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Formulation of Virgin Coconut Oil and Red Chili Oil in Cemceman Hair Growth Oil: Implications for Holistic Nursing Care and Patient Education in Hair and Scalp Health

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KEYWORDS
Hair Growth Activity, Chili Oil, Cemgeman Oil, Virgin Coconut Oil.

ABSTRACT
Hair growth is influenced by a combination of genetic and environmental factors, requiring compounds like flavonoids and saponins to stimulate growth and improve blood circulation to hair follicles. Red chilli (*Capsicum*) contains beneficial compounds such as saponins, flavonoids, alkaloids, terpenoids, and quinones, while Virgin Coconut Oil (VCO), rich in lauric acid, is traditionally used for hair nourishment. This research aims to develop a hair-nourishing preparation, known as *cemceman oil*, combining VCO and chilli oil, and to evaluate its effectiveness in promoting hair growth and its physical stability. Using an experimental method, *cemceman oil* was formulated with chilli oil at concentrations of 1%, 2%, and 4%. The preparation was topically applied to the skin of white rats, and hair length was measured on days 7, 14, and 21, with hair weight assessed on day 21. Results indicated that the formulation with 4% chilli oil produced the most significant increase in hair growth. Additionally, preparations with 1%, 2%, and 4% chilli oil demonstrated good physical stability under room and high-temperature storage conditions. This research concludes that a formulation combining VCO and 4% chilli oil is highly effective in enhancing hair growth, offering potential implications for natural hair care products focused on promoting hair health and growth.

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INTRODUCTION

Hair loss or baldness is a problem. To prevent and overcome hair loss, you can use traditional hair care using natural ingredients in the form of plants that have been known since ancient times (Aqil et al., 2020). Red chilli pepper is a plant that contains the active substance capsaicin contained in saponin compounds that are able to increase hair growth, while flavonoids have antioxidant activity to fight free radicals found in the scalp, in addition to that, there is also an alkaloid, terpenoid, and quinone content that is beneficial for scalp and hair health (Adetunji et al., 2021).

Another ingredient that is often used for hair nourishing is coconut oil. Virgin coconut oil (VCO) or virgin coconut oil is composed of organic compounds mixed with esters of glycerol and fatty acids. Virgin coconut oil contains 80% saturated fatty acids and 20% unsaturated fatty acids. According to the results of research, unsaturated fatty acids are essential elements for skin care, including the scalp, because they work as an emollient on the scalp (Detsi et al., 2020; Setyaningrum, 2020).

One of the mainstays of Banten's farmers' economy is coconut plantations, as many as 30,827.58 tons of coconuts are produced per year with a planting area of 103,241.16 hectares spread across Lebak, Pandeglang, Serang, Cilegon and Tangerang Regencies. There are around 50,338 MSMEs, and among them are coconut oil processing MSMEs, amounting to 133 units of SMEs in Banten Province.

Based on the description above and the lack of innovation in chilli oil, we innovated to make chilli oil and virgin coconut oil for hair nourishment (Dumancas et al., 2016). The use of virgin coconut oil (VCO) produced by MSMEs in Banten Province is expected to be able to improve the economy of coconut farmers in Banten Province and also as a diversification of processed coconut products (Sumarto et al., 2019).

This research presents a novel approach by combining chilli oil and virgin coconut oil (VCO) as a hair-nourishing product, a formulation that has not been extensively explored in previous research. While traditional hair care has long utilized natural ingredients such as chilli pepper and coconut oil for their beneficial properties, this research innovates by formulating a specific blend of chilli oil and VCO in different concentrations, focusing on achieving a physically stable product that meets pharmaceutical standards. Chilli oil, rich in capsaicin from saponins, promotes hair growth, while its flavonoid content acts as an antioxidant against scalp-damaging free radicals. Coconut oil, particularly VCO, is renowned for its high content of saturated and unsaturated fatty acids, essential for scalp health as an emollient (Selwyn & Govindaraj, 2023).

This research contributes to the limited body of knowledge on chilli oil applications for hair care, as well as providing an innovative use of VCO produced by MSMEs in Banten Province, thereby supporting the local coconut farming economy and promoting diversification in coconut product processing. By developing a stable hair-nourishing preparation in varying chilli oil concentrations (1%, 2%, and 4%), this research not only aims to offer an effective formulation but also seeks to fill gaps in natural hair care research and enhance the practical value of locally sourced ingredients for sustainable economic impact.

The formulation of this research problem is how to formulate chilli oil and virgin coconut oil (VCO) with various concentrations in order to obtain a physically stable preparation and meet pharmaceutical requirements (Manikantan et al., 2021). This research aims to obtain a physically stable formulation of chilli oil and VCO as a hair nourishing with a concentration of 1% chilli oil, 2% chilli oil, and 4% chilli oil. This research's expected benefit is obtaining the right formulation of chilli oil and VCO as a stable hair-nourishing preparation and meeting pharmaceutical requirements.

METHOD

The research uses a direct experimental method of making spaceman oil formulations, testing the preparation's activity as a hair-nourishing agent in vivo. The results of the hair growth activity test were statistically analyzed using the ANOVA one-way method. This research was conducted from January to February 2022 at the laboratory of SMAN 8 Tangerang in Tangerang City, Banten Province.

Activity Test Against Hair Growth

The hair rejuvenating activity test was carried out in vivo on male white rats of the Wistar strain, which were divided into 4 groups, each group consisting of 4 experimental animals. Group 1 is a negative control group that is not given a preparation; the 2nd group is the test group that is given an F1 sample preparation; group 2 is the test group that is given an F2 sample preparation, and the 3rd group is the test group that is given an F3 sample preparation.

Table 1. Hair Growth Activity Test Treatment Group

Group	Number of Rats	Treatment
Control	4	Not smeared with chimemceman
Formula 1	4	Applied chilli oil extract 1%
Formula 2	4	Topical chilli oil extract 2%
Formula 3	4	Topical chilli oil extract 4%

The effect on hair growth is determined by observing the presence or absence of hair growth and length every week after 4 weeks of observation. Hair length observations were made on days 7, 14, and 21. A total of 10 strands of the longest rat hair were measured using a calliper. Hair weight measurement was carried out to measure hair elasticity on day 21 by shaving the hair that grew in the test area and then weighing it. The results obtained are calculated statistically (Ruwali et al., 2022).

Test Statistics

The data from the measurement of hair growth in all groups of experimental animals were statistically tested using the ANOVA one-way method to determine whether there was a significant difference in hair growth in each formula. By decision making:

1) If the significance value ≤ 0.05 then H0 is rejected.
2) If the significance value is ≥0.05, then H0 is accepted.

RESULT AND DISCUSSION

Overview

The plant used in this research is Capsicum annum L., better known as red chilli. The plant part used is a fruit that is empirically stated to be efficacious in nourishing hair (Adetunji et al., 2021). The total weight of the dried red pepper used is 200 grams, and the weight of the thick extract obtained is 70 ml. The maceration method is chosen because it is cheap and easy to do; besides that, it is feared that flavonoid compounds are a class of compounds that are not resistant to heat (Rashid et al., 2021).

Ethanol was chosen because it is universal and able to attract all types of active substances, both polar, semi-polar, and non-polar so that active compounds such as flavonoids will be dissolved in ethanol solvents, as well as good absorption and relatively low toxicity levels for living things. In addition to flavonoids, linoleic acid will also be dissolved in ethanol (Darji et al., 2018). 96% ethanol was chosen because ethanol with this concentration can penetrate more quickly into cells and has better extraction ability compared to low-concentration ethanol (Genatrika et al., 2018).

In addition to red chilli, spaceman oil is also manufactured using Cocos nucifera or coconut, which is processed into pure coconut oil (VCO) by Rangkasbitung MSMEs, Lebak Regency, Banten Province.

In this research, formulas with different concentrations of extracts were made but aimed to find the best formulation that can increase optimal hair growth and elasticity (Pereira-Silva et al., 2022).

Evaluation of Red Chili Oil and VCO

The physical evaluation of the three formulas was carried out to compare the changes that occurred after the physical stability test was carried out on the three formulas (Khanfar et al., 2021). Details of the evaluation of chilli oil and VCO can be seen below:

a) Chili oil 1% and VCO 99% (formula 1)
   Bright light yellow colour, with a characteristic smell of coconut oil, homogeneous, pH 6
b) Chili oil 1% and VCO 99% (formula 1)
   Bright orange colour, the distinctive smell of coconut oil, homogeneous, pH 6
c) Chili oil 1% and VCO 99% (formula 1)
   Bright red colour, the distinctive smell of coconut oil, homogeneous, pH 7

Organoleptic Test Results

In the preparation of spaceman oil, organoleptic testing was carried out, including colour, odour, and clarity; the observation was carried out on days 1,7, 14, 21, and 28 during storage. The observation results can be seen in the following table 2:

Table 2. Cemceman Oil Organoleptic Test Results

Observation		Casting the day to				
		1	7	14	21	28
F1	Colour	Clear yellow	Clear yellow	Clear yellow	Clear yellow	Clear yellow
	Smell	Typical VCO	Typical VCO	Typical VCO	Typical VCO	Typical VCO
	Clarity	Clear	Clear	Clear	Clear	Clear
F2	Colour	Clear orange	Clear orange	Clear orange	Clear orange	Clear orange
	Smell	Typical VCO	Typical VCO	Typical VCO	Typical VCO	Typical VCO
	Clarity	Clear	Clear	Clear	Clear	Clear
F3	Colour	Clear red	Clear red	Clear red	Clear red	Clear red
	Smell	Typical VCO	Typical VCO	Typical VCO	Typical VCO	Typical VCO
	Clarity	Clear	Clear	Clear	Clear	Clear

The results of the evaluation of organoleptic for 28 days at a temperature of 400C showed that the three formulas of the caveman oil preparation were stable. Each preparation's physical appearance in the form of colour, smell, and clarity tends not to change (Tiara et al., 2024).

pH Measurement Results

pH observation is carried out to determine the pH of the preparation during storage. pH measurements are performed using litmus paper. Observations of the pH of the preparation for 28 days can be seen in Table 3.

Table 3. Results of Prepared pH Measurement

Formula	pH day-to-day				
	1	7	14	21	28
F1	6	6	6	6	6
F2	6	6	6	6	6
F3	7	7	7	7	7

Based on the results of the evaluation of the pH measurement of the spaceman oil preparation for 28 days, the three formulations did not change significantly, so it can be concluded that the preparation is stable. The pH range of the three formulas is based on the pH requirements for topical preparations in general, which is 5.5-10. The pH of topical preparations should not be too acidic as it can cause irritation to the skin.

Freeze-Thaw Stability Test Results

After the stability test using the Freeze-Thaw method, the data was obtained as shown in table 4. next.

Table 4. Freeze-Thaw Stability Test Results

Formula	Cycle to				
	1	2	3	4	5
F1	Not separating	Not separating	Not separating	Not separating	Not separating
F2	Not separating	Not separating	Not separating	Not separating	Not separating
F3	Not separating	Not separating	Not separating	Not separating	Not separating

The table above shows that the three preparations have good stability, as evidenced by their non-separation and lack of colour and odour changes after 5 cycles of Freeze-Thaw tests.

Activity Test Results on Hair Growth

Hair growth tests from all three formulas were carried out on male white rats of the Wistar strain. The selection of male mice is more stable compared to female mice with the hormone estrogen, which can inhibit hair growth and inhibit the research process (Carlitz et al., 2019). The mice were grouped into 4 groups, namely the control group, the F1 formula group, the F2 formula group and the F3 formula group. The results of the observation of hair length can be seen in Table 5.

Table 5. Results of Measurement of Rat Hair Length

Formula	Average hair length (mm) ± SD		
	Day 7	Day 14	Day 21
Control	3.7875 ± 0.5273	6,615 ± 0.8093	9.6250 ± 0.8145
Formula F1	4.9887 ± 1,412	8,975 ± 1.7189	11.85 ± 1,764
Formula F2	5.4225 ± 1.2945	9.4525 ± 1.9239	12.47 ± 1.9292
Formula F3	5.6025 ± 1.0716	9.7075 ± 1.0506	13.74 ± 1.4192

A one-way ANOVA statistical test was carried out to compare the differences in hair growth in each group. Based on statistical calculations from the first week to the third week, there was a significant difference between groups with a sig value ($\alpha < 0.05$), meaning that the F1, F2, and F3 formulas had activity on hair growth because they were significantly different from the control group.

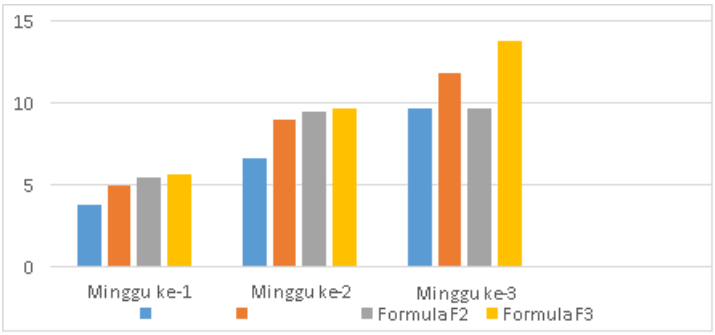

Figure 1. Mouse hair growth graph

The control group at week 3 had an average hair length of 9.6250 ± 0.8145 mm, while the F1 treatment group had an average hair length of 11.85 ± 1.764 mm, the F2 treatment group had an average hair length of 12.47 ± 0.03 mm, and the F3 treatment group had an average hair length of 13.74 ± 1.4192 mm. The formula groups 1, 2, and 3 had significant differences in meaning ($p<0.05$) with the control group. This shows that all henchman oil formulas have hair growth activity in white rats, with the F3 formula being the best formulation.

Table 6. Results of Observation of Rat Hair Weight

Test Group	Average Hair Weight (mg/cm2) ± SD
Control	32,125 ± 4.6636
Formula F1	38,025 ± 1.4728
Formula F2	40,325 ± 1.6460
Formula F3	43,175 ± 1,0013

The results of the ANOVA test showed a significant difference between groups with a sig value ($\alpha < 0.05$), meaning that the preparation had activity against hair thinness. The results of the calculation of hair weight statistics showed a significant difference between the control and formula F1, formula F2, and formula F3. This shows that all Spaceman oil formulas have activity against hair fragility, and the F3 formula is the best (Dewdney, 2018).

CONCLUSION

Based on the research on physical stability tests and activity on hair growth from the red chilli oil and VCO with varying concentrations, namely 1%, 2%, and 4%, it can be concluded that spaceman oil preparations containing chilli oil extract 1%, 2% and 4% show good physical stability at room temperature (25°± 2°C), low temperature (4° ± 2°C) and high temperature (40° ± 2°C) for 4 weeks, with a pH between 6-7, and organoleptically there is no change in colour, smell and aroma after being

stored for 4 weeks. Formula 1, 2 and 3 had significantly different hair growth activity compared to the controls in weeks 1, 2 and 3, with the best formula being a sample of formula 3 containing 4% chilli oil extract, whose hair growth activity scored the highest among other formulas. Diversifying processed VCO into hair-nourishing oil is hoped to improve the economy of coconut farmers and VCO-producing MSMEs in Banten Province.

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