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ORIGINAL ARTICLE

Formulation Shooting Gel on Jamblang Fruit (*Syzgium cumini*) as Sunscreen and Physical Stability

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ABSTRACT

Effect of exposure ultraviolet light, which is bad for human skin, results in sunburn, dryness, premature aging until skin cancer occurs. Shooting gel is a cosmetic product that is just a trend in the community, containing active ingredients with high concentrations, making it suitable for use as a sunscreen. Previous studies of jamblang have antioxidant activity. The purpose of this study is to obtain a stable, optimum formula for shooting jamblang fruit gel by determining the SPF value and measuring the irritation index. Shooting jamblang fruit gel made four concentrations (60, 70, 80, and 90%) and evaluated physical characteristics, determination of SPF values, and stability test. The data obtained were analyzed with a different 95% confidence level test to find out a significant difference between the treatment groups. The results of the research of positive jamblang fruit contain flavonoid compounds, phenolic, polyphenols, tannins, anthocyanins, and saponins. Evaluation of physical characteristics shows that variations in concentration do not affect viscosity ($p > 0.05$) but affect pH, dispersion, and adhesion ($p < 0.05$). SPF FI value of 5.46 (Medium); FII of 11.45 (maximum); FIII of 8.51 (maximum); FIV of 34.73 (Ultra). The Greater the concentration, the greater the SPF value. Stability Shooting jamblang fruit gel almost all formulas there were no significant differences ($p > 0.05$) on the evaluation of viscosity, adhesion, and dispersion. At pH, there were significant differences in all formulas ($p < 0.05$).

Keywords: Physical stability, Shooting gel, SPF, Sunscreen, *Syzgium cumini* extract.

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INTRODUCTION

Exposure from ultraviolet (UV) to humans and the earth as a source of life does not always have a beneficial effect, because it can cause various losses on human skin. Skin that is exposed to chronic ultraviolet light can cause changes in the structure and composition of the skin epidermal skin tissue, unable to fight the oxidative effects. The effects can occur in acute changes such as erythema, photosensitivity, and long-term effects such as premature aging and skin cancer.[1] Not all ultraviolet light can damage human skin tissue, depending on the range of wavelengths and energy waves that are exposed so that damage will occur gradually. The spectrum of UV light is divided into three, namely UV C (200-290nm), UV B (290-320 nm), and UVA (320-400 nm). To prevent the sun exposure, protection is needed: it can be physical, for example, using an umbrella, hat, or jacket while chemical protection using appropriate sunscreen cosmetics.

The mechanism of sunscreen protection as a physical blocker by blocking ultra-violet (UV) rays from penetrating the skin layer by scattering light. Sunscreen is very effective in protecting the skin from exposure to UV-A and UV-B rays.[2]

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The content of UV rays in the sun is one source of free radicals that can damage cell components. Antioxidants are compounds that can neutralize reactive free radicals into a relatively stable non-reactive form that can protect cells from the harmful effects of free radicals. Antioxidants can be obtained from natural ingredients of fruits and plants, one of which is jamblang. In Indonesia, the jamblang tree is one of the rare plants that have many benefits. The jamblang fruit is one part of the jamblang plant that is suspected to

have antioxidant activity due to the content of anthocyanin compounds. From the research,[3] it showed that the antioxidant activity of jamblang fruit was 319.89 ppm. Anthocyanin is a component of flavonoid compounds. In photosynthetic tissues, anthocyanin can be used as a sunscreen that protects cells from damage by absorbing ultraviolet light. Research on efforts to prevent and reduce the negative effects of sun exposure on the skin is increasing, including the development of cosmetics sunscreen (sunscreen) from natural ingredients. Sunscreens made from natural materials are considered the safest to use and affordable prices compared to chemical sunscreens. Sunscreens that have an SPF value of ≥ 4 can protect the skin from UV exposure.[4]

Shooting gel is a semi-solid preparation in the form of cosmetic products that are new to the community, containing active ingredients with high concentrations, making it suitable for use as well as a moisturizer and sunscreen. Gel with optimum physical properties can increase the acceptability and effectiveness of therapy. Gel dosage forms have the advantage of having good dispersal power, easily washed with water, providing a cool effect, allowing use in hairy body parts, and releasing the drug well.[5]

Based on this background, this study aims to obtain the optimum formula, physical stability, and determination of the SPF value fruit gel preparation skin. It is hoped that the results of this study will be useful for the development of sunscreens from natural ingredients.

MATERIAL AND METHOD

Extraction of *Syzgium cumini*

Syzygium cumini, which has been washed is blended with a blender and then squeezed until a liquid extract is obtained.

Phytochemical Screening

Phytochemical screening test of jamblang fruit to a determination of flavonoids, phenolic compounds, tannins, and saponins using methods and anthocyanins.[6]

How to Make Preparations Shooting Gel?

The gel base is made by developing carbopol and HPMC with hot aqua and then mixed with other ingredients such as glycerin, propylene glycol, TEA, nipagin, alcohol, aqua dest little by little to form a gel base. The jamblang fruit is added to the base gel according to each concentration until homogeneous. The gel shooting formulation can be seen in the Table 1.

Soothing Gel Physical Characteristics Test

Organoleptic

The organoleptic test was conducted using the five senses, starting from the shape, smell, and color. The parameter of quality of the physical properties of shooting gel was that there were no changes in the form, color, and smell since the beginning of the production, storage, and up to usage.

Table 1: Formulation of shooting gel *Syzgium cumini*

Material	*FI(g)*	*FI(g)*	*FII (g)*	*FIII(g)*
Active ingredients	60%	70%	80%	90%
The base consists of	40%	30%	20%	10%
Carbopol	1	0.75	0.5	0.25
HPMC	2	1.5	1	0.5
Propylene glycol	3,375	2.25	1.5	0.75
Glycerin	2	1.5	1	0.5
TEA	0,3	0.15	0.1	0.05
Nipagin	0,075	0.0375	0.025	0.0125
Nipasol	1	0,5	0,25	0,125
Alcohol 96%	0,3	0.15	0.1	0.05
Essence	qs	qs	qs	qs
Aquadest	Ad 40	ad 30	ad 20	ad 10
Total (g)	100	100	100	100

Note :

F I shooting gel concentration of 60%,
F II shooting gel concentration of 70%,
F III shooting gel concentration of 80%,
F IV shooting gel concentration of 90%

Homogeneity

The homogeneity test was conducted by smearing the preparation to the surface of the object-glass; then, it was spread to the other object glass to find the homogeneous surface. The shooting gel could be said homogeneous if the particle structure did not cause to clot or was not mixed.

pH

The pH of the preparation was measured using the pH meter.

Viscosity

The test was conducted using the Brookfield viscometer and utilizing 64 spindles. Afterward, the shooting gel was placed in a container; then, the spindle which had been installed was pulled down until the spindles was immersed.

Spreadability

The shooting gel was placed on the glass plate and was left alone for 1 minute; then, the diameter of the shooting gel spread was measured. Next, the load was added by 50 g. It was left alone for 1 minute; then, the diameter of the shooting gel spread was measured. That the same thing should be done again and again until the constant diameter of the shooting gel spread was obtained.[7]

Adhesion Test

As much as 0.1 gram of the preparation is applied above the object of glass, which has been determined to be 2 × 2 cm, placed above the preparation object the other glass and weighed with a load of 1 kg for 5 minutes. Then the glass object is mounted on the test equipment; a weight of 80 grams is released and recorded the time until the two glass objects is loose.

Determination of Sun Protective Factor (SPF)

0.5 g cream of each concentration (60, 70, 80, 90%) was diluted to a concentration of 25, 50, 75, 100, and 125 µL by dissolving it in ethanol PA. After that, the test absorption curve is made with wavelengths between 290-320 nm with an interval of 5 nm. The absorbance results are recorded then the SPF value is calculated using the Mansur method (Table 2).[7]

$$SPF = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times \text{absorbansi}(\lambda)$$

Description:

CF = Correlation factor (10)
EE = Etherermal effect spectrum
I = Spectrum of solar simulation
Abs = Absorbance of sunscreen products

Tabel 2: EE Value x I

Wavelength (λ nm)	*EE x I*
290	0,0150
295	0,0817
300	0,2874
305	0,3278
310	0,1864
315	0,0839
320	0,0180

Testing Physical Stability of Preparation

The preparation is kept at room temperature for 1 month. On days 0 and 28, organoleptic, homogeneity, pH, dispersal, adhesion, and viscosity evaluations were carried out.

RESULTS AND DISCUSSION

This study aims to make a shooting gel preparation from jamblang fruit. These preparations are cosmetic preparations that are just trending and contain high active ingredient components, so it is expected that the effects will be fast on target (Figure 1).

Phytochemical Screening

Phytochemical screening test of jamblang fruit showed positive results containing flavonoids, phenolic compounds, tannins, saponins, polyphenols, and anthocyanins.

Shooting Gel of Jamblang Fruit

Shooting gel of jamblang liquid extract gel in Figure 2 contains high active ingredient components so that it is expected to have a faster effect as a sunscreen. The results of physical characteristics testing on the shooting gel of jamblang fruit can be seen in Table 3.

Homogeneity

Homogeneity testing aims to determine the homogeneity of the shooting gel of jamblang fruit. Homogeneous preparation shows a homogeneous arrangement and uniform color, and there are no spots. Homogeneity of preparation can affect the activity or the efficacy of the

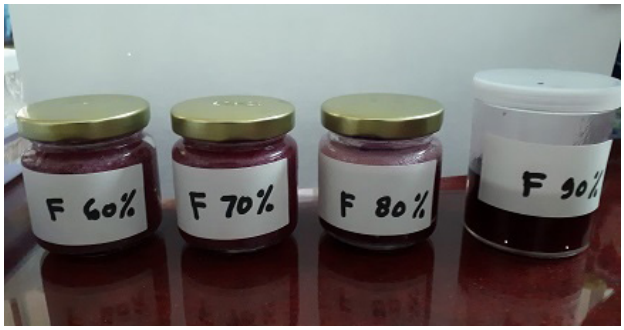

Figure 1: Shooting gel of jamblang fruit (a) 60% concentration, (b) 70% concentration, (c) 80% concentration, (d) 90% concentration

Table 3: Results of physical characteristics test shooting gel of jamblang fruit

Evaluate	*Formula 60%*	*Formula 70%*	*Formula 80%*	*Formula 90%*
Organoleptic	Gel (Thick)	Gel (slightly	Gel (slightly thick)	Gel (runny)
Shape	Rose	viscous)	Rose	Rose
Smell	Violet	Rose	Violet	Violet
Color		Violet		
Homogeneity	Homogeneous	Homogeneous	Homogeneous	Homogeneous
Viscosity * (centipoise)	1382667 ± 104103	260667 ± 43003,9	895334 ± 895334	620000 ± 697054
pH*	3,82 ± 0,02	3,64 ± 0,015	3,62 ± 0,03	3,57 ±0,025
Scatability * (cm)	4,5604 ± 0,0290	7,6657 ± 0,0599	8,5979 ± 0,0237	11,5 ± 0
Adhesion *(seconds)	162,67 ± 2,5166	91 ± 2,6458	72 ± 11,1355	55,67 ± 8,0208

active ingredient. If the active ingredients are evenly distributed then the release of active compounds into the skin will be maximal. Homogeneity test results can be seen in Table 3.

Viscosity

Viscosity is a resistance of a liquid to flow. The higher the viscosity of the shooting gel of jamblang fruit, the greater the resistance of the stock to flow. The test results show that the greater the concentration of the active ingredient, the lower the viscosity of the shooting gel of jamblang fruit. That is because of the greater the active material, the less gel base. The results of statistical tests show that data are normally distributed and homogeneous and then tested with a one-way ANOVA test, which shows a difference with a significant value < 0.05. The results of statistical tests showed that there was no difference in the concentration of the shooting gel used on the viscosity of the shooting gel of jamblang fruit. Viscosity test results can be seen in Figure 3.

pH

The pH test, is done to ensure the shooting gel of jamblang fruit does not cause skin irritation. Good topical preparation has a pH that is suitable for human skin. Human skin has a normal pH, which is around 4.5-7.0.[8] So it is safe when used. These preparations can reduce the risk of irritation to the skin because a pH that is too alkaline can make the skin scaly and a pH that is too acidic can irritate the skin. Based on the results of statistical tests showed that the influence of pH differences in the preparation of jamblang juice extraction gel with a significant value <0.05. The pH test results can be seen in Figure 3.

Spreadability

The spread test is carried out to determine the ability of the preparation to spread at the place of use. The results of the scattering power supply of shooting gel of jamblang fruit can be seen in Figure 4. From the results of the scatter test, all formulas meet the spreadability test requirements, which is 5-7 cm. This study met the distribution of the requirements, the higher the concentration, the greater the spread. Statistics test shows that different concentrations affect the spread shooting of jamblang fruit, where the greater the concentration of active ingredients, the greater the dispersion shooting gel of jamblang fruit.

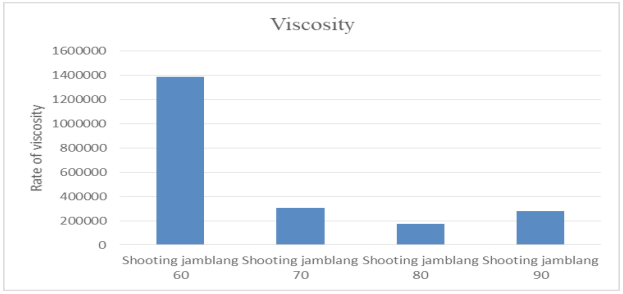

Figure 2: Graph of viscosity test of shooting gel of jamblang fruit

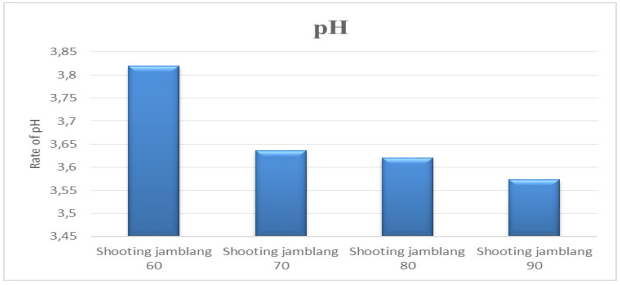

Figure 3: pH test results of gel shooting gel of jamblang fruit

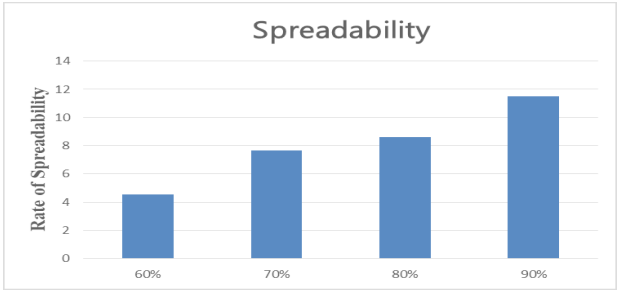

Figure 4: Test results of the spreadability of shooting gel of jamblang fruit

Adhesion Test

Adhesion to the preparation will affect the absorption of active substances in the shooting gel of jamblang fruit. A good shooting gel of jamblang fruit has a longer adhesion. Topical preparations that stick for longer will increase the potential for better absorption of the drug on the skin—adhesion for semi-solid preparations that is not less than 4 seconds.[9] The results of the adhesive test can be seen in Figure 5.

The statistical test shows that different concentrations affect the adhesive strength of shooting gel of jamblang fruit, where the greater the concentration of active ingredients, the smaller the adhesion of shooting gel of jamblang fruit.

Determination of SPF

The determination of the SPF of gel shooting of jamblang fruit can be seen in Table 8.

Determining the SPF value, the greater the concentration of active ingredients, the greater the SPF value. All of the four formulas are included in the range of sunscreen values.[10] This shows that the shooting gel of jamblang fruit has good sunscreen ability.

Evaluation of Stability Test Results

Figure 6 shows the stability of the viscosity evaluation results decreased during storage. Changes in temperature can damage the gelling agent in the preparation, and the packaging is impermeable to absorb moisture from the outside, thereby increasing the volume of water in the gel and causing changes in the viscosity of the gel. The addition of propyleneglycol can also cause it, glycerol, and the higher the concentration of active ingredients can reduce the viscosity of the gel.

Based on Table 4, the results of the viscosity evaluation on the 0th day after preparation and during the 28th-day storage obtained differences in viscosity between formulas. In statistical calculations, a formula I there is a significant difference with a value of $p < 0.05$, while formulas II, III, and IV have no significant difference with a value of $p > 0.05$.

Based on Table 5 and Figure 7, the pH stability test results increase not too much different after storage during the 28th day. This may be caused by the influence of the active ingredient, which is not stable to temperature so that it affects the preparation. The results of the statistical test showed a difference after storage in all formulas with a value of $p < 0.05$.

In Table 6 and Figure 8 shows the longer storage of preparations causes a decrease in the spreadability of the preparations of all formulas. This shows the vertical relationship between viscosity and dispersion—the greater

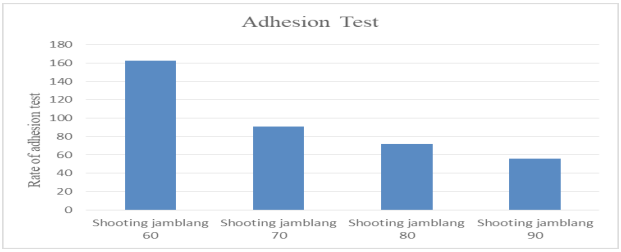

Figure 5: The results of the adhesive strength test of shooting gel of jamblang fruit

Table 4: Evaluate the viscosity of the shooting gel after the stability test

Formulation	*Day-0*	*Day-28*
F I	1382667 ± 104103	684000 ± 292759,3
F II	260667 ± 43003,9	269333,3 ± 23692,47
F III	895334 ± 895334	142666,7 ± 34078,34
F IV	620000 ± 697054	60666,67 ± 48428,64

Note: F I = Shooting gel 60%; F II = Shooting gel 70%; F III = Shooting gel 80%; F IV = Shooting gel 90%

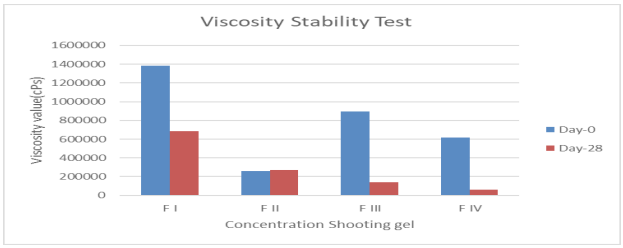

Figure 6: Diagram of the evaluation results of viscosity stability test

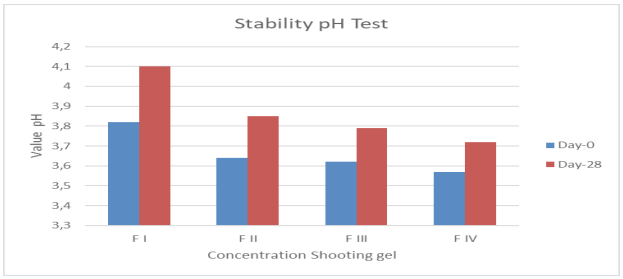

Figure 7: Diagram of the evaluation results of a pH stability test

Table 5: Evaluation of pH after stability test

Formulation	*Day-0*	*Day-28*
F I	3,82 ± 0,02	4,1 ± 0,02
F II	3,64 ± 0,015	3,85 ± 0,012
F III	3,62 ± 0,03	3,79 ± 0,01
F IV	3,57 ± 0,025	3,72 ± 0,015

Note: F I = Shooting gel 60%; F II = Shooting gel 70%; F III = Shooting gel 80%; F IV = Shooting gel 90%

Table 6: Evaluation of spreadability after stability test

Formula	*Hari Ke-0*	*Hari Ke-28*
F I	4,5604 ± 0,0290	4,1792 ± 0,0430
F II	7,6657 ± 0,0599	3,9111 ± 0,0095
F III	8,5979 ± 0,0237	7,1938 ± 0,0602
F IV	11,5 ± 0	11 ± 0

F I = Shooting gel 60%; F II = Shooting gel 70%; F III = Shooting gel 80%; F IV = Shooting gel 90%

Table 7: Evaluation of adhesion after a stability test

Formula	*Hari Ke-0*	*Hari Ke-28*
F I	162,67 ± 2,5166	136 ± 16,8226
F II	91 ± 2,6458	124,6667 ± 11,2398
F III	72 ± 11,1355	90,6667 ± 6,1101
F IV	55,67 ± 8,0208	102,6667 ± 3,5119

F I = Shooting gel 60%; F II = Shooting gel 70%; F III = Shooting gel 80%; F IV = Shooting gel 90%

Table 8: Results of determination of SPF value on shooting gel of jamblang fruit

Concentration	*SPF value*	*Category*
60%	5,46	Medium
70%	11,45	Maximum
80%	8,51	Maximum
90%	34,73	Ultra

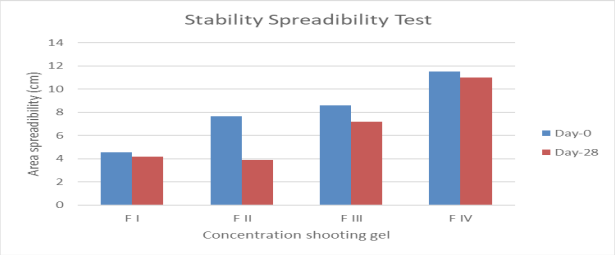

Figure 8: Diagram of the evaluation results of the spreadability stability test

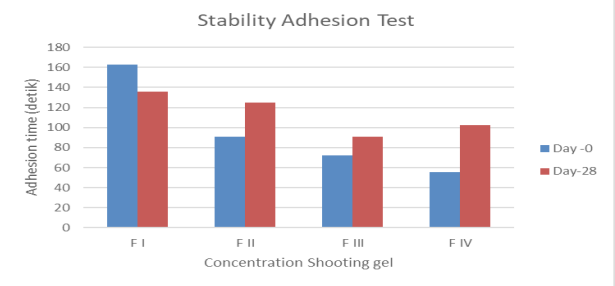

Figure 9: Diagram of the results of the adhesion stability evaluation

the value of viscosity, the wider the dispersal power of the preparation and vice versa. Statistical test results show that there is a significant difference in the results of the evaluation of the stability of the spreadability of all formulas with a value of $p < 0.05$.

In Table 7 and Figure 9 shows the duration of storage of preparations causing an increase in the time of adhesion of the preparations in formulas II, III, and IV, but in formula I has decreased. The results of the statistical tests show that formulas I and IV have significant differences in the results of the evaluation of the spreadability with a p-value of < 0.05. Formulas II and III show no significant difference to the stability test of sticky evaluation with a significant value > 0.05. This shows the inverse relationship between viscosity and dispersion—the greater the value of viscosity, the faster the adhesion time of the preparation and vice versa.

CONCLUSION

The preparation of jamblang fruit gel can be concluded that the shooting gel of jamblang fruit satisfy for physically and chemically test organoleptic, homogeneity, viscosity, spreadability, and adhesion test. For pH that does not satisfy the skin's pH requirements, causing irritation tests for long-term use can irritate. Physical and chemical storage stability test seen from organoleptic, homogeneity, viscosity, dispersal, and adhesion. Stability Shooting jamblang fruit gel almost all formulas, there were no significant differences ($p > 0.05$) on the evaluation of viscosity, adhesion, and dispersion. At pH, there were substantial differences in all formulas ($p < 0.05$). For pH close to the skin's pH requirements criteria so that there is little chance of irritation for long-term use. In determining the SPF value, the higher the concentration of active ingredients, the more the SPF value increases.

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CONTRIBUTION OF AUTHORS

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this the authors have equally contributed to this study.

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