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THE POTENTIAL OF A SOOTHING GEL OF YELLOW WATERMELON (*Citrullus lanatus* (Thunb.) AND CUCUMBER (*Cucumis sativus* L.) EXTRACT COMBINATION AS SUNSCREEN

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ABSTRACT

People, particularly women with dry skin issues, want to apply sunscreen and skincare products to moisturize their skin. As a matter of fact, a formulation, that functions to moisturize is a soothing gel. A soothing gel formulation requires an active substance with a high water content, which can be obtained from fruits such as cucumbers and yellow watermelons. This study aimed to explore the potential of a soothing gel containing yellow watermelon and cucumber extract as a sunscreen, based on its Sun Protection Factor (SPF) value. Moreover, in this study, the yellow watermelon and cucumber extracts were processed using a juicer. Subsequently, a flavonoid test was conducted on the extract combination. The combination of yellow watermelon and cucumber extracts was formulated into a soothing gel at concentrations of 70%, 80%, and 90%. Furthermore, the SPF value of the soothing gel was determined in vitro using the UV-Vis spectrophotometry method. The results of this study showed that yellow watermelon and cucumber extracts, as well as their combination, contained flavonoid compounds. The highest SPF value, namely that of the soothing gel formula, was 80%. The SPF value of soothing gel formula 70%, 80%, and 90% respectively, was 3.5118±0.1969; 4.3771±0.4184; and 3.2274±0.2397. Hence, it can be concluded that, based on the SPF value, the combination of yellow watermelon and cucumber extracts in the soothing gel has potential as a sunscreen with medium protection.

Keywords: *Citrullus lanatus* Thunb., *Cucumis sativus* L., *yellow watermelon, soothing gel, sun protection factor*

INTRODUCTION

Daily activities, either indoors or outdoors, can lead to dry skin issues. Therefore, skin care is required to maintain skin hydration. However, skin care should contain a formulation to moisturize and hydrate the skin, namely a soothing gel formulation. Natural resources can be utilized as herbal cosmetics by considering the active compounds from plants that can be used as moisturizers and sunscreens. Soothing gel is a formulation that contains active compounds at high concentrations, which are expected to work optimally to restore skin moisture (Ariyani, L. W., and Suharsanti, R., 2018). Moreover, the soothing gel calms the skin by creating a cooling sensation upon application. The cooling sensation arises from the high water content of the soothing gel, which exceeds 80%. One type of plant most widely used to prepare soothing gel is aloe vera (*Aloe vera L.*) (Aryantini, *et al.*, 2020). Other plants with high water content, such as cucumber (Cucumis sativus L.), can also be used. Akbar and Syafah (2020) combined cucumber with red dragon fruit to prepare a soothing gel formulation (Akbar and Syafah, 2020).

Cucumber fruit has a water content of 96% and contains vitamins C, A, B2, and niacin (Pane, *et al.*, 2017). Due to these various compounds, cucumbers are used in beauty products

to soften the skin, moisturize the skin, and provide a relaxing (calm) effect (Firmansyah, *et al*., 2021; Aprilliani, 2022; Ningtias and Prima, 2021). In addition, cucumbers have antioxidant activity with an IC50 value of 189.261 µg/mL. The benefits of cucumbers can be optimized by combining them with other fruits that also have high water content and antioxidant activity. One of them is combined with yellow watermelon (*Citrullus lanatus Thunb*.).Yellow watermelon has a water content of 92% and contains carotenoid compounds (neoxanthin, violaxanthin, and luteoxanthin). These three carotenoid compounds are responsible for the antioxidant activity of yellow watermelons. Yellow watermelon also contains flavonoid compounds, specifically anthocyanins, flavonols, and flavan-3-ols (Zamus *et al*., 2021). Flavonoids act as sunscreens because of the conjugated double bonds in the B and C rings of flavonoids (Hailun, *et al*., 2021). Thus, the combination of cucumber and yellow watermelon extracts can be used as active compounds in a phytocosmeceutical soothing gel and is considered to have potential as a sunscreen agent.

Based on the above description, this study was conducted to determine the potential of a soothing gel combination of yellow watermelon and cucumber extracts as a sunscreen. Sunscreen activity was determined in vitro based on the SPF value.

RESEARCH METHODS

Instruments and materials

The tools used in this research included laboratory glassware (*Pyrex*), a digital balance (O'Hauss), a juicer (Philips), a spectrophotometer (UV-Vis, Thermo Fisher Scientific – Genesys 10S UV-Vis/Model G10S UV-Vis), a Brookfield viscometer, and calipers. The plants used in this study were yellow watermelon and cucumber obtained from traditional markets in Malang, East Java. The solvents and reagents used include distilled water, 36% hydrochloric acid,hydroxypropyl methylcellulose (HPMC), propylene glycol, glycerin, sodium benzoate, and Aquadest (PT. Brataco), aluminum foil, and Whatmann filter paper number 40.

Procedure

Preparation of Yellow Watermelon and Cucumber Extracts

Fresh yellow watermelon and cucumber were cleaned thoroughly, peeled, and the flesh was removed. Then, 748 grams of fresh cucumber and 901 grams of fresh yellow watermelon were weighed. Each piece of fresh fruit was placed in a juicer, and fruit extracts were obtained. Each fruit extract was put into a clean bottle and stored in the refrigerator

Phytochemical Screening

Terpenoid Test

A 10 mL extract was placed in an evaporating dish, and the solvent was evaporated until it was completely evaporated. Subsequently, 3 drops of acetic anhydride and 3 drops of concentrated sulfuric acid were added. A blue-green color indicated the presence of steroid saponins, a red-purple color indicated the presence of triterpene steroids, and a light yellow color indicated the presence of saturated saponins.

Alcaloid Test

The extract (0.5 g) was weighed and placed on a porcelain dish. Then, 1 mL of 2N hydrochloric acid and 9 mL of water were added, heated in a water bath for 2 minutes, cooled, and filtered. The filtrate was placed in four test tubes: A, B, C, and D. Solution A served as the blank, solution B was added with Dragendorff's reagent, solution C with Bouchardat's reagent, and solution D with Mayer's reagent. If a white or yellow precipitate formed when Mayer's reagent was added, an orange precipitate formed when Dragendorff's reagent was added, and a brown to black precipitate formed when Bouchardat's reagent was added, the sample likely contained alkaloids.

Flavonoid Test
The extract (1 mL) was placed in a test tube, 0.5 mL of 36% HCl was added, and the mixture was heated for approximately 20 minutes. The presence of flavonoids was indicated by an orange color (Zirconia *et al.*, 2015).

Tannin Test
The extract (3 mL) was placed in a test tube, and 3 drops of 1% FeCl3 were added. The formation of a greenish-brown or blue-black color indicates the presence of tannins.

Saponin Test
The extract (3 mL) was placed in a test tube, and hot water (10 mL) was added. The mixture was then cooled and shaken vigorously for 10 seconds. If foam was formed as high as 1-10 cm for no less than 10 minutes, and when 1 drop of 2 N HCl was added, the foam did not disappear.

Preparation of a Soothing Gel of Yellow Watermelon and Cucumber Extract Combination
The soothing gel was prepared on a small scale in the laboratory by weighing all the materials in the formula, as shown in **Table I**, using a digital balance. Next, hot water was added to the mortar, and HPMC was slowly sprinkled into it. HPMC was allowed to stand for a few minutes until it expanded (looked clear). After expansion, the fruit extract combination was added gradually while stirring constantly until a soothing gel base concentration was formed. Sodium benzoate was dissolved in the remaining fruit extract combinations. Next, propylene glycol, glycerin, and Aquadest were added gradually and stirred gently until the mixture became homogeneous. These materials were placed in a container and stored. The soothing gel formula, featuring varying concentrations of a combination of yellow watermelon and cucumber extracts, is illustrated in **Table I** (Aryantini *et al.*, 2020, with modifications).

Table I. Soothing Gel Formula Combination of Yellow Watermelon and Cucumber

Materials	Formula (%)				Function
	Base	F1	F2	F3	
Yellow watermelon extracts	-	35	40	45	active compounds
Cucumber extracts	-	35	40	45	
HPMC	2	0,5	1	2	gelling agent
propylene glycol	0.75	0.75	0.75	0.75	humectant
glycerin	0.5	0.5	0.5	0.5	emollient
sodium benzoate	-	-	-	0.5	preservative
aquadest	up to 100	up to 100	up to 100	up to 100	solvent

Evaluation of the Physical Properties of Soothing Gel Combination of Yellow Watermelon and Cucumber Extracts
Physical evaluation of the soothing gel formulation included organoleptic, homogeneity, pH, spreadability, adhesion, and viscosity tests.

Organoleptic Test
An organoleptic test was performed by observing the shape, color, and aroma of the preparation. The results of the observation evaluation were recorded as a measure of the acceptance of the preparation.

Homogeneity test
The homogeneity test was performed by applying an sufficient volume of soothing gel to a glass object, then observed under a microscope. Homogeneity was indicated by the absence of coarse-grained regions.

pH Test
1 g of the gel was diluted with 10mL of distilled water to measure the soothing gel pH. It was conducted using a pH meter. The pH was appropriate for the standard if the skin pH criteria were 4.5 – 6.5.

Adhesion Test
The adhesion test was carried out by weighing 0.5 grams of soothing gel, placing it on a glass object, overlapping it with another glass object, and pressing it with a weight of 80 g within 5 minutes and shifting the weight. Next, the glass slide was pulled with a weight of 50 g, and the time required for the two glass objects to separate was calculated.

Spreadability Test
The spreadability test was held by measuring 0.5 g of gel and placing it in the middle of a petri dish, then it was enclosed and put a load of 50 g. Next, it was put aside for a minute, and the dispersion diameter was calculated to determine the spreadability. In fact, the proper spreadability is 5-7 cm.

Viscosity Test
The viscosity test was carried out by measuring 100 mL of gel and placing it in a glass beaker, followed by measurement using a Brookfield viscometer with spindle 64 at a speed of 60 rpm. The required viscosity of the gel preparation was 2,000-4,000 cP.

SPF Value Calculation
The SPF value was calculated by having a test solution, concentrared in 100.000 ppm. Each soothing gel combination was weighed 10 g and dissolved in 100 mL of distilled water. Thus, a test solution with a concentration of 100.000 ppm was obtained. Additionally, the absorbance value of the test solution with a wavelength of 290-320 ppm can be determined (Syarifah, *et al.*, 2022). To investigate the effect of increasing concentrations of yellow watermelon and cucumber extract combinations on the SPF value in the soothing gel formulation. A statistical tests was employed to analyze the SPF value data obtained using a one-way variance test called one-way ANNOVA. Mansur equation was performed to calculate the SPF Value (Dutra, *et al.*, 2004):

SPF = CF x (λ) x I (λ) x absorbance(λ) **(Equation 1)**

Descriptions:

CF = Correlation Factor (CF value is 10)

EE = Erythema Effect Spectrum

I = Light Intensity Spectrum

Abs = Sunscreen sample absorbance

EE value is x I is the constant. The values of the wavelength, ranging from 290 to 320 nm, and every 5 nm gap were determined, as shown in **Table II**. The sunscreen effectiveness based on the SPF value is shown in **Table III.**

Table II. EE value x I (Noviardi, *et al.*, 2019)

Wavelength (nm)	EE value x I
290	0.015
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.018
Total	**1**

Table III. Sunscreen Effectiveness (Damogalad, V,*et al.*, 2013)

SPF	Sunscreen Protection Category
2-4	Minimum protection
4-6	Medium protection
6-8	Extra protection
8-15	Maximum protection
≥ 15	Ultra protection

RESULTS AND DISCUSSIONS

Soothing Gel of Yellow Watermelon and Cucumber Extract

The extraction process was conducted using a juicer without adding any water. Hence, the yellow watermelon and cucumber extracts were 100% fruit extracts. In this extraction process, 580 mL of cucumber extract was obtained from 748 grams fresh cucumber. Therefore, the cucumber extract obtained from this process was 77.54%. Meanwhile, 901 grams of fresh yellow watermelon produced 765 mL of fruit extract. In other words, the yield of cucumber extract was 84.91%. The cucumber extract was a light green solution, and the yellow watermelon extract was a yellow solution. Figure 1 illustrates both fruit extracts. The combination of yellow watermelon and cucumber extracts was formulated as a soothing gel in formulas 1, 2, and 3. The results for the soothing gel are presented in **Figure 2**.

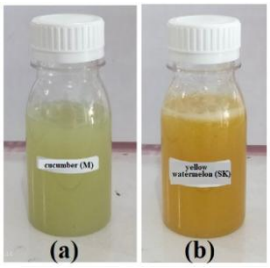

Figure 1. Physical visual of (a) cucumber extract and (b) yellow watermelon

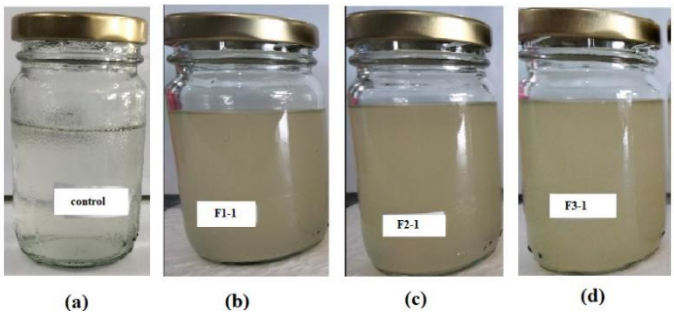

Figure 2. Soothing gel preparation (a) basic gel (controlled); (b) formula 1 (70%); (c) formula 2 (80%); (d) formula 3 (90%)

Qualitative Phytochemical Analysis

Phytochemical analysis was conducted for each solution test of yellow watermelon (SK) extract, cucumber (M) extract, and the yellow watermelon and cucumber extract combination (SKM) at a weight ratio of 1:1. This step was performed to qualitatively identify the component contents before and after the juice extract was combined. In this study, the phytochemical analysis comprised component tests for terpenoids, steroids, flavonoids, alkaloids, saponins, and tannins. This study investigated the secondary metabolite components in the research sample that had the potential to be antioxidants and sunscreens. **Figure 3** and **Table IV** show the phytochemical analysis results. From Figure 3 (b, d, f), it can be seen that there is a color change in the fruit extract reacted with HCl 36% and heated. Meanwhile, Figure 3 (a, c, e) shows that each fruit extract and the extract combination contained flavonoids.

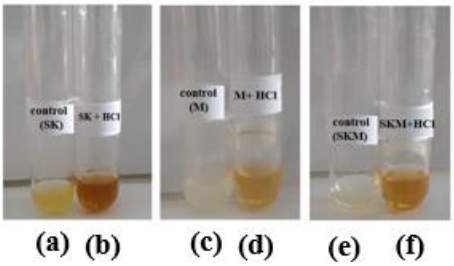

Figure 3. Qualitative Identification of flavonoid of yellow watermelon, cucumber, and combination extract

Description:

- Fruit extracts: (a) yellow watermelon extract; (c) cucumber extract; (e) yellow watermelon and cucumber extract combination (1:1).
- Fruit extract: (b) yellow watermelon extract; (d) cucumber extract; (f) yellow watermelon and cucumber extract combination (1:1).

Based on this data, yellow watermelon extract, cucumber extract, and the combination of yellow watermelon and cucumber extracts contain flavonoid components. This was proven after the reaction with HCl 36% and heating, which resulted in an orange color. In addition, based on the data in **Table IV**, the extracts of SK, M, and SKM (1:1) contain flavonoid components (as determined by the Bale Smith-Merchalf method), as evidenced by their color change to orange/reddish-brown after reacting with HCl 36% and heating. This color change indicates the presence of flavonoids, particularly anthocyanidins. This color change occurred due to a reaction that occurred after HCl was added. As a matter of fact, HCl will hydrolyse

and dissolve anthocyanin into aglycon, namely anthocyanidin. Furthermore, heat accelerates this reaction, resulting in the formation of an orange color (Zirconia *et al.*, 2015).

Table IV. Qualitative Phytochemical Analysis of YWE, CE and YWC Fruit Extract

No.	Reagent	Test results			Standard
		YWE Extract	CE Extract	YWC Extract Combination	
1.	Terpenoids and steroids (Acetic anhydride + H_2SO_4 98%)	light brown (-)	light brown (-)	light brown (-)	Reddish purple (terpenoid) and green (steroid) (Hanani, E., 2014)
2.	Flavonoids using the Bate Smith-Metchalf method (HCl 36% and heated)	color change to orange / reddish brown (+)	color change to orange / reddish brown (+)	color change to orange / reddish brown (+)	Orange to red color (Zirconia, *et al.*, 2015)
3.	Alkaloid	(-)	(-)	(-)	
	a. Dragendorff reagent				Orange precipitation (Ministry of Health, 1995)
	b. Mayer reagent	(-)	(-)	(-)	White precipitation (Ministry of Health, 1995)
	c. Bouchardat Reagent	(-)	(-)	(-)	Light brown precipitation (Ministry of Health, 1995)
4.	Saponins (foam formation)	(-)	(-)	(-)	Stable foam formed (Ministry of Health, 1995)
5.	Tannins ($FeCl_3$)	dark yellow (-)	dark yellow (-)	dark yellow (-)	Blackish green or dark blue (Zirconia, *et al.*, 2015)

Description :
(-) : negative result
(+) : positive result
YWE : yellow watermelon extract
CE : cucumber extract
YWC : yellow watermelon and cucumber extract combination

Preparation Physical Quality of Soothing Gel of Yellow Watermelon and Cucumber Extract Combination

Physical quality was assessed through organoleptic properties, homogeneity, pH, spreadability, adhesion, SPF value, and antioxidant activity. **Table V** presents the results of the organoleptic observations of the soothing gel. The organoleptic test was conducted visually using the five senses. The organoleptic test results for the three soothing gels did not reveal any significant differences. All three samples were semisolid in terms of shape and texture. The color produced by the three soothing gels was light yellow, and all three had an aroma reminiscent of yellow watermelon and cucumber. Each formula is illustrated in Figure 4. The results in Figure 4 show that the three soothing gel formulas, which included yellow watermelon and cucumber extract combination, did not exhibit any differences in texture, color, or aroma.

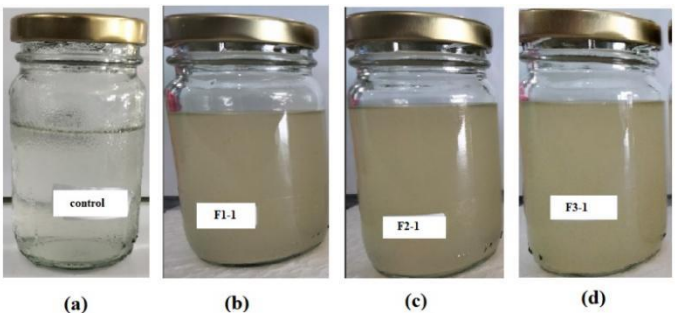

Figure 4. Soothing Gel Preparation (a) Basic gel (controlled); (b) Formula I (70%); (c) Formula II (80%); (d) Formula III (90%)

Table V. Organoleptic Soothing gel of Yellow Watermelon and Cucumber Extract Combination

No.	Sample	Organoleptic Results		
		Texture	Color	Aroma
1.	Base	semisolid	no color	no aroma
2.	Formula 1 (70 %)	semisolid	light yellow	yellow watermelon and cucumber
3.	Formula 2 (80 %)	semisolid	light yellow	yellow watermelon and cucumber
4.	Formula 3 (90 %)	semisolid	light yellow	yellow watermelon and cucumber

A homogeneity test was conducted to ensure that all materials, namely the gelling agent, additional material, and fruit extract, were homogeneously mixed. Thus, if applied to the skin that requires therapy/medicine, all skin parts have an equal chance of experiencing the effect of the substance contained in the soothing gel. Furthermore, **Figure 5** demonstrates that all the soothing gel materials were homogeneously mixed, as evidenced by the absence of rough particles visible in the glass slide.

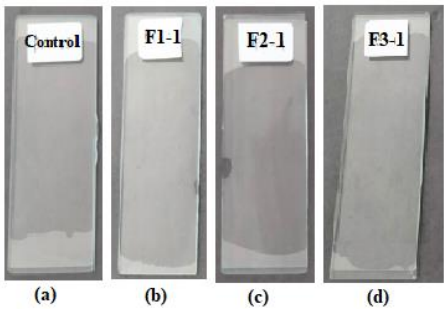

Figure 5. Soothing gel preparation (a) Gel base (control); (b) Formula I (70%); (c) Formula II (80%); (d) Formula III (90%)

A pH test was performed to determine whether the pH of the soothing gel matched that of the skin. According to Aryantini et al. (2020), the pH of topical preparations is similar to that of the skin, ranging from 4.5 to 6.5. Meanwhile, **Table VI** indicates that the pH of the soothing gel of the yellow watermelon and cucumber extract combination ranged from 5.133–5.297. An excessively acidic pH can cause skin irritation, whereas an excessively alkaline pH can lead to dry, scaly skin.

Table VI. pH Soothing Gel of Yellow Watermelon and Cucumber Extract

Replication	pH		
	F1 (70%)	F2 (80%)	F3 (90%)
I	5.06	5.03	5.18
II	5.18	5.11	5.33
III	5.2	5.26	5.38
Average± SD	5.147±0.062	5.133±0.095	5.297±0.084

Table VII. Spreadability of Soothing Gel of Yellow Watermelon and Cucumber Extract Combination

Replication	Weight (gram)	Spreadability (cm)		
		F1 (70%)	F2 (80%)	F3 (90%)
I	50	6.76	7.23	6.83
	300	9.18	8.4	8.93
II	50	6.63	6.30	7.16
	300	9.0	8.63	9.27
III	50	6.83	6.33	7.1
	300	9.1	8.47	8.83
Average ± SD	50	6.74±0.0828	6.62±0.431	7.033±0.144
	300	9.071±0.078	8.5±0.098	9.011±0.185

Moreover, a spreadability test was conducted to measure the spreadability of the soothing gel on the skin surface when applied without significant pressure. The good spreadability of the soothing gel makes it easier to apply to the skin. Furthermore, the active ingredient is more evenly distributed on the skin, thus optimizing its effect. The spreadability test data from the three formulas indicated a range of 8.5–9.071 cm with a 300-gram load. One factor contributing to rapid medicine absorption is the contact between the medicine and the wide

skin area, depending on the preparation's spreadability. Hence, good spreadability makes it easy to apply to the skin. Furthermore, the effect was optimal because of its even distribution.

Tabel VIII. Adhesion Ability of Soothing Gel of Yellow Watermelon and Cucumber Extract Combination

Replication	Adhesion Ability (in seconds)		
	F1 (70%)	F2 (80%)	F3 (90%)
I	25.01	06.13	06.01
II	23.46	05.71	14.07
III	28.21	09.90	12.51
Average ± SD	25.562±1.98	07.25±1.88	11.10±3.65

In this study, an adhesion test was conducted to measure the ability of the preparation to adhere to the skin. Furthermore, **Table VIII** presents the results of the soothing gel adhesion. Based on the data in **Table VIII**, the adhesion of all three formulas met the adhesion requirements for topical preparations, which was more than 4 seconds (Aryantini *et al.,* 2020). This indicates that the gelling agent concentration was appropriate. The average adhesion times for formulas 1, 2, and 3 were 25.562 ± 1.98 seconds, 07.25 ± 1.88 seconds, and 11.10 ± 3.65 seconds, respectively.

Next, a viscosity test was performed to determine the distribution and release of the active material. **Table IX** presents the viscosity results for the three formulas. In addition, based on the data in **Table IX**, the viscosity of all three formulas was classified within the gel preparation viscosity requirement range, namely 2000-4000 cp (Aryantini *et al.,* 2020). The viscosities of formulas 1, 2, and 3 were 2196±125.57, 2120±63.75, and 2130±27.2, respectively. These viscosity results affect the spreadability of the preparation and its absorption into the skin.

Table IX. Viscosity of Soothing Gel of Yellow Watermelon and Cucumber Extract Combination

Replication	Viscosity (cp)		
	F1 (70%)	F2 (80%)	F3 (90%)
I	2358	2124	2160
II	2052	2196	2136
III	2178	2040	2094
Average ± SD	2196±125.57	2120±63.75	2130±27.27

SPF Value of Soothing Gel of Yellow Watermelon and Cucumber Extract Combination

The SPF value was determined in vitro using UV-Vis spectrophotometry in the wavelength range of 290-320 nm. The absorbance data from the measurements were processed using the Mansur formula. In this study, the Correction Factor (CF) value was 10 (Dutra *et al.,* 2004). The SPF values of yellow watermelon, cucumber, and the combination of yellow watermelon and cucumber extracts are shown in Table IV. **Table X** presents the SPF value data of the soothing gels of formulas 1, 2, and 3 for each replication.

Table X. SPF Value of Solution Test of Yellow Watermelon Extract, Cucumber Extract, and Yellow Watermelon and Cucumber Extract Combination

Extract Solution Test	Replication	SPF Value	SPF Average Value
yellow watermelon	1	3.711	3.553 ± 0.216
	2	3.641	
	3	3.307	
cucumber	1	2.169	2.271 ± 0.272
	2	2.580	
	3	2.065	
combination	1	3.053	3.010 ± 0.063
	2	2.937	
	3	3.039	

Table XI. SPF Value Soothing gel of Yellow Watermelon and Cucumber Extract Combination

Formula	Replication	YWC Concentration	SPF Value	SPF Average Value
Formula 1	1	70	3.2848	3.5118±0.1969
	2	70	3.6358	
	3	70	3.6148	
Formula 2	1	80	4.8485	4.3771±0.4184
	2	80	4.2331	
	3	80	4.0498	
Formula 3	1	90	3.3553	3.2274±0.2397
	2	90	3.3761	
	3	90	2.9510	

Description:
(1); (2); (3) : replication of the 1st, 2nd, and 3rd solution test
YWC : yellow watermelon and cucumber extract combination

According to the data in **Table XI**, the SPF values of the three formulas were different. In this study, data analysis was performed using SPSS (version 16) to determine the differences in SPF values for the combination of yellow watermelon and cucumber extract added to each formula. A normality test using the Shapiro-Wilk test was conducted to analyze the data. If the data indicated normal and homogeneous distribution, then a one-way variance test (One Way Anova) would be carried out. On the other hand, if the data indicated abnormal distribution; hence, a Kruskal-Wallis analysis would be performed. The SPF test of the soothing gel of yellow watermelon and cucumber extract combination was repeated 3 times. Furthermore, the normality test indicated that the data for the three formulas (F1, F2, and F3) were normally distributed (p-value > 0.05). In addition, the homogeneity test showed homogeneous data (p-value > 0.05), namely 0.249. Moreover, the One-Way Anova test produced a p-value < 0.05; thus, H0 was rejected and H1 was accepted. This implies a significant difference in SPF values among the three formulas. Based on the data analysis, it was found out that the SPF value of soothing gel of formula 2 was greater than F1 and F3. The higher the concentration of the yellow watermelon and cucumber extract combination, the higher the SPF value. Nevertheless, the SPF value of formula 3 decreased. As a matter of fact, SPF value is a universal indicator elaborating the product effectiveness, which is a UV protector. The increase in SPF was also due to the higher concentration of the yellow

watermelon and cucumber extract combination added to the preparation. In other words, the concentrations of compounds contributing to absorbing UV absorption were higher. In addition, according to the results of the qualitative flavonoid test, the yellow watermelon and cucumber extract combination contains flavonoid compounds. Flavonoids have the potential to be one of the compound groups acting as a sunscreen because of the presence of chromophore groups that can absorb UV rays, both UV A and UV B, thereby reducing the intensity of UV radiation reaching the skin (Zamus *et al*., 2021). However, the SPF value of formula 3 decreased. This indicates that the optimum concentration of the yellow watermelon and cucumber extract combination that can potentially act as a sunscreen is formula 2. Moreover, the FDA requires an SPF value of at least 2 for sunscreens. If the SPF value is less than 2, it does not have the ability to protect the skin from sunlight or has the potential to be a sunscreen. The results obtained for the three cream formulas were 3.5118 ± 0.1969, 4.3771 ± 0.4184, and 3.2274 ± 0.2397, respectively. The SPF value results indicate that the three soothing gel formulas featuring the yellow watermelon and cucumber extract combination meet the requirements for sunscreens in the medium protection category.

CONCLUSION

The SPF results indicated that the three soothing gel formulations, featuring a yellow watermelon and cucumber extract combination, met the requirements for a sunscreen with medium protection. The SPF values of the soothing gels of formulas 1, 2, and 3 were 3,5118±0,1969; 4,3771±0,4184; and 3,2274±0,2397, respectively.

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