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Clinical evaluation of dragon's blood sunscreen (*Daemonorops draco* (Willd.) Blume) as an antioxidant and ultraviolet (UV) protector

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Abstract

Background: Prolonged exposure to ultraviolet (UV) radiation from sunlight can cause various skin problems, including sunburn, hyperpigmentation, and premature aging. Natural-based sunscreens are an innovative alternative to synthetic sunscreens, which may have side effects such as irritation and allergic reactions. Dragon's blood (*Daemonorops draco* (Willd.) Blume) is known for its strong antioxidant properties due to its flavonoid content, which has the potential to be formulated as a sunscreen. This study aims to evaluate the clinical effectiveness of Dragon's blood sunscreen in providing UV protection and improving skin moisture and brightness.
Method: A clinical trial was conducted involving 30 volunteers aged 18–50 years with normal skin and no history of allergies or skin diseases. The study included irritation tests, hedonic evaluations, skin brightness assessments, moisture level analysis using a Skin Analyzer, and UV protection effectiveness using a UV Camera over 30 days. The statistical analysis was performed using One-Way ANOVA and Duncan's test for significant differences.
Results: The results showed that the Dragon's blood resin sunscreen exhibited significant UV protection, maintaining its effectiveness for 30 days. It also enhanced skin moisture and brightness compared to the control group. The hedonic test revealed high acceptability regarding color, texture, and aroma. The irritation test indicated no significant adverse reactions, confirming the product's safety.
Conclusion: Dragon's blood sunscreen has demonstrated excellent potential as an effective and safe natural alternative for UV protection, with added benefits of improving skin hydration and brightness. Further research is recommended to optimize its formulation for commercial use.

Keywords: Dragon's blood; Sunscreen; UV protection; Antioxidant; Skin hydration.

INTRODUCTION

Prolonged exposure to sunlight can cause negative effects on the skin (1). The main danger of sunlight comes from ultraviolet (UV) radiation, which in the electromagnetic spectrum is divided into three types: UV A (320-400 nm), UV B (290-320 nm), and UV C (200-290 nm). Skin problems that can arise from excessive UV exposure include sunburn, skin darkening, and the formation of dark spots on the skin (2).

One of the efforts to prevent the harmful effects of UV radiation is the use of sunscreen (3). The development of natural ingredient sunscreens has become an innovative solution considering the side effects of synthetic chemicals that can cause sunburn, irritation, and allergies (4). Sunscreens often contain antioxidants (5).

One of the plants in nature that has high antioxidant activity is dragon's blood. Dragon's blood is known to have antioxidant activity derived from the flavonoid content within it. The flavonoid compound identified as the active compound is dracorhodin. Dragon's blood (*Daemonorops draco* (Willd.) Blume) is one of the flagship plants considered to have sunscreen properties (6). Based on previous research, jernang has an antioxidant activity of 15.73 ppm, which means it has a very strong antioxidant content (7).

Based on the antioxidant activity of Dragon's blood, an innovation was created as

a sunscreen. One important aspect of using sunscreen is ensuring that the cream can retain skin moisture. Skin moisture is very important in cream formulations because it helps prevent dryness, maintain skin health, and support its elasticity. In addition, the use of sunscreen creams should also be able to improve hyperpigmentation, enhance the effectiveness of brightening creams, and prevent new lesions (8). Although based on its antioxidant activity, Dragon's blood has potential skin protection, its effectiveness in sunscreen formulations still requires further scientific validation through clinical trials.

Clinical trials are an important stage in the development of cosmetic and pharmaceutical products. Clinical trials are conducted to ensure the effectiveness (benefits) and safety of the product being researched that will be marketed or has already been marketed (9). In the case of red sandalwood sunscreen, clinical trials are necessary to assess its UV protection capability and its impact on the moisture and health of the user's skin.

This study focuses on the clinical testing of Dragon's blood (*Daemonorops draco* (Willd.) Blume) sunscreen cream to evaluate its effectiveness as an ultraviolet (UV) blocker and other additional benefits, namely to observe its effects on skin brightness and skin moisture.

METHOD

The tools used in this research are clinical test instruments including a Skin Analyzer (skin detector), UV Camera (Made in China), gauze (OneMed), Plaster (Hansaplast), and Human Skin Tones Set. The experimental subjects in this study were 30 volunteers (humans) aged 18 to 50 years, with normal skin, no history of allergies, and not suffering from skin diseases.

The irritation test was conducted on the inner arm of the volunteers. At 5. With a distance of approximately 1 cm using the patch tester technique. The test material was applied to the marked area, specifically on the right or left arm of 30 volunteers, and the skin at the application site was observed at 0, 24, 48, and 72 hours. The degree of irritation was assessed by scoring from 0 to 4 depending on the severity of the visible erythema and edema reactions on the skin. Without erythema: 0, very slight erythema (diameter < 25 mm): 1, erythema clearly visible (diameter 25.1-30 mm): 2, moderate erythema (diameter 30.1-35 mm): 3, severe erythema (dark red with eschar formation, diameter > 35 mm): 4. Without edema: 0, very little edema (almost not visible): 1, clearly defined edge edema (thickness < 1 mm): 2, moderate edema (edge raised approximately 1 mm): 3, severe edema (edge raised > 1 mm and extending beyond the application area): 4. During the assessment, volunteers are allowed to wash the application site with water without soap, detergent, or cosmetic products (10).

Hedonic or preference testing was conducted using an effective method by utilizing the five human senses with 30 volunteers. Based on the evaluation of the volunteers regarding the parameters of color, aroma, texture, and overall appearance of the jernang sunscreen cream preparation. The volunteers provided their opinions on the jernang sunscreen cream formulation through the provided questionnaire (11). Volunteers rated the parameters of color, aroma, texture, and overall appearance on a scale of 1 to 5. The rating scale is presented using numerical values accompanied by descriptive words, dislike: 1, somewhat dislike: 2, somewhat like: 3, like: 4, very much like: 5.

The skin brightness test was conducted by comparing the skin color of volunteers on the first day of sunscreen use with the skin color after 30 days of use, with observations made on days 0, 10, 20, and 30 using a human skin tones set measuring instrument consisting of 30 scales of skin color brightness levels, with the parameter showing a decrease in numbers after 30 days of use (12).

The skin moisture test was conducted by comparing the first day to the 30th day of using Dragon's blood sunscreen using a Skin Analyzer, observing the percentage of water and oil content in 30 volunteers alternately over 30 days, with observations made on days 0, 10, 20, and 30. Then, the skin

moisture on the first day of use and the thirtieth day of use was recorded, observed, and compared. With the parameters, there was an increase in moisture levels and a decrease in oil levels after 30 days of use (12).

The effectiveness test of sunscreen protection was conducted by applying the sunscreen preparation at 3 points with a distance of approximately 1 cm, then applying cream to the marked areas and observing the effectiveness of the sunscreen protection using a UV camera for 30 days, with observations made on days 0, 10, 20, and 30 to see if the sunscreen protection still lasts on day 30 (13).

Next, the data from the test results are analyzed statistically and descriptively. The data from the sunscreen protection effectiveness test were analyzed descriptively, while the data from the hedonic test, irritation test, moisture test, and brightness test were analyzed using One Way ANOVA, provided the data were normally distributed, followed by the Duncan test to determine the significance of the overall treatment differences. However, if the data is not normally distributed, the Kruskal-Wallis test is used.

RESULTS

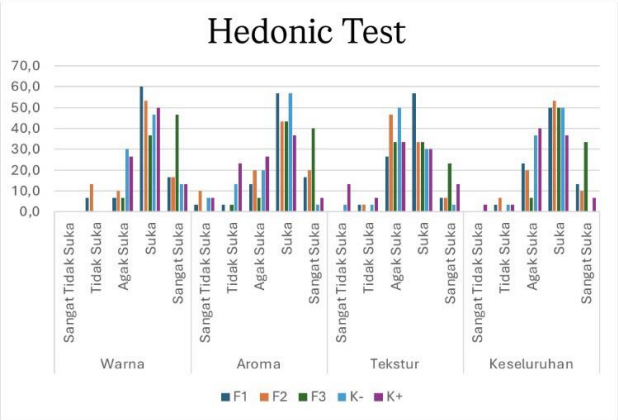

Figure 1. Hedonic Test Results Graph

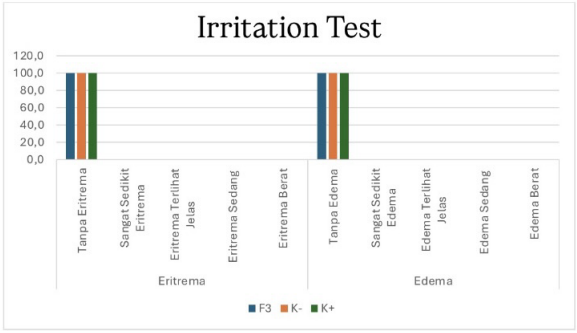

Figure 2. Irritation Test Results Graph

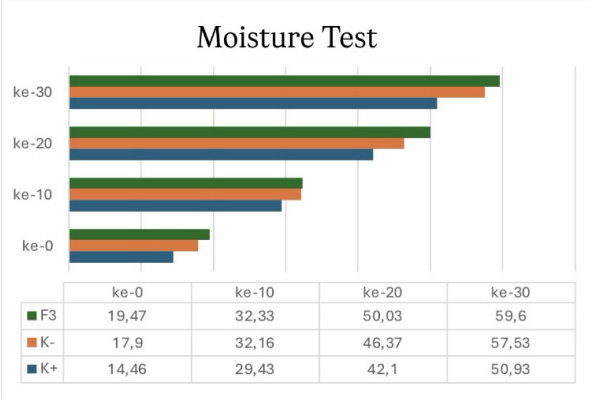

Figure 3. Moisture Test Result Graph

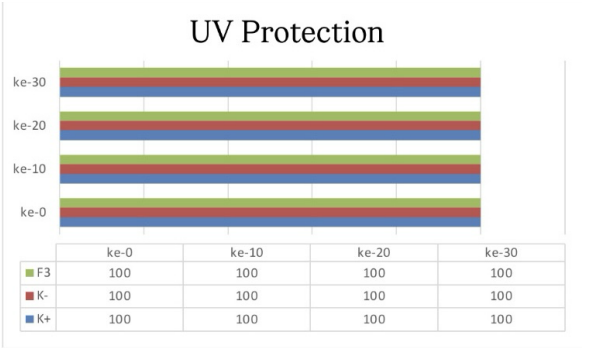

Figure 4. UV Protection Graph

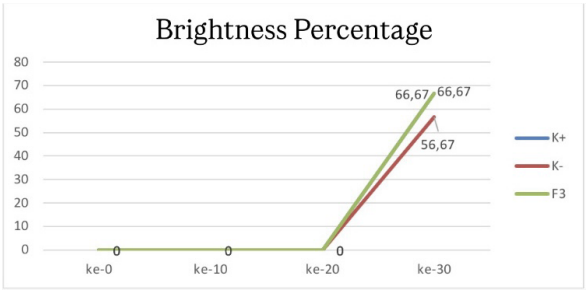

Figure 5. Percentage of Panelists Experiencing Skin Brighness

DISCUSSION

Hedonic testing is one of the steps taken in the evaluation process of the formulation. This hedonic test is conducted so that the results of the formulation obtained from the research receive feedback and suggestions regarding the quality of color, aroma, texture, and overall appearance not only from the researchers' subjective perspective (14). Based on the graph of the hedonic test results shown in Figure 1, the majority of the panelists gave positive evaluations of the tested sunscreen formulation. Formula F3 received the highest scores in terms of color, aroma, texture, and overall appearance compared to K+ (commercial sunscreen) and K- (base). In the color category, F3 received the highest percentage for the "Very Like" option (46.7%), which is statistically significant with a p-value <0.05, indicating that the formulated product influences color preference based on the panelists' assessment.

In terms of aroma, F3 also excelled with 40.0% of the panelists giving a "Very Like" rating. The OneWay ANOVA statistical test produced a p-value of <0.05, indicating that the formula used affects the level of preference for the sunscreen's aroma. Similarly, in the texture category, F3 received the highest score with 23.3% of panelists rating it as "Very Liked," and the statistical test results showed p<0.05, confirming that the formula affects the texture of the sunscreen.

Overall, F3 received the best rating with 33.3% of the panelists choosing "Very Much Like." Post-Hoc and One Way ANOVA test results with p < 0.05 confirm that the formula affects the overall appearance of the sunscreen. These findings are consistent with previous research indicating that formulations based on natural ingredients can enhance user preference for certain cosmetic preparations.

The evaluation of the irritation test on sunscreen cream aims to determine the skin's reaction after the use of the sunscreen cream. This evaluation is conducted by observing the onset of erythema and edema over a period of 48 hours. Skin irritation is characterized by the appearance of stinging, itching, and redness in the area where the cream is applied, usually occurring after a few minutes to 1 hour after application. Whereas an allergy is characterized by the appearance of irritation symptoms that spread to the area where the cream was applied, usually occurring 24-48 hours after the cream is used (15). Based on the irritation test result graph shown in Figure 2, there are no indications of irritation such as erythema and edema on the skin after the application of F3, K+, or K-. Statistical testing using the Kruskal-Wallis method yielded a p-value > 0.05, indicating that there is no significant difference in irritation levels between the tested formulas. Thus, formula F3 can be considered safe for application on the skin without causing adverse side effects.

The moisture testing aims to determine whether the application of sunscreen can provide a hydrating effect on the skin, which plays an important role in preventing skin damage such as dryness and cracking. The research results show that there was an increase in skin moisture over the 30-day observation period, with routine checks every 10 days. And this was done to see whether the sunscreen formulation still has the ability to hydrate the skin in addition to its primary function as a UV blocker, using 30 panelists. (16)

The result of the moisture test are considered very satisfactory. The consistent and significant increase in skin moisture indicates the effectiveness of formulation F3. Formula 3 (F3) showed the most significant increase in hydration compared to the other formulas. These results arw attributed to olive oil and moringa seed oil, both rich in oleic acid, which helps retain moisture, as well as niacinamide, which also acts as a powerful antioxidant and moisturizer. The statistical test (Paired T-Test) confirmed significance with a p-value < 0,05. These findings support previous research that confirmed the beneficial role of these ingredients in enhancing skin hydration. Our innovation aspect has successfully demonstrated dual functionality, not only acting as a UV protector but also as an effective skin moisturizer. These dual benefits enhance the product's

value and position it competitively in the skincare market. (17–19)

The formulation's ability to block UV rays was tasted using a UV Camera, with result showing that areas of skin coated with sunscreen appeared darker under the UV Camera. The research result indicate that both F3, the commercial sunscreen, and the base have the ability to block UV rays with a 100% protection level across all panelists. This protective effect is supported by the content of vegetable oils in the base and F3, which are known to have UV protection activity. In F3, the presence of dragon's blood provides additional UV protection, as confirmed by previous research showing that dragon's blood can enhance protection levels up to ultra. Meanwhile, commercial sunscreens use Zinc Oxide, which is a UV filter agent that reflects UV rays. The UV protection test result are very good. Formulation F3 is able to match the UV blocking ability of commercial sunscreens, which is an excellent result for a natural formulation. The use of dragon's blood significantly contributes to this result, confirming the strength of its active compounds. (1,20–22)

These findings are consistent with previous research that shows physical sunscreens, such as those containing Zinc Oxide, tend to reflect UV rays, whereas chemical sunscreens absorb more UV rays and convert them into heat. These results indicate that F3 has the same potential as commercial sunscreen in blocking UV rays. These result show that our innovation has reached a high level of development, capable of providinf protection equivalent to standard synthetic products, thus offering a viable natural alternative in the sunscreen industry. (13)

The brightness test was conducted to evaluate whether the sunscreen used could improve skin brightness levels. The research results show that after 30 days of application, 66.67% of panelists using F3 experienced an increase in skin brightness, whereas only 56.67% of panelists on the baseline experienced a similar effect. This effect is attributed to the presence of 4% niacinamide in F3, which has been proven in previous studies to have skin-brightening effects and reduce hyperpigmentation after eight weeks of use. In addition, Vitamin E in olive oil and moringa seed oil also plays a role in providing photoprotective and antioxidant effects that contribute to the improvement of skin brightness. (23–27)

The skin brightness result are very encouraging and show a significant improvement. A statistically significant improvement (p-value < 0,05) was observed after use, supporting the effectiveness or the active ingredients in F3. This indicates that the use of sunscreen with natural active ingredients, such as in F3, can contribute to an increase in skin brightness over a certain period. F3 ability to enhance brightness highlights the multifunctionality of our innovation, expanding its appeal not only as a sunscreen but also as a brightening skincare product, aligning with cunsumer expectations for versatile cosmetic product (28,29).

CONCLUSIONS

Based on the research results, sunscreen cream made from dragon's blood (*Daemonorops draco* (Willd.) Blume) has proven effective as an antioxidant and protector against ultraviolet (UV) rays. Clinical tests show that the developed formulation can increase skin moisture, prevent hyperpigmentation, and provide maximum protection against UV exposure. Additionally, the panelists' preference levels for the color, aroma, texture, and overall appearance of the cream were quite high, indicating the product's potential for widespread acceptance. No significant indications of skin irritation were found after use, so this cream is considered safe for regular application. This research reinforces the potential of using natural ingredients as an alternative in formulating effective and skin-friendly sunscreens.

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