Potential Test Of Jojoba Oil-Based Sunscreen In Lotion Preparations

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Abstract.
This study aimed to determine the formula of anti-aging cream using lemongrass leaf extract. The treatment by giving respondents lemongrass leaf extract and using moisture, evenness, pore, spot, and wrinkle as parameters. Human skin provides protection on the surface of the body against the influence of the surrounding environment. Skin can experience aging, especially in areas that are often exposed to direct sunlight such as the face, neck, upper arms, and hands. Aging is a process experienced by humans in their 30s whose functions in the human body are decreasing, for example, thinning skin, wrinkles, rough skin, and dark spots on the face. Treatment to prevent aging of the skin by using an antioxidant product such as flavonoids because it has the function of preventing or neutralizing free radicals. In Indonesia, several species of plants can be found that function as food and cosmetic ingredients. The lemongrass leaf extract which contains antiaging are Alkaloids, Flavonoids, and Tannins. The data were analysed by using the Kolmogorov-Smirnov method to determine homogeneity and normality. Then, if the data is normal, it is continued to be analysed using the One-Way ANOVA method to determine the average difference between groups. There is a difference between treatments, and it is continued with the Post-hoc Tukey HSD test. The higher the concentration of extract used, the greater the anti-aging productivity formed. It is concluded, the best anti-aging effect is a concentration of 9% with increase in moisture, evenness, pore reduction, reducing spots and wrinkles.

Keywords: *Extract of Lemongrass Leaves, Skin and Anti-aging cream.*

I. INTRODUCTION

Sunscreen is a substance that contains skin protection against sun exposure that can cause skin disorders. UV rays are known to have potential dangers to human skin and based on their influence on human health, UV rays are distinguished into 3 groups namely UV-A, UV-B, and UV-C. Ultraviolet A is a light that has a wavelength between 400 – 315 nm with the highest effectiveness at 340 nm, which can cause a brown color on the skin without causing redness. Ultraviolet B is a wavelength between 315–280 nm with the highest effectiveness at 297.6 nm, is an erythrogenic region, can cause solar shocks and early melanin formation reactions occur. Ultraviolet C is a beam with wavelengths below 280 nm, which can cause damage to skin tissue, but has largely filtered by ozone layer in the atmosphere.Antioxidants are chemical compounds that can contribute one or more electrons to free radicals, so that those free radicals can be muted [1]. Antioxidants can work by overcoming the effects of skin damage caused by free radicals which are the main factors in the aging process and damage to skin tissue. In the Journal of Cosmetics Dermatology, it is suggested that antioxidants can also serve as sunscreen. A product that can protect human skin from UV rays is sunscreen content [1]. Recently, the development of sunscreen leads to the use of natural materials because it is more readily accepted by society. This is due to the assumption that natural materials are safer to use and the negative impact is less than chemicals. Therefore, the use of natural materials that can lower sunlight radiation and increase protection against the negative effects of sunlight radiation on the skin became the focus in some studies [2].

Aging is a complex phenomenon defined as process that result produces aging and causes the ability to survive and decreases functional disorders Clear signs of skin aging are atrophy, weakness, wrinkles, sagging, dryness and many other stain pigments on the skin [3]. Antioxidant deficiencies in the body and skin cause faster aging. The cause is also an environmental factor. Therefore, the use of antioxidant-enhancing products should be considered. Exposure to sunlight is short, can increase the activity of enzymes that break down collagen and elastin proteins that provide structural support for the skin, so pretreatment of the skin with lotions containing active ingredients that can reduce the activity of this enzyme is highly recommended [3]. Jojoba (*Simmondsia Chinensis*) is a plant that is always green in various seasons. Jojoba plants can be extracted by extracting the seeds, these seeds will produce oils that can be used as natural

emollients. One of the advantages of jojoba oil is that it is soft and has a chemical structure similar to sebum. Jojoba oil (*Simmondsia Chinensis*) is very similar to composed with human natural skin oil. Jojoba oil is an excellent moisturizer and is ideal for all skin type problems whether acne or other skin. Jojoba oil (*Simmondsia Chinensis*) helps cure irritated skin conditions such as psoriasis or any form of dermatitis and helps control acne and oily scalp. Jojoba oil (*Simmondsia Chinensis*) contains miristat acid which is anti-inflammatory. Because the composition is similar to the skin oil itself, it is quickly absorbed and is excellent for dry skin as well as when the skin condition is inflamed. Jojoba oil also has antioxidant properties.Based on this description, jojoba oil has the potential to be sunscreen. But there has been no scientific research testing the activity of that potential. Therefore, research is needed to find out the activity of potential as sunscreen and calculate the value of SPF (Sun Protecting Factor) [4].

II. METHODS

Types, time and Research Designs

This research method was carried out experimentally. Research includes the krim manufacture of jojoba oil creams,pH tests, irritation tests, and in vitro determination of SPF (Sun Protection Factor) numbers using UV-Vis spectrophotometers.-Vis. Independent variable: jojoba oil concentrations of 1%, 5% and 10%, combination with oksibenzon and octyl metoximate, Dependent variable: SPF and Parameters: SPF, pH, Homogeneity, Irritation.

Research Tools and Materials

This research was conducted from July 2019 to August 2019 in the Laboratory of Cosmology and Physical Pharmacy Laboratory, Faculty of Pharmacy, University of North Sumatra. The tools used are laboratory glassware, UV-Vis spectrophotometer (Shimadzu UV 1800), analytical balance sheet (Boeco Germany), pH meter (Hanna Instruments), drip pipette, conduction, aluminum foil, parchment paper, tissue, mortar, stamfer, spatula and water bath. Research materials: 1,3-butilen glycol, Distilled water, 96% alcohol, stearicacid, Disodium Edetat, Trietanolamin, Oxybenzon, Octyl metoximate, Petrolatum, Setil alcohol, Glyceryl monostearate, Sodium metabisulfit, Nipagin, and Jojoba Oil.

Working Procedures

Cream base ready based on modified standard formula. Standard Formula According to Mitsui [5]: R/ 1.3-butilen glycol 7%, Titanium Dioxide 5%, Disodium Edetat 0.05%, Trietanolamin 1%, Octil metoximate 5%, Oksibenzon 2%, Squalane 10%, Petrolatum 5%, Stearil alcohol 3%, Stearic acid 3%, Glyceryl monostearat 3%, Polyacrylate ethyl 1%, Antioxidant q.s, Preservative q.s, Perfume q.s and distilled water ad 100%.Then modified into the following formula: R/ 1.3-butilen glycol 7%, Disodium edetat 0.05%, Trietanolamin 1%, Octilmetoksisinamat 5%, Oksibenzon 2%, Petrolatum 5%, Alcohol setil 3%, Stearic acid 3%, Glyceryl monostearat 3%, Sodium metabisulphite 0.1%, Nipagin 0.1% and distilled water ad 100%.

Modified Formula with Oil Concentration Modification

The modified formula is as follows:

F1 : blanko (cream base)
F2 : Cream base + Oksibenzon 2% + Octil metoximate 5%
F3 : Oksibenzon 2% + Octil toxic 5% + Jojoba oil 1%
F4 : Oksibenzon 2% + Octil toxic 5% + Jojoba oil 5%
F5 : Oksibenzon 2% + Octil toxic 5% + Jojoba oil 10%

Sunscreen Cream Making

The base of the cream to be made is the type of oil emulsion in water (m/a). The necessary materials include the water phase and the oil phase. The water phase consists of 1,3-butilen glycol, disodium edetat, nipagin, sodium metabisulfit, trietanolamin, distilled water. While the oil phase consists of stearic acid, glyceral monostearat, setil alcohol, oksibenzon and petrolatum. The material is weighed first, then the oil phase is melted over the water bath using a evaporation cup at a temperature ± 70-75^{o}C (mass I). The water phase is dissolved in heated distilled water (mass II). Mass II is inserted into the heated lumpang then slowly added mass I to it while constantly being constantly snared at a temperature of ± 70oC until it is obtained a

mass of cream andinserted octilmetoxosisinamat, snared until homogeneous then inserted jojoba oil and cream gerus until homogeneous [5].

Homogeneity Check

A certain number of arrangements are applied to a piece of glass or other transparent material, must indicate a homogeneous arrangement and no visible absence of coarse granules [8].

pH Size

Determination of pH of the available is carried out using the pH meter. The tool is first calibrated using a neutral standard (pH 7.01) and an acidic pH solution (pH 4.01) until the device shows the pH price. Electrodes are washed with distilled water, then dried with tissues. Samples are made in a concentration of 1% which is weighed 1 gram of preparation and dissolved in 100 ml of distilled water and then electrodes dipped in the solution. Left the tool shows the pH price until constant. The number indicated by the pH meter is the pH of the available.

Irritation Test

Irritation test is done by applying test conditions on the normal skin of the human to know whether or not irritation occurs on the skin. The technique used in this irritation test is an open paste test of 12 volunteers with the following criteria [6]: Able-bodied women, between 20-30 years old, no history of allergy-related illnesses and Willing to volunteer.This experiment was conducted using the highest concentration of jojoba oil which is 10%. Open paste test is carried out by applying the test set on a circle area 3cm in diameter, performed on the fold area of the elbow and left open for approximately 24 hours, observed skin reactions that occur. The observed reaction is the onion of erythema, papules, vesicles or edema. According to the Directorate General of POM [6], the signs for recording the paste test reaction are as follows:

1. No reaction 0
2. Erythema +
2. Erythema and papules ++
3. Erythema, papules and bubbles (vesicles) +++
4. Edema and bubbles (vesicles) ++++.

SPF Value Determination

Measurement of the SPF value of a sunscreen set can be done in vitro. The method of measuring SPF values in vitro is generally divided into two types. The first type is to measure the absorption or transmission of UV radiation through a layer of sunscreen products on quartz or bio membranous plates. The second type is to determine the characteristics of sunscreen absorption using spectrophotometric analysis of sunscreen dilution results tested with a spectrophotometer.The SPF value is calculated using the Mansur equation because it specifically calculates the absorbance at uvb wavelengths, as we know that SPF only shows protection against UVB rays, but at the time of measurement is done up to a wavelength of 400 nm as additional information about the absorption of the sample up to that wavelength. Sample absorption spectrum is obtained using a UV-Vis spectrophotometer at wavelengths of 290-400 nm with 96% alcohol as a blanko, the absorption value is recorded at intervals of 5 nm at wavelengths of 290-320 nm and intervals of 10 nm wavelengths of 320-400 nm. The absorption value obtained is multiplied by EE x I for each interval. The EE x I value and correction factor are a constant where the EE x I value of the wavelength is 290-320 nm and each difference of 5 nm and correction factor 10 [7].

pH Measurement

Determination of pH of the available is carried out using the pH meter. The tool is first calibrated using a neutral standard dapar solution (pH 7.01) and an acidic pH solution (pH 4.01) until the device shows the pH price. Electrodes are washed with distilled water, then dried with tissues. Samples are made in a concentration of 1% which is weighed 1 gram of preparation and dissolved in 100 ml of distilled water and then electrodes dipped in the solution. Left the tool shows the pH price until constant. The number indicated by the pH meter is the pH of the available [13].

Data Analysis

Measurements are performed with the same treatment 6 times for each formula. To determine the difference in meaningful SPF values between formulas, statistical tests were conducted using the ANOVA (Analysis of Variance) method with the SPSS (Statistical Package for the Social Sciences) program with a 95% level of trust.

III. RESULT AND DISCUSSION

Sunscreen Cream Making

The sunscreen cream is made using Mitsui sunscreen cream standard formula [5], the formula is modified with the addition of jojoba oil as the active ingredient as well as without the use of titanium dioxide. The concentration of jojoba oil used is 1%, 5%, and 10%. The color of the sunscreen cream produced in Formula 1 is white, while Formula 2 to Formula 5 (with the addition of oksibenzon and octyl metoksisinamat as well as various concentrations of jojoba oil) is white.

Homogeneity Check

Homogeneity testing is carried out by applying the available on a piece of glass or other transparent material, the arrangement must show a homogeneous arrangement and no visible absence of coarse granules [8]. From experiments conducted on all formulas of sunscreen cream is not obtained rough granules on pieces of glass.

Measurement of pH Value

The stability of the cream can also be seen from the pH value obtained by the available during storage. The average measurement of the pH of the cream's available can be seen in Table 3.1 as follows:

Table 3.1 Preliminary pH results on sunscreen cream when finished

Formula	Ph			
	I	II	III	Average
F1	6,9	7,0	7,0	6,90
F2	7,0	7,0	7,0	7,00
F3	6,9	7,0	6,9	6.93
F4	6,9	7,0	6,8	6,90
F5	6,9	6,8	6,9	6,87

Description:

F1 : blanko (cream base)

F2 : Cream base + Oksibenzon 2% + Octil metoximate 5%

F3 : Oksibenzon 2% + Octil toxic 5% + Jojoba oil 1%

F4 : Oksibenzon 2% + Octil toxic 5% + Jojoba oil 5%

F5 : Oksibenzon 2% + Octil toxic 5% + Jojoba oil 10%

From Table 3.1 it appears that jojoba oil shows a pH range corresponding to the physiological pH of the skin's "acid coat" of 4.5-7.0 so that it is not at risk of causing a negative reaction to the skin.

Irritation Test

This test is done to determine whether or not the irritation reaction is carried out an irritation test on the skin i.e., a paste test. Paste test is an irritation test conducted for the purpose of knowing whether the test is irritating or not [6]. Paste test is carried out for ± 24 hours and then observed the reaction that occurs.

Table 3.2 Skin Irritation Testing Data

Volunteer	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Response	0	0	0	0	0	0	0	0	0	0	0	0

Description: No reaction 0 Erythema

\+

Erythema and papules ++

Erythema, papules and bubbles (vesicles) +++

Edema and bubbles ++++

Based on the results of irritation tests conducted against volunteers above Formula 5 does not give an irritant reaction so it is safe to use. It can then be concluded that F1 to F5 also does not cause irritation to the skin and can be said that the entire set of sunscreen creams is safe to use.

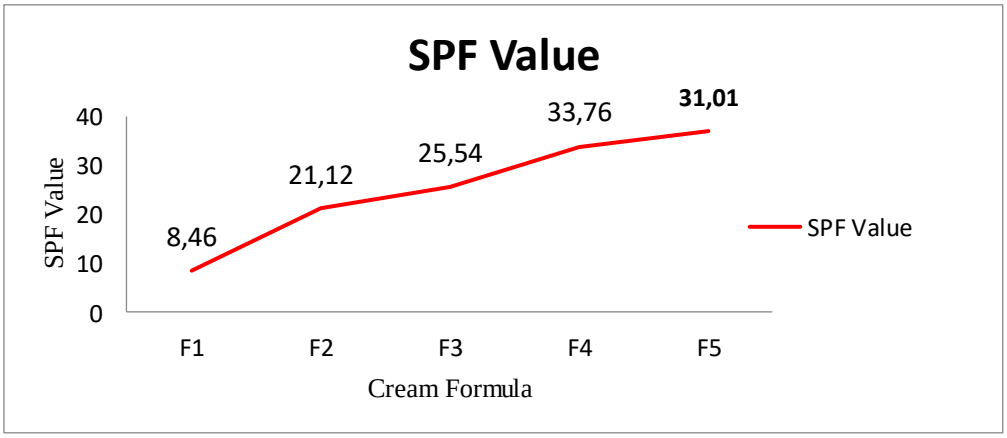
SPF Scoring

SPF determination is done in vitro using UV-Vis spectrophotometer by means of cream resolving on solvents and then measured and obtained absorbance. The absorbance of each set is then incorporated into the calculation of the Mansur equation. The results of mansur equation calculation can be seen in Appendix.

Table 3.3 Average results of Sun Protection Factor (SPF) values and their categories

Formula	SPF Value						Average SPF value	Category SPF
F1	8,45	8,44	8,52	8,46	8,45	8,44	8,46	Maximum
F2	20,87	21,16	21,03	21,32	21,18	21,14	21,12	Ultra
F3	25,72	24,91	25,63	25,68	25,65	25,63	25,54	Ultra
F4	35,70	35,74	35,27	35,28	35,22	35,33	33,76	Ultra
F5	36,86	36,85	37,08	37,21	37,35	36,71	37,01	Ultra

Figure 3.1 Graph of the effect of jojoba oil concentration on the SPF value of sunscreen cream.



The result of calculating the sun protection factor (SPF) value refers to the Mansur method, it can be concluded that the higher the concentration of jojoba oil used, the higher the SPF value obtained. Meanwhile, the category of sun protection factors according to Wasitaatmadja [9] is as follows:

1. At a minimum, when the SPF is between 2-4
2. Medium, when the SPF is between 4-6
3. Extras, when the SPF is between 6-8
4. Maximum, when the SPF is between 8-15
5. Ultra, when the SPF is more than 15

From Table 3.3 and Figure 3.1 it can be seen that F1 (cream base) has a value of 8.46 where this SPF value shows the effect of protection against UV-B rays. This is because the minimum protection value against UV-B rays is 2. Oxybenzone and octyl are good UV B absorbing synapses. The two active substances are the ingredients most widely used in sunscreen cells around the world [10].The addition of jojoba oil also increases the SPF value significantly when compared to F1 and F2. This is because jojoba oil contains vitamin E which is antioxidant. Vitamin E is highly effective against free radical damage caused by UV-B rays. Vitamin E absorbs strongly in the UV-B region of 280-320 nm. It can therefore act as photoprotective sunscreen in skin cell membranes. Alpha-tocopherol and its acetate derivatives have been shown to act as UV sunscreen photo protectants by the free radical reduction flushing mechanism [11].Topical use of vitamin E can reduce erythema, risk of skin cancer, as well as premature aging of the skin of mice radiated with ultraviolet light Topical use of vitamin E also prevents DNA damage that triggers the onion of skin cancer due to ultraviolet light radiation in the skin of mice. Photoprotective properties of vitamin E have also been shown to inhibit the onion of melanogenesis in the skin [12].

Statistical Test

After a statistical test was carried out on the SPF value of the preparation using One Way Anova, a significance value of 0.000 was obtained, so it can be concluded that there is a significant difference with a probability smaller than 0.05 between each formula with the difference in the concentration of added jojoba oil. Based on the results of the post-Hoc test using the Tukey method, there is a significant difference in the SPF value between each formula with the addition of jojoba oil in different concentrations. F5 with a jojoba oil concentration of 10% gave the highest average SPF value when compared to other formulas, namely 37.01. In this study it can be concluded that the greater the concentration of jojoba oil added, the greater the SPF value obtained. This shows that jojoba oil can increase the SPF value of sunscreen preparations combined with oxybenzone and octyl methoxycinnamate.

IV. CONCLUSION

The addition of jojoba oil can increase the effectiveness of the combination of oxybenzone and octylmetoxycinamate sunscreen in cream preparations, where the average SPF value of F1 (blank) is 8.46; F2 (blank + 2% oxybenzone + 5% octyl methoxycinnamate) has an average SPF value of 21.12; F3 (1% jojoba oil) has an average SPF value of 25.54; F4 (5% jojoba oil) has an average SPF value of 33.76; and F5 (10% jojoba oil) has an average SPF value of 37.01. The addition of jojoba oil in various concentrations gave a significant difference in increasing the SPF value between each formula combined with oxybenzone and octylmetoxycinamate.It is recommended that researchers further test the effect of adding jojoba oil in the sunscreen cream formula so that the results can be compared.

V. ACKNOWLEDGMENTS

The authors are grateful to the Head of the Master Program of Biomedicine, Faculty of Medicine, Universitas Prima Indonesia, Medan. We also thank the thesis supervisors for their invaluable advice. And also, thanks to the Chairperson Laboratory of Cosmology and Physical Pharmacy Laboratory, Faculty of Pharmacy, University of North Sumatra as a test site for jojoba oil samples.

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