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[JFIKI] Submission Acknowledgement

1 message

apt. Elida Zairina, S.Si., MPH., Ph.D. <jfiki@ff.unair.ac.id> Mon, Jun 26, 2023 at 11:47 PM
To: Antonius Budiawan <antonius.budiawan@ukwms.ac.id>

Antonius Budiawan:

Thank you for submitting the manuscript, "Sun Protective Factor Evaluation of Purslane (Portulaca grandiflora) Magenta Flower Variety Herbs Extract Cream Formula: Evaluasi Sun Protective Factor Formula Sediaan Krim Ekstrak Herba Krokot (Portulaca grandiflora) Varietas Bunga Magenta" to JURNAL FARMASI DAN ILMU KEFARMASIAN INDONESIA. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

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Reply-To: "apt. Elida Zairina, S.Si., MPH., Ph.D." <jfiki@ff.unair.ac.id>
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Sun Protective Factor Evaluation of Purslane (Portulaca grandiflora) Magenta Flower Variety Herbs Extract Cream Formula

1 message

Antonius Budiawan M.Farm. Apt. <antonius.budiawan@ukwms.ac.id> Mon, Jul 3, 2023 at 9:14 AM
To: jfiki@ff.unair.ac.id

Yth. Ibu Elida Zairina, S.Si., MPH., Ph.D., Apt.

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   has never been published in another journal and is originally the work of the authors.

2. The order of authors' names in the manuscript of **Jurnal Farmasi dan Ilmu Kefarmasian Indonesia (Pharmacy and Pharmaceutical Sciences Journal)** is as follows:

   1) Bida Cincin Kirana

   2) Erlien Dwi Cahyani

   3) Antonius Budiawan

Surabaya, ……

Best regards,

Author 1

Bida Cincin Kirana

Acknowledging,

Author 2

Erlien Dwi Cahyani

Author 3

Antonius Budiawan

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Conceptualization	Ideas; formulation or evolution of overarching research goals and aims	BCK, EDC, AB
Methodology	Development or design of methodology; creation of models	BCK, EDC
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Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs	BCK, EDC
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data	BCK, AB
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection	EDC, AB
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Funding acquisition	Acquisition of the financial support for the project leading to this publication	BCK

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Erlien Dwi Cahyani	NONE
Antonius Budiawan	NONE

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Bida Cincin Kirana, Erlien Dwi Cahyani, Antonius Budiawan

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Mobile Number:

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Novelty:
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This article explains the new finding of purslane (*Portulaca grandiflora*) magenta flower variety extract cream preparation as sunscreen

Statement:

This article has never been published in another journal publication

Place and Date:

Madiun, June 26th 2023

Best regards,
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Sun Protective Factor Evaluation of Purslane (*Portulaca grandiflora*) Magenta Flower Variety Herbs Extract Cream Formula

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[1]Department of Pharmacy Diploma III, Vocational Faculty, Universitas Katolik Widya Mandala Surabaya, Indonesia

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Abstract
Background*: Indonesia is an equatorial country which rich in sunlight all year. UV light is divided into three wavelength groups such as UV-A (320-400nm), UV-B (280-320nm), and UV-C (100-290nm). The UV-A light will be absorbed by intracell chromophores in skin cell membranes such as riboflavin, porphyrin, nicotinamide, and enzyme. The UV-B light penetrates the dermis layer and causes DNA structure changes which lead to wrinkles and rising skin cancer risk. Premature skin aging and skin cancer can be prevented with sunscreen preparation containing compounds that can protect the skin from UV radiation. Flavonoid is one of the purslane (Portulaca grandiflora) active metabolites which have the potency to develop as sunscreen.* ***Objective****: The research aimed to determine the ability of purslane (Portulaca grandiflora) magenta flower variety herbs extract cream as a sunscreen as indicated by the %Te, %Tp, and Sun Protective Factor value.* ***Methods****: This research was an experimental study with various purslane magenta flower variety herbs extract cream formulas that were tested for their %Te, %Tp, and SPF value with a UV-Vis spectrophotometer.* ***Results****: The sunscreen cream preparation with 2.5% of purslane (Portulaca grandiflora) magenta flower variety herb extract had %Te, %Tp, and SPF values of 25.86 ± 2.41%, 36.05 ± 2.82%, and 3.97 ± 0.35 respectively. While preparations with 5% concentration of extract had %Te, %Tp, and SPF values of 8.23 ± 0.86%, 16.65 ± 0.92%, and 8.03 ± 0.38 respectively.* ***Conclusion****: The sunscreen activity of all extract concentration creams was significantly different compared to the negative control (cream base) in all parameters.*

Keywords*: Sun Protective Factor; purslane; Portulaca grandiflora; magenta; cream.*

Abstrak
Pendahuluan: Indonesia merupakan negara yang berada di garis khatulistiwa sehingga memperoleh paparan sinar matahari sepanjang tahun. Sinar UV dikelompokkan berdasarkan panjang gelombangnya menjadi tiga yaitu UV-A (320-400nm), UV-B (280-320nm), dan UV-C (100-290nm). Sinar UV-A diserap kromofor intrasel pada membran sel kulit seperti riboflavin, porfirin, nikotinamida, dan enzim. Sinar UV-B menembus sampai lapisan dermis pada kulit akan menyebabkan terjadinya perubahan struktur DNA yang menyebabkan timbulnya kerutan dan meningkatkan resiko kanker kulit. Pencegahan penuaan dini serta kanker kulit dapat dilakukan dengan menggunakan sediaan tabir surya yang mengandung senyawa yang dapat melindungi kulit dari radiasi sinar UV. Salah satu kandungan aktif dari krokot adalah flavonoid, sehingga berpotensi dikembangkan sebagai tabir surya. **Tujuan**: Tujuan penelitian ini untuk mengetahui kemampuan sediaan krim ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta sebagai tabir surya yang ditunjukkan melalui nilai %Te, %Tp, dan *Sun Protective Factor*. **Metode**: Penelitian ini merupakan penelitian eksperimental dengan berbagai formulasi krim ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta yang diuji nilai %Te, %Tp, dan SPF menggunakan spektrofotometer UV-Vis. **Hasil**: Sediaan tabir surya ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta dengan kadar 2,5% memiliki nilai %Te, %Tp, dan SPF berturut-turut yaitu 25,86 ± 2,41%, 36,05 ± 2,82%, dan 3,97 ± 0,35. Sedangkan sediaan dengan kadar 5% memiliki nilai %Te, %Tp, dan SPF berturut-turut yaitu 8,23 ± 0,86%, 16,65 ± 0,92%, dan 8,03 ± 0,38. **Kesimpulan**: Aktivitas tabir surya seluruh formula krim ekstrak dan kontrol negatif (basis krim) memiliki perbedaan yang signifikan pada seluruh parameter.

Kata kunci: *Sun Protective Factor*; krokot; *Portulaca grandiflora*; magenta; krim.

INTRODUCTION

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One of the energy sources needed by living creatures is sunlight because of its involvement in every stage of the living process. For example, is vitamin D generation. Otherwise, sunlight overexposure also give a negative effect. Sunlight radiation consists of infrared light (wavelength > 760 nm), visible light (400-760 nm), and UV (ultraviolet) light consisting of UV-A (320-400 nm), UV-B (290-320 nm) as well as UV-C (200-290 nm) (Limpiangkanan & Limpiangkanan, 2010). UV-A and UV-B rays are radiation from sunlight that reaches the earth's surfaces and has an impact on the skin (Wang *et al*., 2008). The UV-A light that reaches the skin surface will be absorbed by intracell chromophores in cell membranes such as riboflavin, porphyrin, nicotinamide, and enzyme. This causes oxidative stress whereas Reactive Oxygen Species (ROS) production overwhelms the natural skin antioxidant mechanism leading to decreasing in collagen production and wrinkle appearance (Gragnani *et al*., 2014). The UV-B light that reaches the skin will be penetrating the dermis layer and cause DNA structure changes which lead to wrinkles and rising skin cancer risk (Matsuda *et al*., 2013).

Premature skin aging and skin cancer can be prevented with sunscreen preparation containing compounds that can protect the skin from UV radiation. The ability to protect skin from sunlight exposure showed by erythema transmission percentage (%Te), pigmentation transmission percentage (%Tp), and Sun Protective Factor (SPF). Commonly, plants rich with flavonoids have a high SPF value because of its chromophore chemical structure capable to absorb UV light radiation energy (Saewan & Jimtaisong, 2013). Besides that, flavonoids also have antioxidant activity to prevent oxidative stress so that premature skin aging and cancer risk can be prevented (Chen *et al*., 2012).

Purslane is a plant that has been studied for its health benefits because of its various secondary metabolites. Flavonoid is one of the purslane active metabolites which have the potency to develop as sunscreen. Purslane *Portulaca grandiflora* magenta flower variety has higher levels of flavonoids compared to other varieties making it suitable to be developed as a sunscreen (Budiawan *et al*., 2023).

Cream is topical preparation with a semi-solid emulsion system. This preparation is easy to use and gives a comfortable feeling in its application. In addition, with the right cream consistency, the extracts in sunscreen can stick long enough and provide sufficient time for the flavonoid compounds to be absorbed by the skin and provide a maximum sun protection effect.

MATERIALS AND METHODS

Materials

Fresh purslane (*Portulaca grandiflora*) magenta flower variety herb was obtained from Madiun regency, East Java, Indonesia. Ethanol 96% was used to extraction process. Ceto stearyl alcohol, stearic acid, cetyl alcohol, methylparaben, propylparaben, tween 80, and aqua destilata were used to make cream base preparation. Magnesium powder, HCl 2N, C_2H_5OH, NH_3, $CHCl_3$, Dragendorff, Mayer, Bouchardat, $FeCl_3$, H_2SO_4 concentrate, and methanol pro analysis were used as reagents.

Tools

Tools used in this experiment were Spectrophotometer UV-Vis (JaSCO V-730), rotary evaporator, water bath, analytical balance, and glassware (pyrex).

Method

Extract Preparation

Two hundred grams of dried purslane (*Portulaca grandiflora*) magenta flower variety herb was extracted with maceration method using 500 ml ethanol 96% for 5 days. The dregs were re-macerated using the same solvent for another 5 days. The first and second filtrates were then mixed and thickened with a rotary evaporator at 40°C until a thick extract was obtained.

Phytochemical Screening

1. Flavonoids Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was dissolved into water and transferred into a test tube. Magnesium metal and 5 drops of HCl 2N were added into the tube and then the mixture was heated for 5-10 minutes. After filtration, the filtrate waited until cool down and was added with amil alcohol and then shaken hardly. The reaction was positive if red color formed in amil alcohol layer (Harbone, 1987; Hanani, 2017).

2. Alkaloid Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract basified with 1 mL of ammonia, then added chloroform and crushed vigorously. The chloroform liquid was filtered, the filtrate was placed in a test tube then 2 N HCl was added, the mixture was shaken, then left to separate. In a separate test tube: Filtrate 1: As much as 1 drop of Dragendorff reagent solution is dropped into the filtrate, the presence of alkaloids is indicated by the formation of precipitate or turbidity that is colored brown. Filtrate 2: As much as 1 drop of Mayer's reagent solution is dripped into the filtrate, the presence of alkaloids is indicated by the formation of a white precipitate or turbidity. Filtrate 3: As a blank or negative control (Harbone, 1987; Hanani, 2017).

3. Saponin Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put in a test tube, added hot water and cooled, then shaken for 10 seconds, a stable foam will form in less than 10 minutes, 1-10 cm high, and with the addition of 1 drop of HCl The 2N foam was persistence which indicated the presence of saponins (Harbone, 1987; Hanani, 2017).

4. Tannin Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put into a test tube and reacted with FeCl3 1% solution. The extract contains tannins if a green-black or dark-blue color was formed (Harbone, 1987; Hanani, 2017).

5. Terpenoid Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put into a test tube and added with chloroform and H2SO4 concentrated. The extract contains terpenoids if a brown color was formed (Harbone, 1987; Hanani, 2017).

Cream Preparation

The preparation of this research cream was based on the Arisca formula (2018) with minor modifications.

Table 1. Purslane magenta flower variety herb extract cream formula

Ingredients	Negative Control Formula (%)	2,5% Extract Formula (%)	5% Extract Formula (%)
Ceto stearyl alcohol	7	7	7
Stearic acid	7	7	7
Cetyl alcohol	6	6	6
Nipagin	0.15	0.15	0.15
Nipasol	0.05	0.05	0.05
Purslane extract	-	2.5	5
Tween 80	0.5	0.5	0.5
Aqua destilata ad	100	100	100

Each material was measured and the oil phase (ceto stearyl alcohol, cetyl alcohol, stearic acid, and propylparaben) was mixed. The water phase (tween 80 and methylparaben) was mixed. Both phases were heated with a water bath until dissolved. Cream preparation was done by adding the hot water phase to the hot oil phase and the mixture stirred until a cold cream base formed. The purslane (*Portulaca grandiflora*) magenta flower variety herb extract was added to the cream base and stirred until a homogeneous cream was formed.

Sunscreen Activity Test

The sunscreen activity test was carried out by determining the SPF value in vitro using the UV-Vis spectrophotometry method. The purslane magenta flower variety herbs extract cream was dissolved into methanol pro analysis to obtain a 1000 ppm concentration of test solution. After that, the test solution transmission was read at 292.5 – 372.5 nm wavelength (every 5 nm interval). The amount of erythema flux that was transmitted by the sunscreen agent (Ee) is calculated by the formula: $Ee = \Sigma T.Fe$ while the pigmentation flux is calculated by the formula: $Ep = \Sigma T.Fe$. %Te and %Tp value calculated by formula $\%Te = Ee/\Sigma Ee$ and $\%Tp = Ep/\Sigma ep$ (Cumpelick, 1927). SPF value measurement was done by reading the test solution absorbance at 290-320 nm wavelength with 5 nm interval (Mansur *et al*., 1986; Mishra *et al*., 2012) (Table 2).

Table 2. Value of EE x I

λ (nm)	EE x I
290	0.015

295	0,0817
300	0,2874
305	0,03278
310	0,1864
315	0,0839
320	0,018

Data Analysis

The %Te, %Tp, and SPF values were analyzed statistically using one-way ANOVA analytical method with $\alpha = 0.05$ and followed by post hoc test.

RESULTS AND DISCUSSION

Fresh purslane (*Portulaca grandiflora*) magenta flower variety herb dried and extracted using maceration method until 5.51 gram thick extract was obtained with 10.64% of yield (Table 3).

Table 3. Purslane (*P. grandiflora*) magenta flower variety herb extract yield

Simplicia	Powder weight (g)	Extract weight (g)	Yield (%)
Purslane magenta flower variety herb	51.78	5.51	10.64

The next step was qualitative phytochemical identification of obtained extract. The phytochemical screening result is explained in Table 4.

Table 4. Purslane (*P. grandiflora*) magenta flower variety herb extract phytochemical screening

Test	Reagent	Result
Flavonoid	Mg powder + HCl 2N + C_2H_5OH	+
Alkaloid	NH_3+$CHCl_3$+HCl 2N+ Dragendorff/ Mayer/ Bouchardat	+
Saponin	Foam test	+
Tannin	$FeCl_3$	+
Terpenoid	H_2SO_4 concentrate + $CHCl_3$	+

The purslane extract was used as an active ingredient in cream preparation with 2.5% and 5% concentration variations. Cream preparation was chosen because it has benefits such as being easy to use, comfortable, and easy to wash with water. Cream also has various functions as a drug carrier, skin emollient, and to protect skin from different interference including sunlight.

Sunscreen preparation could contain active ingredients in an inorganic compound (reflect UV radiation) and an organic compound (absorb UV radiation). The purpose of sunscreen application is not only to protect the skin from UV rays exposure which can trigger negative effects but also it's expected to inhibit ROS formation which trigger gene mutations, premature aging, and carcinogenic effect in the long term. Therefore, active antioxidant compounds are needed in sunscreen preparations that can help increase the physical activity of sunscreen. Purslane (*Portulaca grandiflora*) magenta flower variety herb extract contains various secondary metabolites and has antioxidant activity (Addor *et al*., 2022).

The cream sunscreen activity is determined from the percentage of erythema transmission (% Te), the percentage of penetration transmission (% Tp), and the Sun Protective Factor (SPF) value as follows:

Table 5. Cream preparation %Te value

Replication	Value of %Te (%)		
	Negative Control (Cream Base)	2.5% Extract	5% Extract
I	97,56	27,36	8,97
II	90,28	23,08	8,44
III	93,06	27,14	7,29
Mean	93,64 ± 3,67	25,86 ± 2,41	8,23 ± 0,86

The percent erythema transmission value (%Te) describes the amount of UV rays exposure from the sun that hits the skin after using sunscreen, which causes erythema (redness) on the skin (Chen *et al*., 2012). The lower the % Te value, the better the sunscreen protection to prevent erythema. Based on Table 5 it can be observed that the highest % Te was in the negative control (preparation basis) which was 93.64 ± 3.67%, followed by preparations containing 2.5% extract which was 25.86 ± 2.41%, and the lowest was the preparation with 5% extract which was 8.23 ± 0.86%. Based on the statistical test results, it showed that there was a significant difference in the % Te value both in the negative control, preparations with 2.5% and 5% extract. This shows that the extract concentration determines the erythema transmission value of sunscreen preparations.

Table 6. Cream preparation %Tp value

Replication	Value of %Tp (%)		
	Negative Control (Cream Base)	**2.5% Ekstrak**	**5% Extract**
I	98.29	36.69	17.46
II	91.49	32.96	16.83
III	95.66	38.49	15.65
Mean	95.15 ± 3.43	36.05 ± 2.82	16.65 ± 0.92

The percentage value of pigmentation transmission (% Tp) describes the amount of exposure to UV rays from the sun that hits the skin after using sunscreen, which causes pigmentation of the skin. As with % Te, the lower % Tp value indicates better protection of sunscreen against pigmentation on the skin. Based on Table 6, shows that the highest % Tp was in the negative control (preparation basis) which was 95.15 ± 3.43, followed by preparations containing 2.5% extract which was 36.05 ± 2.82, and the lowest is a preparation with 5% extract, namely 16.65 ± 0.92. Based on the results of statistical tests, showed that there was a significant difference in the % Tp value both in the negative control, preparations with 2.5% and 5% extract with a $p>0.05$. This shows that the extract concentration in preparation determines the pigmentation transmission value of the sunscreen preparation.

Table 7. Cream preparation SPF value

Replication	Value of SPF		
	Negative Control (Cream Base)	**2.5% Ekstrak**	**5% Extract**
I	0.18	3.84	7.83
II	0.16	3.71	8.47
III	0.19	4.37	7.79
Mean	0.18 ± 0.02	3.97 ± 0.35	8.03 ± 0.38

The SPF value states how many times the skin's natural resistance is multiplied so that it is safe in the sun without experiencing sunburn16. Based on the test result, the SPF value also shows an increasing trend with increasing extract concentration in the preparation. Based on Table 7 it can be seen that the lowest SPF value was in the negative control (preparation base) which was 0.18 ± 0.02, followed by preparations containing 2.5% extract which was 3.97 ± 0.35, and those containing the highest was the preparation with 5% extract, namely 8.03 ± 0.38. Based on the results of statistical tests, it showed that there was a significant difference in the SPF value both in the negative control, preparations with extracts of 2.5% and 5% with $p>0.05$. This shows that the extract concentration determines the SPF value of the sunscreen preparation.

Based on these results, a cream preparation containing 5% purslane herb extract had a higher % Te and % Tp value compared to preparations containing 2.5% purslane herb extract. At the % Tp value, both preparations showed the most maximum protection which was in the sunblock category, while based on % Te the protection was still in the tanning and suntan categories (Kasitowati *et al*., 2021). To obtain better protection based on the % Te value, a higher extract content is needed in the preparation.

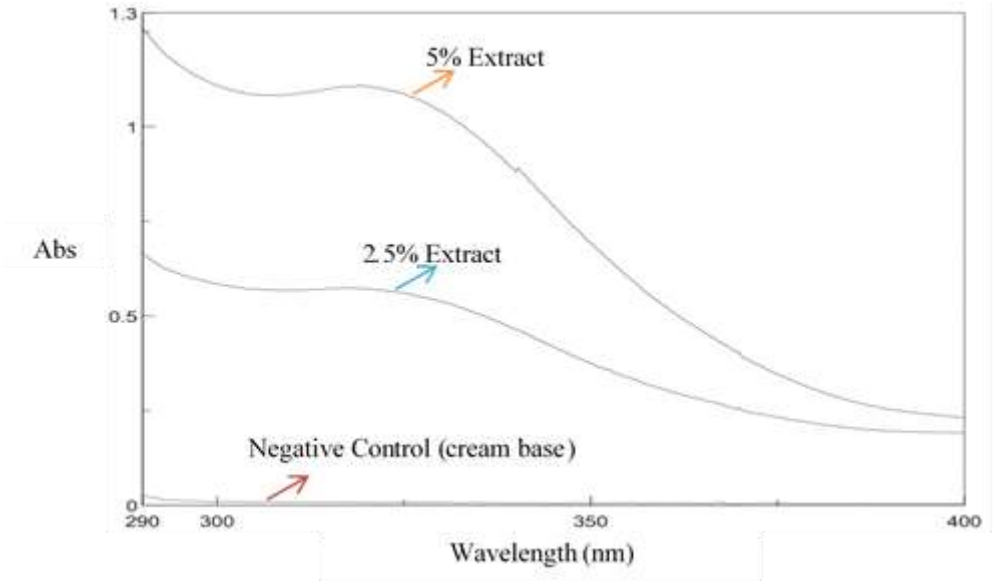

Figure 1. Preparation absorbance spectra at 290-400 nm wavelength

The potential for sunscreen activity can be expressed through the value of the Sun Protective Factor (SPF). The SPF value is determined from the absorption results of the preparation at UV wavelengths between 290 – 400 nm (Figure 1). Based on the research results, it was obtained that the SPF value of cream preparations containing 2.5% and 5% of purslane herb extract were 3.97 ± 0.35 and 8.03 ± 0.38, respectively. Both of these SPF values are less than 12 which was in the minimal protection category. This SPF value is not optimal for providing protection, because, with an SPF value of less than 15, protection is only given for 1.5 hours (Buso *et al*., 2017).

Statistical tests were carried out to determine whether there were differences in sunscreen activity in each preparation. Based on statistical tests using one-way ANOVA, a significance value of <0.05 was obtained for both the %Te, %Tp, and SPF values. This means that the sunscreen activity is determined by the purslane herb extract concentration in the preparation. The higher the extract concentration in the preparation, the better the sunscreen protection will be.

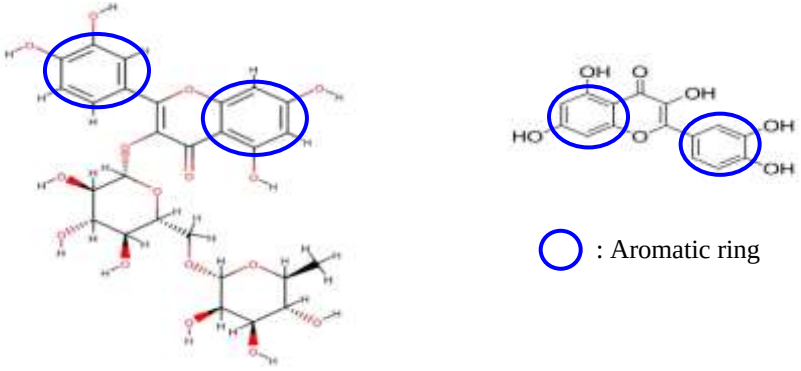

Figure 2. Structure of flavonoid A: rutin, B: kuersetin (Ganeshpurkar *et al*., 2017; El-Saber Batiha *et al*., 2020)

Flavonoids are compounds contained in purslane herb extracts that are thought to have sunscreen activity (Cahyani *et al*., 2022). Flavonoids can absorb energy at UV light wavelengths because they have covalent bonds in their structure. Flavonoids can absorb energy at a wavelength of 240-290 nm, and flavonoids that have conjugated covalent bonds can absorb at a wavelength of up to 550 nm (He *et al*., 2021). Magenta flower variety purslane herb contains the largest amount of flavonoids compared to other variants, therefore this study used extracts from purslane herb with the magenta flower variant. Flavonoids contained in purslane (*Portulaca grandiflora*) herb are rutin, quercetin, and isoquercetin compounds (Husein *et al*., 2021). Flavonoids have at least 2 aromatic rings with a basic carbon skeleton consisting of 15 C atoms forming C6-C3-C6 (Figure 2) (Julianto, 2019).

CONCLUSION

The sunscreen cream preparation with 2.5% of purslane (*Portulaca grandiflora*) magenta flower variety herb extract had %Te, %Tp, and SPF values of 25.86 ± 2.41%, 36.05 ± 2.82%, and 3.97 ± 0.35 respectively. While preparations with 5% concentration of extract had %Te, %Tp, and SPF values of 8.23 ± 0.86%, 16.65 ± 0.92%, and 8.03 ± 0.38 respectively. The sunscreen activity of all extract concentration creams was significantly different compared to the negative control (cream base) in all parameters.

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[JFIKI] Editor Decision

1 message

Jurnal Farmasi dan Ilmu Kefarmasian Indonesia <jfiki@ff.unair.ac.id> Sun, Dec 17, 2023 at 2:35 PM
To: bida.cincin.kirana@ukwms.ac.id, antonius.budiawan@ukwms.ac.id

Dear Author(s),

We have received the reports from our reviewers on your manuscript, "Sun Protective Factor Evaluation of Purslane (Portulaca grandiflora) Magenta Flower Variety Herbs Extract Cream Formula: Evaluasi Sun Protective Factor Formula Sediaan Krim Ekstrak Herba Krokot (Portulaca grandiflora) Varietas Bunga Magenta", submitted to JURNAL FARMASI DAN ILMU KEFARMASIAN INDONESIA.

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Please submit your contribution as editable source files (i. e. Word) with yellow highlights on the revised part/section in the manuscript (without tracked changes) and submit your revised manuscript online by using the JFIKI system. Also, submit your resp onse to the reviewers' comments online as a separate submission item and addressing each point from the reviewer's comments (and editor comments, if any) in the Comment & Response table.

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Thank you very much.

With kind regards,
Editorial Team.

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REVIEWER I

Protective Factor Evaluation of Purslane (*Portulaca grandiflora*) Magenta Flower Variety Herbs Extract Cream Formula

Abstract

Background*: Indonesia is an equatorial country which rich in sunlight all year. UV light is divided into three wavelength groups such as UV-A (320-400nm), UV-B (280-320nm), and UV-C (100-290nm). The UV-A light will be absorbed by intracell chromophores in skin cell membranes such as riboflavin, porphyrin, nicotinamide, and enzyme. The UV-B light penetrates the dermis layer and causes DNA structure changes which lead to wrinkles and rising skin cancer risk. Premature skin aging and skin cancer can be prevented with sunscreen preparation containing compounds that can protect the skin from UV radiation. Flavonoid is one of the purslane (Portulaca grandiflora) active metabolites which have the potency to develop as sunscreen.* ***Objective****: The research aimed to determine the ability of purslane (Portulaca grandiflora) magenta flower variety herbs extract cream as a sunscreen as indicated by the %Te, %Tp, and Sun Protective Factor value.* ***Methods****: This research was an experimental study with various purslane magenta flower variety herbs extract cream formulas that were tested for their %Te, %Tp, and SPF value with a UV-Vis spectrophotometer.* ***Results****: The sunscreen cream preparation with 2.5% of purslane (Portulaca grandiflora) magenta flower variety herb extract had %Te, %Tp, and SPF values of 25.86 ± 2.41%, 36.05 ± 2.82%, and 3.97 ± 0.35 respectively. While preparations with 5% concentration of extract had %Te, %Tp, and SPF values of 8.23 ± 0.86%, 16.65 ± 0.92%, and 8.03 ± 0.38 respectively.* ***Conclusion****: The sunscreen activity of all extract concentration creams was significantly different compared to the negative control (cream base) in all parameters.*

Keywords*: Sun Protective Factor; purslane; Portulaca grandiflora; magenta; cream.*

Abstrak

Pendahuluan: Indonesia merupakan negara yang berada di garis khatulistiwa sehingga memperoleh paparan sinar matahari sepanjang tahun. Sinar UV dikelompokkan berdasarkan panjang gelombangnya menjadi tiga yaitu UV-A (320-400nm), UV-B (280-320nm), dan UV-C (100-290nm). Sinar UV-A diserap kromofor intrasel pada membran sel kulit seperti riboflavin, porfirin, nikotinamida, dan enzim. Sinar UV-B menembus sampai lapisan dermis pada kulit akan menyebabkan terjadinya perubahan struktur DNA yang menyebabkan timbulnya kerutan dan meningkatkan resiko kanker kulit. Pencegahan penuaan dini serta kanker kulit dapat dilakukan dengan menggunakan sediaan tabir surya yang mengandung senyawa yang dapat melindungi kulit dari radiasi sinar UV. Salah satu kandungan aktif dari krokot adalah flavonoid, sehingga berpotensi dikembangkan sebagai tabir surya.**Tujuan**: Tujuan penelitian ini untuk mengetahui kemampuan sediaan krim ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta sebagai tabir surya yang ditunjukkan melalui nilai %Te, %Tp, dan*Sun Protective Factor*.**Metode**: Penelitian ini merupakan penelitian eksperimental dengan berbagai formulasi krim ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta yang diuji nilai %Te, %Tp, dan SPF menggunakan spektrofotometer UV-Vis.**Hasil**: Sediaan tabir surya ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta dengan kadar 2,5% memiliki nilai %Te, %Tp, dan SPF berturut-turut yaitu 25,86 ± 2,41%, 36,05 ± 2,82%, dan 3,97 ± 0,35. Sedangkan sediaan dengan kadar 5% memiliki nilai %Te, %Tp, dan SPF berturut-turut yaitu 8,23 ± 0,86%, 16,65 ± 0,92%, dan 8,03 ± 0,38.**Kesimpulan**: Aktivitas tabir surya seluruh formula krim ekstrak dan kontrol negatif (basis krim) memiliki perbedaan yang signifikan pada seluruh parameter.

Kata kunci: *Sun Protective Factor*; krokot; *Portulaca grandiflora*; magenta; krim.

INTRODUCTION

One of the energy sources needed by living creatures is sunlight because of its involvement in every stage of the living process. For example, is vitamin D generation. Otherwise, sunlight overexposure also give a negative effect.

Sunlight radiation consists of infrared light (wavelength > 760 nm), visible light (400-760 nm), and UV (ultraviolet) light consisting of UV-A (320-400 nm), UV-B (290-320 nm) as well as UV-C (200-290 nm) (Limpiangkanan & Limpiangkanan, 2010). UV-A and UV-B rays are radiation from sunlight that reaches the earth's surfaces and has an impact on the skin (Wang *et al*., 2008). The UV-A light that reaches the skin surface will be absorbed by intracell chromophores in cell membranes such as riboflavin, porphyrin, nicotinamide, and enzyme. This causes oxidative stress whereas Reactive Oxygen Species (ROS) production overwhelms the natural skin antioxidant mechanism leading to decreasing in collagen production and wrinkle appearance (Gragnani *et al*., 2014). The UV-B light that reaches the skin will be penetrating the dermis layer and cause DNA structure changes which lead to wrinkles and rising skin cancer risk (Matsuda *et al*., 2013).

Premature skin aging and skin cancer can be prevented with sunscreen preparation containing compounds that can protect the skin from UV radiation. The ability to protect skin from sunlight exposure showed by erythema transmission percentage (%Te), pigmentation transmission percentage (%Tp), and Sun Protective Factor (SPF). Commonly, plants rich with flavonoids have a high SPF value because of its chromophore chemical structure capable to absorb UV light radiation energy (Saewan & Jimtaisong, 2013). Besides that, flavonoids also have antioxidant activity to prevent oxidative stress so that premature skin aging and cancer risk can be prevented (Chen *et al*., 2012).

Purslane is a plant that has been studied for its health benefits because of its various secondary metabolites. Flavonoid is one of the purslane active metabolites which have the potency to develop as sunscreen. Purslane *Portulaca grandiflora* magenta flower variety has higher levels of flavonoids compared to other varieties making it suitable to be developed as a sunscreen (Budiawan *et al*., 2023).

Cream is topical preparation with a semi-solid emulsion system. This preparation is easy to use and gives a comfortable feeling in its application. In addition, with the right cream consistency, the extracts in sunscreen can stick long enough and provide sufficient time for the flavonoid compounds to be absorbed by the skin and provide a maximum sun protection effect.

MATERIALS AND METHODS

Materials

Fresh purslane (*Portulaca grandiflora*) magenta flower variety herb was obtained from Madiun regency, East Java, Indonesia. Ethanol 96% was used to extraction process. Ceto stearyl alcohol, stearic acid, cetyl alcohol, methylparaben, propylparaben, tween 80, and aqua destilata were used to make cream base preparation. Magnesium powder, HCl 2N, C_2H_5OH, NH_3, $CHCl_3$, Dragendorff, Mayer, Bouchardat, $FeCl_3$, H_2SO_4 concentrate, and methanol pro analysis were used as reagents.

Tools

Tools used in this experiment were Spectrophotometer UV-Vis (JaSCO V-730), rotary evaporator, water bath, analytical balance, and glassware (pyrex).

Method

Extract Preparation

Two hundred grams of dried purslane (*Portulaca grandiflora*) magenta flower variety herb was extracted with maceration method using 500 ml ethanol 96% for 5 days. The dregs were re-macerated using the same solvent for another 5 days. The first and second filtrates were then mixed and thickened with a rotary evaporator at 40°C until a thick extract was obtained.

Phytochemical Screening

1. Flavonoids Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was dissolved into water and transferred into a test tube. Magnesium metal and 5 drops of HCl 2N were added into the tube and then the mixture was heated for 5-10 minutes. After filtration, the filtrate waited until cool down and was added with amil alcohol and then shaken hardly. The reaction was positive if red color formed in amil alcohol layer (Harbone, 1987; Hanani, 2017).

2. Alkaloid Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract basified with 1 mL of ammonia, then added chloroform and crushed vigorously. The chloroform liquid was filtered, the filtrate was placed in a test tube then 2 N HCl was added, the mixture was shaken, then left to separate. In a separate test tube: Filtrate 1: As much as 1

drop of Dragendorff reagent solution is dropped into the filtrate, the presence of alkaloids is indicated by the formation of precipitate or turbidity that is colored brown. Filtrate 2: As much as 1 drop of Mayer's reagent solution is dripped into the filtrate, the presence of alkaloids is indicated by the formation of a white precipitate or turbidity. Filtrate 3: As a blank or negative control (Harbone, 1987; Hanani, 2017).

3. Saponin Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put in a test tube, added hot water and cooled, then shaken for 10 seconds, a stable foam will form in less than 10 minutes, 1-10 cm high, and with the addition of 1 drop of HCl The 2N foam was persistence which indicated the presence of saponins (Harbone, 1987; Hanani, 2017).

4. Tannin Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put into a test tube and reacted with FeCl3 1% solution. The extract contains tannins if a green-black or dark-blue color was formed (Harbone, 1987; Hanani, 2017).

5. Terpenoid Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put into a test tube and added with chloroform and H2SO4 concentrated. The extract contains terpenoids if a brown color was formed (Harbone, 1987; Hanani, 2017).

Cream Preparation

The preparation of this research cream was based on the Arisca formula (2018) with minor modifications.

Table 1. Purslane magenta flower variety herb extract cream formula

Ingredients	Negative Control Formula (%)	2,5% Extract Formula (%)	5% Extract Formula (%)
Ceto stearyl alcohol	7	7	7
Stearic acid	7	7	7
Cetyl alcohol	6	6	6
Nipagin	0.15	0.15	0.15
Nipasol	0.05	0.05	0.05
Purslane extract	-	2.5	5
Tween 80	0.5	0.5	0.5
Aqua destilata ad	100	100	100

Each material was measured and the oil phase (ceto stearyl alcohol, cetyl alcohol, stearic acid, and propylparaben) was mixed. The water phase (tween 80 and methylparaben) was mixed. Both phases were heated with a water bath until dissolved. Cream preparation was done by adding the hot water phase to the hot oil phase and the mixture stirred until a cold cream base formed. The purslane (*Portulaca grandiflora*) magenta flower variety herb extract was added to the cream base and stirred until a homogeneous cream was formed.

Sunscreen Activity Test

The sunscreen activity test was carried out by determining the SPF value in vitro using the UV-Vis spectrophotometry method. The purslane magenta flower variety herbs extract cream was dissolved into methanol pro analysis to obtain a 1000 ppm concentration of test solution. After that, the test solution transmission was read at 292.5 – 372.5 nm wavelength (every 5 nm interval). The amount of erythema flux that was transmitted by the sunscreen agent (Ee) is calculated by the formula: $Ee = \Sigma T.Fe$ while the pigmentation flux is calculated by the formula: $Ep = \Sigma T.Fe$. %Te and %Tp value calculated by formula $\%Te = Ee/\Sigma Ee$ and $\%Tp = Ep/\Sigma ep$ (Cumpelick, 1927). SPF value measurement was done by reading the test solution absorbance at 290-320 nm wavelength with 5 nm interval (Mansur *et al*., 1986; Mishra *et al*., 2012) (Table 2).

Table 2. Value of EE x I

λ (nm)	EE x I
290	0.015
295	0,0817
300	0,2874

305	0,03278
310	0,1864
315	0,0839
320	0,018

Data Analysis

The %Te, %Tp, and SPF values were analyzed statistically using one-way ANOVA analytical method with α = 0.05 and followed by post hoc test.

RESULTS AND DISCUSSION

Fresh purslane (*Portulaca grandiflora*) magenta flower variety herb dried and extracted using maceration method until 5.51 gram thick extract was obtained with 10.64% of yield (Table 3).

Table 3. Purslane (*P. grandiflora*) magenta flower variety herb extract yield

Simplicia	Powder weight (g)	Extract weight (g)	Yield (%)
Purslane magenta flower variety herb	51.78	5.51	10.64

The next step was qualitative phytochemical identification of obtained extract. The phytochemical screening result is explained in Table 4.

Table 4. Purslane (*P. grandiflora*) magenta flower variety herb extract phytochemical screening

Test	Reagent	Result
Flavonoid	Mg powder + HCl 2N + C_2H_5OH	+
Alkaloid	NH_3+$CHCl_3$+HCl 2N+ Dragendorff/ Mayer/ Bouchardat	+
Saponin	Foam test	+
Tannin	$FeCl_3$	+
Terpenoid	H_2SO_4 concentrate + $CHCl_3$	+

The purslane extract was used as an active ingredient in cream preparation with 2.5% and 5% concentration variations. Cream preparation was chosen because it has benefits such as being easy to use, comfortable, and easy to wash with water. Cream also has various functions as a drug carrier, skin emollient, and to protect skin from different interference including sunlight.

Sunscreen preparation could contain active ingredients in an inorganic compound (reflect UV radiation) and an organic compound (absorb UV radiation). The purpose of sunscreen application is not only to protect the skin from UV rays exposure which can trigger negative effects but also it's expected to inhibit ROS formation which trigger gene mutations, premature aging, and carcinogenic effect in the long term. Therefore, active antioxidant compounds are needed in sunscreen preparations that can help increase the physical activity of sunscreen. Purslane (*Portulaca grandiflora*) magenta flower variety herb extract contains various secondary metabolites and has antioxidant activity (Addor *et al*., 2022).

The cream sunscreen activity is determined from the percentage of erythema transmission (% Te), the percentage of penetration transmission (% Tp), and the Sun Protective Factor (SPF) value as follows:

Table 5. ~~Cream preparation~~ %Te value of Cream preparation

Replication	Value of %Te (%)		
	Negative Control (Cream Base)	2.5% Extract	5% Extract
I	97,56	27,36	8,97
II	90,28	23,08	8,44
III	93,06	27,14	7,29
Mean	93,64 ± 3,67	25,86 ± 2,41	8,23 ± 0,86

The percent erythema transmission value (%Te) describes the amount of UV rays exposure from the sun that hits the skin after using sunscreen, which causes erythema (redness) on the skin (Chen *et al*., 2012). The lower the % Te value, the better the sunscreen protection to prevent erythema. Based on Table 5 it can be observed that the highest %

Te was in the negative control (preparation basis) which was 93.64 ± 3.67%, followed by preparations containing 2.5% extract which was 25.86 ± 2.41%, and the lowest was the preparation with 5% extract which was 8.23 ± 0.86%. Based on the statistical test results, it showed that there was a significant difference in the % Te value both in the negative control, preparations with 2.5% and 5% extract. This shows that the extract concentration determines the erythema transmission value of sunscreen preparations.

Table 6. ~~Cream preparation~~ %Tp value of Cream preparation

Replication	Value of %Tp (%)		
	Negative Control (Cream Base)	2.5% Ekstrak	5% Extract
I	98.29	36.69	17.46
II	91.49	32.96	16.83
III	95.66	38.49	15.65
Mean	95.15 ± 3.43	36.05 ± 2.82	16.65 ± 0.92

The percentage value of pigmentation transmission (% Tp) describes the amount of exposure to UV rays from the sun that hits the skin after using sunscreen, which causes pigmentation of the skin. As with % Te, the lower % Tp value indicates better protection of sunscreen against pigmentation on the skin. Based on Table 6, shows that the highest % Tp was in the negative control (preparation basis) which was 95.15 ± 3.43, followed by preparations containing 2.5% extract which was 36.05 ± 2.82, and the lowest is a preparation with 5% extract, namely 16.65 ± 0.92. Based on the results of statistical tests, showed that there was a significant difference in the % Tp value both in the negative control, preparations with 2.5% and 5% extract with a $p>0.05$. This shows that the extract concentration in preparation determines the pigmentation transmission value of the sunscreen preparation.

Table 7. ~~Cream preparation~~ SPF value of Cream preparation

Replication	Value of SPF		
	Negative Control (Cream Base)	2.5% Ekstrak	5% Extract
I	0.18	3.84	7.83
II	0.16	3.71	8.47
III	0.19	4.37	7.79
Mean	0.18 ± 0.02	3.97 ± 0.35	8.03 ± 0.38

The SPF value states how many times the skin's natural resistance is multiplied so that it is safe in the sun without experiencing sunburn16. Based on the test result, the SPF value also shows an increasing trend with increasing extract concentration in the preparation. Based on Table 7 it can be seen that the lowest SPF value was in the negative control (preparation base) which was 0.18 ± 0.02, followed by preparations containing 2.5% extract which was 3.97 ± 0.35, and those containing the highest was the preparation with 5% extract, namely 8.03 ± 0.38. Based on the results of statistical tests, it showed that there was a significant difference in the SPF value both in the negative control, preparations with extracts of 2.5% and 5% with $p>0.05$. This shows that the extract concentration determines the SPF value of the sunscreen preparation.

Based on these results, a cream preparation containing 5% purslane herb extract had a higher % Te and % Tp value compared to preparations containing 2.5% purslane herb extract. At the % Tp value, both preparations showed the most maximum protection which was in the sunblock category, while based on % Te the protection was still in the tanning and suntan categories (Kasitowati *et al.*, 2021). To obtain better protection based on the % Te value, a higher extract content is needed in the preparation.

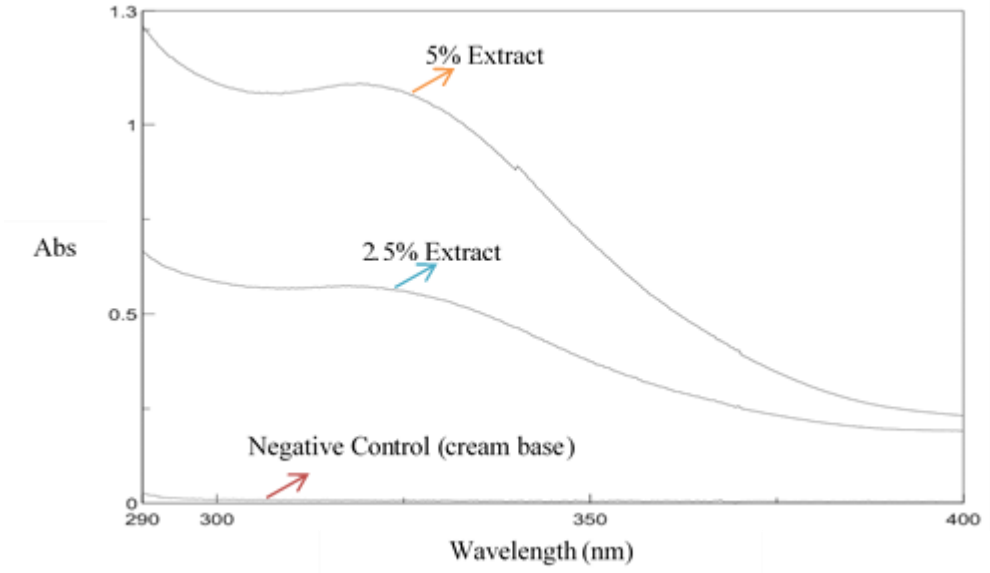

Figure 1. ~~Preparation~~ Absorbance spectra at 290-400 nm wavelength of cream preparation

The potential for sunscreen activity can be expressed through the value of the Sun Protective Factor (SPF). The SPF value is determined from the absorption results of the preparation at UV wavelengths between 290 – 400 nm (Figure 1). Based on the research results, it was obtained that the SPF value of cream preparations containing 2.5% and 5% of purslane herb extract were 3.97 ± 0.35 and 8.03 ± 0.38, respectively. Both of these SPF values are less than 12 which was in the minimal protection category. This SPF value is not optimal for providing protection, because, with an SPF value of less than 15, protection is only given for 1.5 hours (Buso *et al*., 2017).

Statistical tests were carried out to determine whether there were differences in sunscreen activity in each preparation. Based on statistical tests using one-way ANOVA, a significance value of <0.05 was obtained for both the %Te, %Tp, and SPF values. This means that the sunscreen activity is determined by the purslane herb extract concentration in the preparation. The higher the extract concentration in the preparation, the better the sunscreen protection will be.

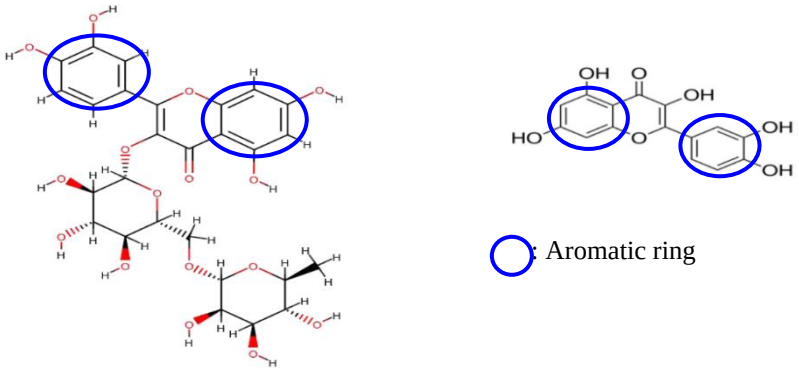

Figure 2. Structure of flavonoid A: rutin, B: ~~kuers~~quercetin (Ganeshpurkar *et al*., 2017; El-Saber Batiha *et al*., 2020)

Flavonoids are compounds contained in purslane herb extracts that are thought to have sunscreen activity (Cahyani *et al*., 2022). Flavonoids can absorb energy at UV light wavelengths because they have covalent bonds in their structure. Flavonoids can absorb energy at a wavelength of 240-290 nm, and flavonoids that have conjugated covalent bonds can absorb at a wavelength of up to 550 nm (He *et al*., 2021). Magenta flower variety purslane herb contains the largest amount of flavonoids compared to other variants, therefore this study used extracts from purslane herb with the magenta flower variant. Flavonoids contained in purslane (*Portulaca grandiflora*) herb are rutin, quercetin, and isoquercetin compounds (Husein *et al*., 2021). Flavonoids have at least 2 aromatic rings with a basic carbon skeleton consisting of 15 C atoms forming C6-C3-C6 (Figure 2) (Julianto, 2019).

CONCLUSION

The sunscreen cream preparation with 2.5% of purslane (*Portulaca grandiflora*) magenta flower variety herb extract had %Te, %Tp, and SPF values of 25.86 ± 2.41%, 36.05 ± 2.82%, and 3.97 ± 0.35 respectively. While preparations with 5% concentration of extract had %Te, %Tp, and SPF values of 8.23 ± 0.86%, 16.65 ± 0.92%, and 8.03 ± 0.38 respectively. The sunscreen activity of all extract concentration creams was significantly different compared to the negative control (cream base) in all parameters.

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REFEREE'S REPORT

Article ID :	47015
Title of Article :	**Sun Protective Factor Evaluation of Purslane (Portulaca grandiflora) Magenta Flower Variety Herbs Extract Cream Formula**

REVIEW

No.	Items	Very poor	Poor	Average	Good	Very Good
1	The manuscript contains original and self-consisted ideas and of interest	☐	☐	☐	x	☐
2	The manuscript makes major contributions to the advancement of the subject	☐	☐	☐	x	☐
3	The manuscript contains sufficient information included or cited to support the made assertions and the drawn conclusion	☐	☐	☐	x	☐
4	The format of the manuscript (Tittle, Abstract, Introduction, Methods, Results and Discussion, Conclusion, Acknowledgements, References)	☐	☐	☐	x	☐
5	The manuscript is clearly presented, well organized, and clearly written	☐	☐	☐	x	☐
6	All the illustrations / figures and tables are adequate and necessary	☐	☐	☐	x	☐
7	All the figures and tables' captions complete and accurate	☐	☐	☐	x	☐
8	The references are adequate to related work, up to date and accessible	☐	☐	☐	x	☐

Please give your appreciation of the scientific interest and novelty of results described

(in English)

REVIEW	
Title	ok
Abstract	good
Introduction	good
Methods	good
Results and Discussion	good
Conclusion	good
References	good
Figures and Tables	good
For article in English, is the English satisfactory? x**YES** ☐**NO**	

REVIEWER II

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REFEREE'S REPORT

Article ID :	47015
Title of Article :	Sun Protective Factor Evaluation of Purslane (Portulaca grandiflora) Magenta Flower Variety Herbs Extract Cream Formula

REVIEW

No.	Items	Very poor	Poor	Average	Good	Very Good
1	The manuscript contains original and self-consisted ideas and of interest	☐	☐	☒	☐	☐
2	The manuscript makes major contributions to the advancement of the subject	☐	☐	☒	☐	☐
3	The manuscript contains sufficient information included or cited to support the made assertions and the drawn conclusion	☐	☒	☐	☐	☐
4	The format of the manuscript (Tittle, Abstract, Introduction, Methods, Results and Discussion, Conclusion, Acknowledgements, References)	☐	☐	☒	☐	☐
5	The manuscript is clearly presented, well organized, and clearly written	☐	☐	☒	☐	☐
6	All the illustrations / figures and tables are adequate and necessary	☐	☐	☒	☐	☐
7	All the figures and tables' captions complete and accurate	☐	☐	☒	☐	☐
8	The references are adequate to related work, up to date and accessible	☐	☐	☒	☐	☐

Please give your appreciation of the scientific interest and novelty of results described

(in English)

REVIEW	
Title	→ *should state the potency of Magenta Flower Variety Herbs as Sun Protective Factor*
Abstract	complete but less specific
Introduction	It does not show the importance of carrying out this research
Methods	- When making a thick extract, it is not explained how long it will take or what the volume will be. Differences in these variables cause differences in levels of active ingredients (flavonoids) - -When making cream, the conditions for making it are not explained: temperature, stirring speed and duration of heating or stirring - When testing the SPF of creams containing extracts using the spectrophotometric method, no filtering is carried out. Is it clear? - There is no explanation of the Ee, Ep and SPF formulas
Results and Discussion	There is no discussion regarding the results and the influencing factors related to these results are related to the content of the extract tested (
Conclusion	The conclusions are less specific so they do not illustrate the importance of conducting this research
References	ok
Figures and Tables	ok
For article in English, is the English satisfactory? ☐**YES** ☒**NO**	

Protective Factor Evaluation of Purslane (*Portulaca grandiflora*) Magenta Flower Variety Herbs Extract Cream Formula

Abstract

***Background**: Indonesia is an equatorial country which rich in sunlight all year. UV light is divided into three wavelength groups such as UV-A (320-400nm), UV-B (280-320nm), and UV-C (100-290nm). The UV-A light will be absorbed by intracell chromophores in skin cell membranes such as riboflavin, porphyrin, nicotinamide, and enzyme. The UV-B light penetrates the dermis layer and causes DNA structure changes which lead to wrinkles and rising skin cancer risk. Premature skin aging and skin cancer can be prevented with sunscreen preparation containing compounds that can protect the skin from UV radiation. Flavonoid is one of the purslane (Portulaca grandiflora) active metabolites which have the potency to develop as sunscreen. **Objective**: The research aimed to determine the ability of purslane (Portulaca grandiflora) magenta flower variety herbs extract cream as a sunscreen as indicated by the %Te, %Tp, and Sun Protective Factor value. **Methods**: This research was an experimental study with various purslane magenta flower variety herbs extract cream formulas that were tested for their %Te, %Tp, and SPF value with a UV-Vis spectrophotometer. **Results**: The sunscreen cream preparation with 2.5% of purslane (Portulaca grandiflora) magenta flower variety herb extract had %Te, %Tp, and SPF values of 25.86 ± 2.41%, 36.05 ± 2.82%, and 3.97 ± 0.35 respectively. While preparations with 5% concentration of extract had %Te, %Tp, and SPF values of 8.23 ± 0.86%, 16.65 ± 0.92%, and 8.03 ± 0.38 respectively. **Conclusion**: The sunscreen activity of all extract concentration creams was significantly different compared to the negative control (cream base) in all parameters. Flavonoids are the compounds responsible for sunscreen activity of purslane extract*

***Keywords**: Sun Protective Factor; purslane; Portulaca grandiflora; magenta; cream.*

Abstrak

Pendahuluan: Indonesia merupakan negara yang berada di garis khatulistiwa sehingga memperoleh paparan sinar matahari sepanjang tahun. Sinar UV dikelompokkan berdasarkan panjang gelombangnya menjadi tiga yaitu UV-A (320-400nm), UV-B (280-320nm), dan UV-C (100-290nm). Sinar UV-A diserap kromofor intrasel pada membran sel kulit seperti riboflavin, porfirin, nikotinamida, dan enzim. Sinar UV-B menembus sampai lapisan dermis pada kulit akan menyebabkan terjadinya perubahan struktur DNA yang menyebabkan timbulnya kerutan dan meningkatkan resikokanker kulit. Pencegahan penuaan dini serta kanker kulit dapat dilakukan dengan menggunakan sediaan tabir surya yang mengandung senyawa yang dapat melindungi kulit dari radiasi sinar UV. Salah satu kandungan aktif dari krokot adalah flavonoid, sehingga berpotensi dikembangkan sebagai tabir surya. **Tujuan**: Tujuan penelitian ini untuk mengetahui kemampuan sediaan krim ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta sebagai tabir surya yang ditunjukkan melalui nilai %Te, %Tp, dan*Sun Protective Factor*. **Metode**: Penelitian ini merupakan penelitian eksperimental dengan berbagai formulasi krim ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta yang diuji nilai %Te, %Tp, dan SPF menggunakan spektrofotometer UV-Vis. **Hasil**: Sediaan tabir surya ekstrak herba krokot (*Portulaca grandiflora*) varietas bunga magenta dengan kadar 2,5% memiliki nilai %Te, %Tp, dan SPF berturut-turut yaitu 25,86 ± 2,41%, 36,05 ± 2,82%, dan 3,97 ± 0,35. Sedangkan sediaan dengan kadar 5% memilikinilai %Te, %Tp, dan SPF berturut-turut yaitu 8,23 ± 0,86%, 16,65 ± 0,92%, dan 8,03 ± 0,38. **Kesimpulan**: Aktivitas tabir surya seluruh formula krim ekstrak dan kontrol negatif (basis krim) memiliki perbedaan yang signifikan pada seluruh parameter. Flavonoid adalah senyawa yang bertanggung jawab atas aktivitas tabir surya dari ekstrak krokot

Kata kunci: *Sun Protective Factor*; krokot; *Portulaca grandiflora*; magenta; krim.

INTRODUCTION

One of the energy sources needed by living creatures is sunlight because of its involvement in every stage of the living process. For example, is vitamin D generation. Otherwise, sunlight overexposure also give a negative effect.

Sunlight radiation consists of infrared light (wavelength > 760 nm), visible light (400-760 nm), and UV (ultraviolet) light consisting of UV-A (320-400 nm), UV-B (290-320 nm) as well as UV-C (200-290 nm) (Limpiangkanan & Limpiangkanan, 2010). UV-A and UV-B rays are radiation from sunlight that reaches the earth's surfaces and has an impact on the skin (Wang *et al*., 2008). The UV-A light that reaches the skin surface will be absorbed by intracell chromophores in cell membranes such as riboflavin, porphyrin, nicotinamide, and enzyme. This causes oxidative stress whereas Reactive Oxygen Species (ROS) production overwhelms the natural skin antioxidant mechanism leading to decreasing in collagen production and wrinkle appearance (Gragnani *et al*., 2014). The UV-B light that reaches the skin will be penetrating the dermis layer and cause DNA structure changes which lead to wrinkles and rising skin cancer risk (Matsuda *et al*., 2013).

Indonesia is a country in the equatorial area with abundances of sunlight which leads to high premature skin aging and skin cancer risk. Premature skin aging and skin cancer can be prevented with sunscreen preparation containing compounds that can protect the skin from UV radiation. The ability to protect skin from sunlight exposure showed by erythema transmissionpercentage (%Te), pigmentation transmission percentage (%Tp), and Sun Protective Factor (SPF). Commonly, plants rich with flavonoids have a high SPF value because of its chromophore chemical structure capable to absorb UV light radiation energy (Saewan & Jimtaisong, 2013). Besides that, flavonoids also have antioxidant activity to prevent oxidative stress so that premature skin aging and cancer risk can be prevented (Chen *et al*., 2012).

Purslane is a plant that has been studied for its health benefits because of its various secondary metabolites. Flavonoid is one of the purslane active metabolites which have the potency to develop as sunscreen. Purslane *Portulacagrandiflora* magenta flower variety has higher levels of flavonoids compared to other varieties making it suitable to be developed as a sunscreen (Budiawan *et al*., 2023).

Cream is topical preparation with a semi-solid emulsion system. This preparation is easy to use and gives a comfortable feeling in its application. In addition, with the right cream consistency, the extracts in sunscreen can stick long enough and provide sufficient time for the flavonoid compounds to be absorbed by the skin and provide a maximum sun protection effect.

MATERIALS AND METHODS

Materials

Fresh purslane (*Portulaca grandiflora*) magenta flower variety herb was obtained from Madiun regency, East Java, Indonesia. Ethanol 96% was used to extraction process. Ceto stearyl alcohol, stearic acid, cetyl alcohol, methylparaben, propylparaben, tween 80, and aqua destilata were used to make cream base preparation. Magnesium powder, HCl 2N, C_2H_5OH, NH_3, $CHCl_3$, Dragendorff, Mayer, Bouchardat, $FeCl_3$, H_2SO_4 concentrate, and methanol pro analysis were used as reagents.

Tools

Tools used in this experiment were Spectrophotometer UV-Vis (JaSCO V-730), rotary evaporator, water bath, analytical balance, and glassware (pyrex).

Method

Extract Preparation

Two hundred grams of dried purslane (*Portulaca grandiflora*) magenta flower variety herb was extracted with maceration method using 500 ml ethanol 96% for 5 days. The dregs were re-macerated using the same solvent for another 5 days. The first and second filtrates were then mixed and thickened with a rotary evaporator at 40°C until one-third of the volume was remaining. The thickened filtrates were then dried in the oven at 50°C for 24 hours until thick extract was obtained.

Phytochemical Screening

1. Flavonoids Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was dissolved into water and transferred into a test tube. Magnesium metal and 5 drops of HCl 2N were added into the tube and then the mixture was heated for 5-10 minutes. After filtration, the filtrate waited until cool down and was added with amil alcohol and then shaken hardly. The reaction was positive if red color formed in amil alcohol layer (Harbone, 1987; Hanani, 2017).

2. Alkaloid Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract basified with 1 mL of ammonia, then added chloroform and crushed vigorously. The chloroform liquid was filtered, the filtrate was placed in a test tube then 2 N HCl was added, the mixture was shaken, then left to separate. In a separate test tube: Filtrate 1: As much as 1

drop of Dragendorff reagent solution is dropped into the filtrate, the presence of alkaloids is indicated by the formation of precipitate or turbidity that is colored brown. Filtrate 2: As much as 1 drop of Mayer's reagent solution is dripped into the filtrate, the presence of alkaloids is indicated by the formation of a white precipitate or turbidity. Filtrate 3: As a blank or negative control (Harbone, 1987; Hanani, 2017).

3. Saponin Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put in a test tube, added hot water and cooled, then shaken for 10 seconds, a stable foam will form in less than 10 minutes, 1-10 cm high, and with the addition of 1 drop of HCl The 2N foam was persistence which indicated the presence of saponins (Harbone, 1987; Hanani, 2017).

4. Tannin Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put into a test tube and reacted with FeCl3 1% solution. The extract contains tannins if a green-black or dark-blue color was formed (Harbone, 1987; Hanani, 2017).

5. Terpenoid Identification

Half a gram of purslane (*Portulaca grandiflora*) magenta flower variety extract was put into a test tube and added with chloroform and H2SO4 concentrated. The extract contains terpenoids if a brown color was formed (Harbone, 1987; Hanani, 2017).

Cream Preparation

The preparation of this research cream was based on the Arisca formula (2018) with minor modifications.

Table 1. Purslane magenta flower variety herb extract cream formula

Ingredients	Negative Control Formula (%)	2,5% Extract Formula (%)	5% Extract Formula (%)
Ceto stearyl alcohol	7	7	7
Stearic acid	7	7	7
Cetyl alcohol	6	6	6
Nipagin	0.15	0.15	0.15
Nipasol	0.05	0.05	0.05
Purslane extract	-	2.5	5
Tween 80	0.5	0.5	0.5
Aqua destilata ad	100	100	100

Each material was measured and the oil phase (ceto stearyl alcohol, cetyl alcohol, stearic acid, and propylparaben) was mixed. The water phase (tween 80 and methylparaben) was mixed. Both phases were heated at 80°C with a water bath until dissolved. Cream preparation was done by adding the hot water phase to the hot oil phase and the mixture stirred at 12500 rpm until a cold cream base formed. The purslane (*Portulaca grandiflora*) magenta flower variety herb extract was added to the cream base and stirred at 20 rpm until a homogeneous cream was formed.

Sunscreen Activity Test

The sunscreen activity test was carried out by determining the SPF value in vitro using the UV-Vis spectrophotometry method. The purslane magenta flower variety herbs extract cream was dissolved into methanol pro analysis to obtain a 1000 ppm concentration of test solution. After that, the test solution transmission was read at 292.5–372.5 nm wavelength (every 5 nm interval). The amount of erythema flux that was transmitted by the sunscreen agent (Ee) is calculated by the formula: Ee = ΣT.Fe while the pigmentation flux is calculated by the formula: Ep = ΣT.Fe. %Te and %Tp value calculated by formula %Te = Ee/ΣEe and %Tp = Ep/Σep, where T= Transmition value, Fe= a constant of flux erythema, Fp= a constant of flux pigmentation (Cumpelick, 1927). SPF value measurement was done by reading the test solution absorbance at 290-320 nm wavelength with 5 nm interval (Mansur *et al*., 1986; Mishra *et al*., 2012) (Table 2). SPF was obtained using the formula:

$$SPF = CF \times \sum_{290}^{320} EE \times I \times Abs$$

Where: CF: correction factor, EE: erythema effect spectrum, I: light intensity spectrum, Abs: sample absorbance

Table 2. Value of EE x I

λ (nm)	EE x I
290	0.015
295	0,0817
300	0,2874

305	0,03278
310	0,1864
315	0,0839
320	0,018

Data Analysis

The %Te, %Tp, and SPF values were analyzed statistically using one-way ANOVA analytical method with α = 0.05 and followed by post hoc test.

RESULTS AND DISCUSSION

Fresh purslane (*Portulaca grandiflora*) magenta flower variety herb dried and extracted using maceration method until 5.51 gram thick extract was obtained with 10.64% of yield (Table 3).

Table 3. Purslane (*P. grandiflora*) magenta flower variety herb extract yield

Simplicia	Powder weight (g)	Extract weight (g)	Yield (%)
Purslane magenta flower variety herb	51.78	5.51	10.64

The next step was qualitative phytochemical identification of obtained extract. The phytochemical screening result is explained in Table 4.

Table 4. Purslane (*P. grandiflora*) magenta flower variety herb extract phytochemical screening

Test	Reagent	Result
Flavonoid	Mg powder + HCl 2N + C_2H_5OH	+
Alkaloid	NH_3+$CHCl_3$+HCl 2N+ Dragendorff/ Mayer/ Bouchardat	+
Saponin	Foam test	+
Tannin	$FeCl_3$	+
Terpenoid	H_2SO_4 concentrate + $CHCl_3$	+

The purslane extract was used as an active ingredient in cream preparation with 2.5% and 5% concentration variations. Cream preparation was chosen because it has benefits such as being easy to use, comfortable, and easy to wash with water. Cream also has various functions as a drug carrier, skin emollient, and to protect skin from different interference including sunlight.

Sunscreen preparation could contain active ingredients in an inorganic compound (reflect UV radiation) and an organic compound (absorb UV radiation). The purpose of sunscreen application is not only to protect the skin from UV rays exposure which can trigger negative effects but also it's expected to inhibit ROS formation which trigger gene mutations, premature aging, and carcinogenic effect in the long term. Therefore, active antioxidant compounds are needed in sunscreen preparations that can help increase the physical activity of sunscreen. Purslane (*Portulaca grandiflora*) magenta flower variety herb extract contains various secondary metabolites and has antioxidant activity (Addor *et al*., 2022).

The cream sunscreen activity is determined from the percentage of erythema transmission (% Te), the percentage of penetration transmission (% Tp), and the Sun Protective Factor (SPF) value as follows:

Table 5. %Te value of Cream preparation

Replication	Value of %Te (%)		
	Negative Control (Cream Base)	2.5% Extract	5% Extract
I	97,56	27,36	8,97
II	90,28	23,08	8,44
III	93,06	27,14	7,29
Mean	93,64 ± 3,67	25,86 ± 2,41	8,23 ± 0,86

The percent erythema transmission value (%Te) describes the amount of UV rays exposure from the sun that hits the skin after using sunscreen, which causes erythema (redness) on the skin (Chen *et al*., 2012). The lower the % Te value, the better the sunscreen protection to prevent erythema. Based on Table 5 it can be observed that the highest %

Te was in the negative control (preparation basis) which was 93.64 ± 3.67%, followed by preparations containing 2.5% extract which was 25.86 ± 2.41%, and the lowest was the preparation with 5% extract which was 8.23 ± 0.86%. Based on the statistical test results, it showed that there was a significant difference in the % Te value both in the negative control, preparations with 2.5% and 5% extract. This shows that the extract concentration determines the erythema transmission value of sunscreen preparations.

Table 6. %Tp value of Cream preparation

Replication	Value of %Tp (%)		
	Negative Control (Cream Base)	2.5% Ekstrak	5% Extract
I	98.29	36.69	17.46
II	91.49	32.96	16.83
III	95.66	38.49	15.65
Mean	95.15 ± 3.43	36.05 ± 2.82	16.65 ± 0.92

The percentage value of pigmentation transmission (% Tp) describes the amount of exposure to UV rays from the sun that hits the skin after using sunscreen, which causes pigmentation of the skin. As with % Te, the lower % Tp value indicates better protection of sunscreen against pigmentation on the skin. Based on Table 6, shows that the highest % Tp was in the negative control (preparation basis) which was 95.15 ± 3.43, followed by preparations containing 2.5% extract which was 36.05 ± 2.82, and the lowest is a preparation with 5% extract, namely 16.65 ± 0.92. Based on the results of statistical tests, showed that there was a significant difference in the % Tp value both in the negative control, preparations with 2.5% and 5% extract with a $p>0.05$. This shows that the extract concentration in preparation determines the pigmentation transmission value of the sunscreen preparation.

Table 7. SPF value of Cream preparation

Replication	Value of SPF		
	Negative Control (Cream Base)	2.5% Ekstrak	5% Extract
I	0.18	3.84	7.83
II	0.16	3.71	8.47
III	0.19	4.37	7.79
Mean	0.18 ± 0.02	3.97 ± 0.35	8.03 ± 0.38

The SPF value states how many times the skin's natural resistance is multiplied so that it is safe in the sun without experiencing sunburn16. Based on the test result, the SPF value also shows an increasing trend with increasing extract concentration in the preparation. Based on Table 7 it can be seen that the lowest SPF value was in the negative control (preparation base) which was 0.18 ± 0.02, followed by preparations containing 2.5% extract which was 3.97 ± 0.35, and those containing the highest was the preparation with 5% extract, namely 8.03 ± 0.38. Based on the results of statistical tests, it showed that there was a significant difference in the SPF value both in the negative control, preparations with extracts of 2.5% and 5% with $p>0.05$. This shows that the extract concentration determines the SPF value of the sunscreen preparation.

Based on these results, a cream preparation containing 5% purslane herb extract had a higher % Te and % Tp value compared to preparations containing 2.5% purslane herb extract. At the % Tp value, both preparations showed the most maximum protection which was in the sunblock category, while based on % Te the protection was still in the tanning and suntan categories (Kasitowati *et al.*, 2021). To obtain better protection based on the % Te value, a higher extract content is needed in the preparation.

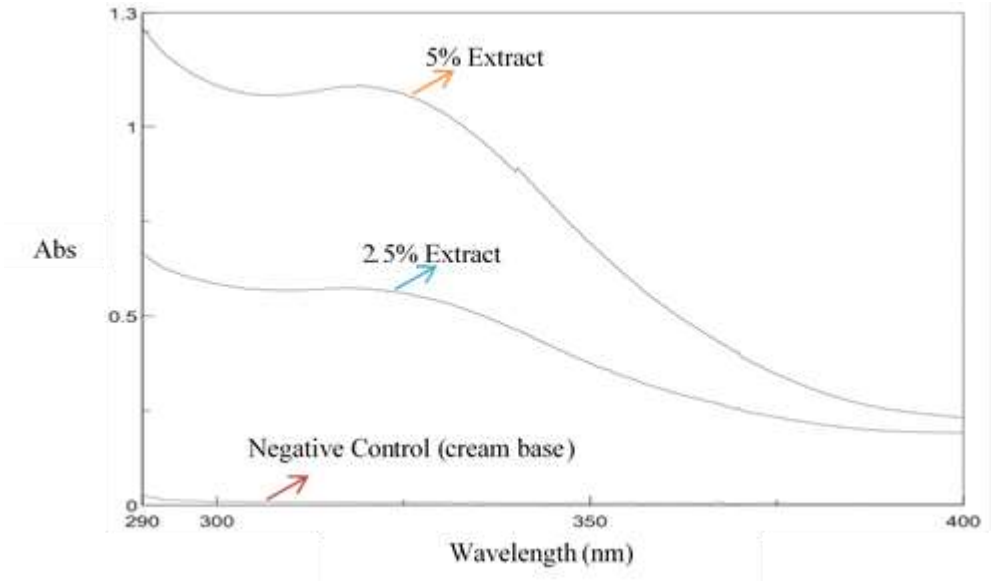

Figure 1. Absorbance spectra at 290-400 nm wavelength of cream preparation

The potential for sunscreen activity can be expressed through the value of the Sun Protective Factor (SPF). The SPF value is determined from the absorption results of the preparation at UV wavelengths between 290 – 400 nm (Figure 1). Based on the research results, it was obtained that the SPF value of cream preparations containing 2.5% and 5% of purslane herb extract were 3.97 ± 0.35 and 8.03 ± 0.38, respectively. Both of these SPF values are less than 12 which was in the minimal protection category. This SPF value is not optimal for providing protection, because, with an SPF value of less than 15, protection is only given for 1.5 hours (Buso *et al*., 2017).

Statistical tests were carried out to determine whether there were differences in sunscreen activity in each preparation. Based on statistical tests using one-way ANOVA, a significance value of <0.05 was obtained for boththe %Te, %Tp, and SPF values. This means that the sunscreen activity is determined by the purslane herb extract concentration in the preparation. The higher the extract concentration in the preparation, the better the sunscreen protection will be.

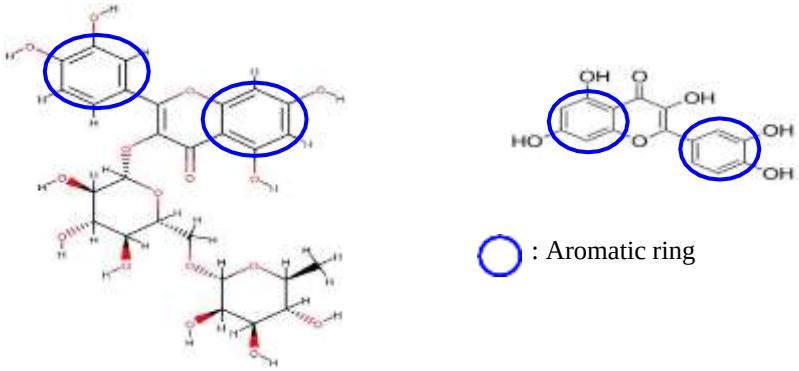

Figure 2. Structure of flavonoid A: rutin, B: quercetin (Ganeshpurkar *et al*., 2017; El-Saber Batiha *et al*., 2020)

Flavonoids are compounds contained in purslane herb extracts that are thought to have sunscreen activity (Cahyani *et al*., 2022). Flavonoids can absorb energy at UV light wavelengths because they have covalent bonds in their structure. Flavonoids can absorb energy at a wavelength of 240-290 nm, and flavonoids that have conjugated covalent bonds can absorb at a wavelength of up to 550 nm (He *et al*., 2021). Magenta flower variety purslane herb contains the largest amount of flavonoids compared to other variants, therefore this study used extracts from purslane herb with the magenta flower variant. Flavonoids contained in purslane (*Portulaca grandiflora*) herb are rutin, quercetin, and isoquercetin compounds (Husein *et al*., 2021). Flavonoids have at least 2 aromatic rings with a basic carbon skeleton consisting of 15 C atoms forming C6-C3-C6 (Figure 2) (Julianto, 2019).

CONCLUSION

The sunscreen cream preparation with 2.5% of purslane (*Portulaca grandiflora*) magenta flower variety herb extract had %Te, %Tp, and SPF values of 25.86 ± 2.41%, 36.05 ± 2.82%, and 3.97 ± 0.35 respectively. While preparations with 5% concentration of extract had %Te, %Tp, and SPF values of 8.23 ± 0.86%, 16.65 ± 0.92%, and 8.03 ± 0.38 respectively. The sunscreen activity of all extract concentration creams was significantly different compared to the negative control (cream base) in all parameters. Flavonoids are the compounds responsible for sunscreen activity of purslane (*Portulaca grandiflora*) magenta flower variety herb extract.

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TABEL COMMENT AND RESPONSE

REVIEWER 1

Comments	Responses	Page
Table 5. Cream preparation become **Table 5**. %Te value of Cream preparation	We have revised it per the reviewer's suggestion	4
Table 6. Cream preparation become **Table 6**. %Tp value of Cream preparation	We have revised it per the reviewer's suggestion	5
Table 7. Cream preparation become **Table 7**. SPF value of Cream preparation	We have revised it per the reviewer's suggestion	5
Figure 1. Preparation become **Figure 1**. Absorbance spectra at 290-400 nm wavelength of cream preparation	We have revised it per the reviewer's suggestion	6
Figure 2. Structure of flavonoid A: rutin, B: kuersetin become **Figure 2**. Structure of flavonoid A: rutin, B: quercetin	We have revised it per the reviewer's suggestion	6

REVIEWER 2

Comments	Responses	Page
Title: Should state the potency of Magenta Flower Variety Herbs as Sun Protective Factor	We have revised it per the reviewer's suggestion	1
Abstract: Complete but less specific	Thanks for the suggestion; we have provided more detailed explanation as suggested; please refer to conclusion of abstract	1
Introduction: It does not show the importance of carrying out this research	Thanks for the suggestion; we have provided more detailed explanation as suggested; please refer to introduction second paragraph	2
When making a thick extract, it is not explained how long it will take or what the volume will be. Differences in these variables cause differences in	Thanks for the suggestion; we have provided more detailed explanation as suggested; please refer to Extract Preparation	2

levels of active ingredients (flavonoids)		
When making cream, the conditions for making it are not explained: temperature, stirring speed and duration of heating or stirring	Thanks for the suggestion; we have provided more detailed explanation as suggested; please refer to Cream Preparation	3
When testing the SPF of creams containing extracts using the spectrophotometric method, no filtering is carried out. Is it clear?	Yes it is a clear solution obtained when the cream dissolved with methanol pro analysis at 1000 ppm	3
There is no explanation of the Ee, Ep and SPF formulas	Thanks for the suggestion; we have provided more detailed explanation as suggested; please refer to Sunscreen Activity Test	3
Results and Discussion: There is no discussion regarding the results and the influencing factors related to these results are related to the content of the extract tested	Thanks for the suggestion; it's already explained on page 6 third paragraph	6
The conclusions are less specific so they do not illustrtae the importance of conducting this research	Thanks for the suggestion; we have provided more detailed explanation as suggested; please refer to conclusion	7

EDITOR (if any)

Comments	**Responses**	**Page**

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Acceptance letter dan permohonan pengisian persetujuan terbit

1 message

Jurnal Farmasi dan Ilmu Kefarmasian Indonesia <jfiki@ff.unair.ac.id> Tue, Dec 19, 2023 at 3:55 PM
To: bida.cincin.kirana@ukwms.ac.id, antonius.budiawan@ukwms.ac.id

Yth. Author,

Berikut kami lampirkan acceptance letter untuk artikel berjudul:

Protective Factor Evaluation of Purslane (*Portulaca grandiflora*) Magenta Flower Variety Herbs Extract Cream Formula

Selain itu, kami mohon untuk mengisi form persetujuan terlampir pada email ini paling lambat besok **20 Desember 2023** sehingga kami dapat mempersiapkan dan memproses naskah lebih lanjut untuk keperluan publikasi.

Demikian atas perhatian dan kerjasamanya kami ucapkan terima kasih.

Hormat Kami,
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2 attachments

Acceptance letter - Bida Cincin Kirana et al.pdf
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Surabaya, 19-12-2023

ID: 47015

Dear Mrs. Bida Cincin Kirana,

Your manuscript entitled **"Protective Factor Evaluation of Purslane (*Portulaca grandiflora*) Magenta Flower Variety Herbs Extract Cream Formula"** written by **Bida Cincin Kirana, Erlien Dwi Cahyani, Antonius Budiawan** has been evaluated by the anonymous reviewers, and discussed with the Chief Editors, and we are please to inform you that your manuscript has been **accepted** for publication in the **Jurnal Farmasi dan Ilmu Kefarmasian Indonesia Volume 10 (2023)** (https://e-journal.unair.ac.id/JFIKI/).

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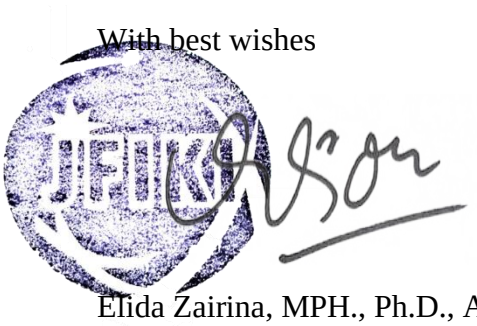
With best wishes



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