing a healthy, non-dry hair appearance, stable hair growth and can reduce hair loss. VCO has the ability to penetrate well by increasing skin hydration or through the help of short chain fatty acids which easily cross the skin. The fatty acids contained in coconut oil can enter the hydrophobic part of the stratum corneum and penetrate the skin barrier, thereby helping in penetration.

The lauric acid contained can act as an antiseptic. VCO is known to protect hair damage by blocking around 20% of the sun's ultraviolet rays. Using VCO as a hair nourishing oil can also compensate for protein loss in the hair. The mixture of acids in VCO has a hair growth effect by acting as an anti-androgenic or testosterone 5α reductase inhibitor. Inhibiting the enzyme 5α-reductase can help speed up hair growth. This is because the job of 5α-reductase is to convert testosterone into dehydrotestosterone (DHT).

DHT will connect with receptors in the hair follicles on the scalp which causes the pores in the follicles to become blocked so that the hair lacks nutrition and the hair follicles will shrink (miniaturize) so they are unable to form hair. DHT will also shorten the hair growth time (anagen phase) which will cause hair to fall out easily. By inhibiting this enzyme, the conversion of testosterone to DHT will be reduced, so that hair follicles will remain intact and hair can grow healthily (Fahrudin, 2012).

The nutrients that hair needs are vitamin A which acts as an antioxidant and maintains blood circulation in the skin, vitamin B5, vitamin B6, vitamin B7 which plays a role in triggering hair growth and increasing hair density, vitamin B12, vitamin C which plays a role in forming flexible, strong hair. and unbranched, vitamin D, iron which plays a role in delivering oxygen to hair follicles and zinc plays a role in forming a stronger hair structure. Water content is also needed. Water fills almost a quarter of the hair. The presence of water will make the hair soft due to the humidity (Kristiningrum, 2018).

The main compound components of citronella oil consist of citronellal, citronellol, and geraniol. The citronellal, geraniol and citronellol content in citronella oil is also able to inhibit bacterial activity (Hardjono, 1994). The combination of the two oils showed a synergistic effect on hair growth in rabbits. The content of linoleic and linolenic acids and long chain polyunsaturated fatty acids found in VCO are important ingredients in the horn layer. The use of natural ingredients such as seh wangi oil and VCO in hair growth oil formulations is considered to reduce the side effects of using minoxidil which can cause local irritation, allergic contact dermatitis, and hair growth on the face.

CONCLUSION

Citronella oil (*Chrysopogon zizanoides* L.) combined with pure coconut oil (VCO) can be formulated as a hair-fertilizing oil. A combination of citronella oil and VCO oil has the ability to act as a hair fertilizer. Formula 4 showed hair growth of 7.83 mm on day 28.

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