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Research Article

Irritation, Hedonic, and Activity Tests of Nanoserum Extract of Red Shoot Leaves (*Syzigium myrtifolium* Walp) as a UV Ray Blocker

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Abstract: (1) Background: Red shoot leaf extract (Syzigium myrtifolium Walp) contains bioactive compounds such as flavonoids, tannins, and anthocyanins that have the potential to act as antioxidants and protect the skin from UV exposure. This study aims to test the irritation, hedonic level, and the activity of red shoot leaf extract nanoserum as an ultraviolet (UV) ray blocker before and after use; (2) Methods: The process of making na-noserum is carried out through the ionic gelation method using chitosan and alginate polymers with HPMC serum carriers. The manu-facture of red shoot leaf extract nanoparticles is intended to increase the stability, absorption, and effectiveness of the active ingredients. The irritation test was carried out on 20 people on the skin of volunteers to ensure safety of use, while the hedonic test involved panelists to assess the aspects of color, aroma, texture, and comfort of use. The UV ray blocker activity test was carried out using a Sunscreen UV Mirror (UV Camera Built in). (3) Results: Nanoserum red shoot leaf extract did not cause skin irritation by 100%, was liked by most panelists by 90% (color, aroma, texture, and comfort), and had a very high protective category against UV radiation by 100%; (4) Conclusions: Nanoserum red shoot leaf extract with a concentration of 0.28% is a natural cosmetic product that is safe, widely liked, and has high protection in protecting the skin from damage due to exposure to ultraviolet rays

Keywords: irritation; hedonic; red shoots; UV rays

1. Introduction

Exposure to ultraviolet (UV) rays is one of the main causes of skin damage such as premature aging, hyperpigmentation, and even skin cancer. UV rays consist of three types: UVA, UVB, and UVC. UVA and UVB can penetrate the skin layers and trigger oxidative stress by forming free radicals. To protect the skin from these negative impacts, various cosmetic and skin care products have been developed, including antioxidant serums and sunscreens. However, most of these products still rely on synthetic chemicals that can cause side effects such as irritation or allergic reactions in sensitive skin [1].

One potential natural alternative as an active ingredient to counteract UV rays is red shoot leaves (*Syzygium myrtifolium* Walp). This plant is known to contain secondary metabolites such as flavonoids, tannins, and anthocyanins, which have high antioxidant activity. These compounds are able to capture free radicals and inhibit oxidative reactions caused by UV exposure. Several previous studies by Lestari et al. 2024 have shown the very strong antioxidant activity of red shoot leaf extract with an IC50 of 6.164 ppm. In

reality, the use of red shoot leaf extract has not been found in modern cosmetic preparations on the market [2].

The use of nanotechnology in cosmetic formulations provides significant advantages because it can increase the penetration of active substances into the skin layer, extend the release time of active ingredients, and increase the stability of the preparation [3]. Nanoserum is an innovative form of serum that has a very small particle size (1–100 nm), so it is easily absorbed by the skin and is effective in providing protection and repair of skin tissue [4,5]. Therefore, the combination of red shoot leaf extract with nanoparticle technology is expected to produce a nano serum product with good UV protection capabilities and very strong antioxidants [6].

In addition to effectiveness, product safety and comfort are also important factors in developing cosmetic preparations. Irritation testing is necessary to ensure that nano serum does not cause skin irritation, while hedonic testing is used to assess consumer acceptance of product characteristics such as color, aroma, texture, and comfort. This testing is essential to ensure that the resulting product is not only effective but also safe and preferred by users [7,8].

Based on this background, this study aims to test the activity of red shoot leaf extract nanoserum as a UV ray deterrent, while also assessing its safety through irritation testing and consumer acceptance through hedonic testing. The research results are expected to contribute to the development of safe, effective, and innovative natural ingredient-based cosmetic products, while also supporting the utilization of local biological resources as high-value active ingredients in the beauty industry. The novelty of this research is that no nanoserum based on red shoot leaf extract encapsulated in nanoparticles with natural polymers has been found.

2. Materials and Methods

The tools and materials used in this study were nanoserum extract from red shoot leaves (Syzygium myrtifolium Walp) with a FII concentration of 0.28%. This selection was based on the characteristics of the nanoparticles, physical properties, stability testing during 3 months of storage at room temperature, and its very strong antioxidant activity compared to other formulas.

The tools used in this study included a patch test chamber or Finn chamber, a small plastic device applied to the subjects' skin, a skin analyzer (a tool for testing whitening, moisturizing, oil, and elasticity), a hedonic scale (fragrance, texture, color, and comfort of use), and a Sunscreen UV Mirror (built-in UV camera) to document the results regarding the nanoserum's UV protection.

This research method begins with a skin irritation test on the nanoserum formula of red shoot leaf extract which is stable during 3 months of storage and has the best physical properties, where the irritation test was carried out using the patch test method on 20 panelists with the following inclusion criteria: willing to fill out a statement of willingness, women aged 18 to 25 years, have normal skin, do not experience skin irritation, are not sick. The following exclusion criteria are having allergies to cosmetics such as nanoserum, having open wounds and skin infections on the face, undergoing dermatological skin therapy (topical steroids/retinoids), having very sensitive skin conditions, pregnant and breastfeeding women [9].

The next study involved a hedonic test involving 20 panelists to assess various sensory aspects of the red shoot leaf extract nanoserum product, such as aroma, texture, color, and comfort of use, using a hedonic scale [9].

The irritation test was conducted using a patch test method. The red shoot leaf extract nanoserum was applied to the inner arm and covered with a transdermal patch, left for 24 hours. After 24 hours, the patch was removed and irritation, such as redness, itching, and inflammation, was observed. The irritation test results were analyzed descriptively to determine the safety of the nanoserum. A positive score was given if the above signs of

irritation occurred and a negative score if no irritation occurred. The total score was then calculated as a percentage. If >80% of patients did not experience redness and itching, the red shoot leaf extract nanoserum was declared safe for use [10, 11].

The comfort test consisted of observing drying speed and interviewing 20 panelists about taste and comfort before and after applying nanoserum extract from red shoot leaves. The results were scored as follows: 1 (not cool), 2 (slightly cool), and 3 (cold). The drying speed category consisted of 2 (fast), 1 (slow), and 2 (comfort) [12].

The hedonic test was conducted through direct interviews with 20 panelists, and the results were recorded on questions such as aroma, texture, color, and comfort. The scores were as follows: 5 (very like), 4 (like), 3 (neutral), 2 (dislike), and 1 (very dislike). Percentages were then calculated for the hedonic results obtained from the 20 panelists [13, 14].

Clinical trials were conducted using a skin analyzer to monitor whitening, moisturizing, oil, and elasticity. Whitening, moisturizing, oil, and elasticity were directly measured using numbers on the skin analyzer. These observations were performed before and after application of the red shoot leaf extract nanoserum [1].

UV protection was tested using a Sunscreen UV Mirror (built-in UV camera) before and after application of the red shoot leaf extract nanoserum. UV protection was demonstrated when the skin after application of the nanoserum was black, indicating very strong UV protection, while the silver color indicated no (weak) UV protection [1].

3. Results

3.1 Irritation test

From the research results obtained formula II Nano Serum Extract of Red Shoot Leaves with a concentration of 0.28% red shoot leaf extract, where this formula is the best formula from the results of testing the characteristics of nanoparticles, has good physical properties and stability during 3 months of storage then an irritation test was carried out based on the permit of the code of ethics letter number 2731 / UN21.8 / PT.01.04 / 2024 from 20 panelists who were willing to fill out the letter of willingness to become panelists, it was found that none of the panelists experienced redness, itching and allergies on their skin after applying nanoserum extract of red shoot leaves. The results of the irritation test of nanoserum extract of red shoot leaves on 20 panelists can be seen in Table 1 below:

Table 1. Irritation test of Nano Serum Red Pucuk Leaf Extract

No	Name	F II Nano Serum Red Shoot Leaf Extract (NSEDPM)		
		red	itchy	allergies
1	NH	-	-	-
2	IF	-	-	-
3	UL	-	-	-
4	AH	-	-	-
5	NI	-	-	-
6	KS	-	-	-
7	RY	-	-	-

8	WY	-	-	-
9	AY	-	-	-
10	FH	-	-	-
11	SH	-	-	-
12	DL	-	-	-
13	MR	-	-	-
14	KN	-	-	-
15	ED	-	-	-
16	LO	-	-	-
17	NJ	-	-	-
18	SS	-	-	-
19	WH	-	-	-
20	AY	-	-	-

3.2 Comfort Test

From the results of interviews with 20 panelists regarding the taste after applying nanoserum extract of red shoots leaves, 2 panelists (10%) stated that it felt a bit cold and 1 panelist (5%) stated that it felt cold, the remaining 17 panelists (85%) stated that it felt cold after applying nanoserum extract of red shoots leaves. Comfort after applying nanoserum extract of red shoots leaves, 19 panelists (95%) stated that they felt comfortable after use and 1 panelist (5%) felt uncomfortable after use. From the results of the drying speed, all 20 panelists (100%) stated that the nanoserum dried quickly and left no residue after application. This can be seen in the comfort test results of nanoserum extract of red shoots leaves as shown in the following table:

Table 2. Comfort Test of Nano Serum Extract of Red Shoot Leaf

No	**Name**	**F II Nano Serum Red Shoot Leaf Extract (NSEDPM)**		
		Sense	Drying speed	Comfortable
1	NH	3	2	2
2	IF	3	2	2
3	UL	3	2	2
4	AH	3	2	2
5	NI	3	2	2

6	KS	2	2	2
7	RY	3	2	2
8	WY	3	2	2
9	AY	3	2	2
10	FH	3	2	2
11	SH	2	2	2
12	DL	3	2	2
13	MR	3	2	2
14	KN	3	2	2
15	ED	3	2	2
16	LO	3	2	2
17	NJ	3	2	2
18	SS	3	2	2
19	WH	3	2	2
20	AY	1	2	1
Total		**17**	**20**	**19**
% tase		**85**	**100**	**95**

Description: Score 1 (not cold); score 2 (slightly cold); score 3 (cold); score 2 (fast); score 1 (slow); score 2 (comfortable); score 1 (not)

3.3 Hedonic Test

Hedonic test or preference for nanoserum red shoot leaf extract consisting of aroma, texture, color and comfort categories. From the results of the hedonic test above, in general, all panelists really liked the aroma of 9 panelists (45%), texture of 18 panelists (90%), color of 17 panelists (85%) and comfort of 18 panelists (90%) only a few did not like the aroma of 1 panelist (5%), color of 1 panelist (5%) did not like and comfort of 1 panelist (5%) did not like. The results of the hedonic test can be seen in Table 3 below:

Table 3. Hedonic test of Nano Serum Red Pucuk Leaf Extract

Name	Aroma					Texture					Color					Comfort				
	SS	S	N	TS	STS	SS	S	N	TS	STS	SS	S	N	TS	STS	SS	S	N	TS	STS
NH	√	-	-	-	-	√	-	-	-	-	-	√	-	-	-	-	√	-	-	-
IF	√	-	-	-	-	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-
UL	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
AH	-	√	-	-	-	√	-	-	-	-	-	√	-	-	-	√	-	-	-	-

NI	-	-	√	-	-	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-
KS	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
RY	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
WY	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
AY	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
FH	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
SH	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
DL	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
MR	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
KN	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
ED	-	-	√	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
LO	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
NJ	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
SS	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
WH	-	√	-	-	-	√	-	-	-	-	√	-	-	-	-	√	-	-	-	-
AY	-	-	-	√	-	√	-	-	-	-	-	-	-	√	-	-	-	-	√	-
Total	**9**	**8**	**2**	**1**	**0**	**18**	**2**	**0**	**0**	**0**	**17**	**2**	**0**	**1**	**0**	**18**	**1**	**0**	**1**	**0**
% tase	**45**	**40**	**10**	**5**	**0**	**90**	**10**	**0**	**0**	**0**	**85**	**10**	**0**	**5**	**0**	**90**	**5**	**0**	**5**	**0**

Description: Score 5 (Strongly Like); Score 4 (Like); Score 3 (Neutral); Score 2 (Dislike); Score 1 (Strongly Dislike)

3.4 Clinical Test (whitening, moisturizer, oil and elasticity)

Whitening, moisturizing, oil and elasticity tests were conducted using a skin analyzer. From the results above, it can be concluded that Nano Serum Extract of Pucuk Merah Leaf does not have whitening properties but has moisturizing properties (61.3% increased to 68.80%), oil reducing properties 41.2% decreased to 38.25%) and elasticity increasing properties (66.3% increased to 70.9%). 2 people were found who did not experience a decrease and increase in oil levels because their oil levels remained at 41% and 38%, 1 person experienced a decrease in moisture from 61% decreased to 60% and 1 person who did not experience an increase in elasticity and the results remained at 66%. For more detailed clinical test results can be seen in table 4 below:

Table 4. Clinical Tests (whitening, moisturizer, oil and elasticity) on Nanoserum red shoot leaf extract

No	Name	Before use				After use			
		W	M	O	E	W	M	O	E
1	NH	10	35	50	49	10	49	46	58
2	IF	10	33	51	49	10	39	50	53
3	UL	10	43	47	54	10	57	42	63
4	AH	10	54	43	61	10	71	37	72

5	NI	10	58	42	64	10	73	36	74
6	KS	10	71	38	73	10	74	37	74
7	RY	10	77	35	77	10	75	36	74
8	WY	10	71	38	72	10	67	38	69
9	AY	10	73	37	73	10	75	35	74
10	FH	10	67	39	69	10	67	39	69
11	SH	10	77	36	76	10	80	34	79
12	DL	10	60	42	65	10	66	39	70
13	MR	10	67	38	69	10	73	36	73
14	KN	10	71	38	73	10	74	37	75
15	ED	10	75	35	74	10	77	36	76
16	LO	10	41	49	54	10	85	33	82
17	NJ	10	74	36	75	10	79	34	78
18	SS	10	65	35	68	10	68	39	70
19	WH	10	72	38	79	10	82	34	80
20	AY	10	74	37	74	10	80	34	79
Aver-age		**10**	**62.9**	**40.2**	**67.4**	**10**	**70.55**	**37.6**	**72.1**

From the results above, it can be claimed that the red shoot leaf extract nanoserum can moisturize the skin, reduce excess oil and increase skin elasticity, but cannot brighten the skin.

3.5 UV protection test

The results of the UV protection ability test using the Sunscreen UV Mirror (UV Camera Built in) before being applied with red shoot leaf extract nanoserum, almost all 20 panelists (0%) did not use sunscreen so that in the initial examination, no testing was carried out with the UV Camera mirror tool, giving a silver color and after being applied with the red shoot leaf extract nanoserum, almost all 20 panelists (100%) were black on the UV camera mirror, this shows a very strong protective ability against UV rays while the silver color indicates no protective ability against UV rays (weak). The results of the red shoot leaf extract nanoserum protection ability test can be seen in the table below:

Table 5. Protection test of Nanoserum extract of red shoot leaves against UV rays

No	Name	Before Use	After Use
		UV Ray (Color)	UV Ray (Color)
1	NH	No (Silver)	Protection (Black)
2	IF	No (Silver)	Protection (Black)
3	UL	No (Silver)	Protection (Black)
4	AH	No (Silver)	Protection (Black)
5	NI	No (Silver)	Protection (Black)
6	KS	No (Silver)	Protection (Black)
7	RY	No (Silver)	Protection (Black)
8	WY	No (Silver)	Protection (Black)
9	AY	No (Silver)	Protection (Black)
10	FH	No (Silver)	Protection (Black)
11	SH	No (Silver)	Protection (Black)
12	DL	No (Silver)	Protection (Black)
13	MR	No (Silver)	Protection (Black)
14	KN	No (Silver)	Protection (Black)
15	ED	No (Silver)	Protection (Black)
16	LO	No (Silver)	Protection (Black)
17	NJ	No (Silver)	Protection (Black)
18	SS	No (Silver)	Protection (Black)
19	WH	No (Silver)	Protection (Black)
20	AY	No (Silver)	Protection (Black)
Average		**0%**	**100%**

The evidence from the examination that Nanoserum Red Pucuk Leaf Extract has protection against UV rays can be seen in the image below:

Figure 1. The Ability of Nanoserum Red Pucuk Leaf Extract Against UV Rays

4. Discussion

4.1 Irritation test

The results of the study showed that formula II Nano Serum Extract of Pucuk Merah Leaf with a concentration of 0.28% was the best formula based on the characteristics of nanoparticles (PSA, PDI, zeta potential). With the small particle size in this formula, the active ingredients of Pucuk Merah leaf extract are more easily absorbed into the deeper layers of the skin so that it can increase the effectiveness and absorption of nanoserum on the skin. Uniform particle size, high stability, and homogeneous particle distribution are important indicators in the effectiveness and absorption of nanoserum on the skin [15].

Physical properties tests including organoleptic examination, homogeneity, sedimentation degree, pH, adhesive power, spreadability, viscosity that formula II with a concentration of red shoot leaf extract of 0.28% remains stable during a three-month storage period. This stability indicates that the active ingredient of nanoserum does not experience damage or significant changes in chemical properties during storage, which ensures that the product remains safe and effective for a certain time. This is very important for making cosmetic products based on natural ingredients because the stability of the product determines its quality when used by customers and its shelf life [3].

With ethical permit number 2731/UN21.8/PT.01.04/2024, skin irritation tests on 20 panelists showed very positive results. After the red shoot leaf extract nanoserum was applied to the skin, there were no skin reactions such as redness, itching, or allergies. The results of the study indicate that formula II is safe for use on human skin and does not cause side effects. Therefore, the Red Shoot Leaf Extract Nano Serum Formula II can be used as a stable, safe, and effective natural cosmetic product to protect the skin from ultraviolet exposure and maintain overall skin health.

Irritation testing on natural nanoserums is crucial to ensure product safety before consumer use. Although herbal ingredients are known to be natural and offer numerous skin benefits, some of their active compounds can potentially cause allergic reactions, redness, or itching in certain individuals. Irritation testing ensures that the nanoserum formulation does not cause adverse side effects and is safe for topical use. Furthermore, this testing demonstrates that the nanoencapsulation process does not alter the active ingredients' irritant properties, ensuring that the resulting product is not only effective but also safe and complies with ethical standards and applicable cosmetic regulations [16, 17].

4.2 Comfort Test

Based on the results of interviews with 20 panelists regarding the sensation of taste after applying the red shoot leaf extract nanoserum, it was found that most panelists felt a cooling sensation on the skin. A total of 17 people (85%) of panelists stated that the nanoserum gave a cooling sensation, 2 people (10%) stated that it felt slightly cooling, and only 1 person (5%) stated that it felt cold. These results indicate that the nanoserum formula is able to provide a cooling sensation effect that is generally desired in skin care products, because it gives a refreshing impression and indicates the activity of natural ingredients that are easily absorbed into the skin. This effect can come from the bioactive

components of the red shoot leaf which have calming and antioxidant properties, as well as the nanoparticle structure that facilitates rapid absorption into the skin layer.

In terms of comfort of use, 19 (95%) panelists stated that the red shoot leaf extract nanoserum felt comfortable after application, while only 1 (5%) felt uncomfortable. This high level of comfort indicates that the nanoserum formula has a light, non-sticky, and easily absorbed texture, making it suitable for use in daily skincare routines. This comfort factor is an important aspect in consumer acceptance of cosmetic products, because users tend to choose products that are not only effective but also provide a pleasant usage experience.

Furthermore, all panelists (100%) stated that the nanoserum dries quickly and leaves no residue on the skin's surface after use. This proves that the nanoparticle formulation system in the product works optimally in accelerating the absorption and evaporation of solvents, so that the skin remains smooth and non-greasy. Good drying speed also indicates the physical stability and homogeneity of the formula, which affects the efficient absorption of the active ingredients of red shoot leaves into the skin. Thus, the results of this interview inform that the red shoot leaf extract nanoserum is not only safe, but also provides a comfortable, refreshing sensation and is quickly absorbed, making it a potential product in the modern natural cosmetics category.

Comfort testing of nanoserum derived from natural ingredients is crucial for assessing the level of user acceptance of the product. Although red shoot leaf extract nanoserum has functional benefits as an antioxidant and UV protector, comfort remains a key factor in determining the product's success on the market. Comfort includes the sensation upon application, such as non-sticky, fast absorption, no burning or stinging sensation, and a cool, soft sensation on the skin. Comfort testing also serves to ensure that the nanoencapsulation process and the composition of the supporting ingredients do not cause discomfort or negative reactions to the skin. Thus, this testing not only supports the safety and effectiveness aspects, but also increases consumer trust and satisfaction with natural nanoserum products [12].

4.3 Hedonic test

The results of the hedonic test on the red shoot leaf extract nanoserum showed that in general the panelists' level of preference for the product was in the high category. Based on the assessment of 20 panelists, it was found that 9 people (45%) really liked the aroma of the nanoserum, while only 1 person (5%) did not like the aroma. This indicates that the aroma produced by the red shoot leaf extract gives a natural and soft impression, although a small number of panelists may have different aroma preferences. The aroma aspect in cosmetic products is very important because it can influence the user's initial perception of quality and comfort of use.

In addition to aroma, the test results showed a high level of preference for the texture, color, and comfort aspects. A total of 18 panelists (90%) stated that they really liked the texture and comfort of the nanoserum, while 17 panelists (85%) liked the color of the product. Only 1 panelist (5%) stated that they did not like the color and comfort, which indicates that overall the nanoserum formula has been well received. The light texture, attractive natural color, and comfortable sensation when applied are the main advantages of this product. Thus, it can be concluded that the red shoot leaf extract nanoserum has high potential to be developed as a natural cosmetic product that is preferred by consumers because it meets the aspects of aesthetics, comfort, and sensory appeal.

Hedonic testing on red shoot leaf extract nanoserum is very important to determine the level of consumer acceptance and preference for the product's sensory characteristics, such as aroma, color, texture, and comfort when used. The hedonic aspect is a determining factor in the success of a cosmetic product in the market, because in addition to being functionally effective, the product must also provide a pleasant experience for the user. Through hedonic testing, it can be determined to what extent the nanoserum formulation

has met consumer preferences, while also being the basis for improvements to the aesthetic and sensorial aspects of the product. Thus, this test not only functions as a quality evaluation, but also as a strategic step in the development of natural ingredient-based cosmetic products that are attractive, safe, and preferred by the public [12].

4.4. Clinical Test (whitening, moisturizer, oil and elasticity)

The test results using a skin analyzer showed that the Nano Serum Extract of Pucuk Merah Leaf has a positive effect on moisture, oil content, and skin elasticity, although it does not show a whitening effect. Based on the data obtained, skin moisture levels increased from an average of 61.3% to 68.8%, indicating that this nanoserum is effective in maintaining skin hydration. This effect likely comes from the content of active compounds in Pucuk Merah leaves, such as flavonoids and tannins, which have the ability to bind water and strengthen the skin's protective layer [18,19]. Thus, this nanoserum has the potential to be developed as a natural moisturizing product that can help maintain skin moisture without causing a sticky or oily feeling.

Furthermore, the test results showed a decrease in oil levels from 41.2% to 38.25%, indicating that the nanoserum can help control sebum production in the skin. This oil-reducing effect indicates that the nanoserum formula not only moisturizes but also helps balance skin conditions, making it suitable for various skin types, including oily skin. However, there were two panelists who did not experience significant changes in oil levels, possibly due to differences in skin type or individual skin metabolism factors. This finding suggests that the effectiveness of the nanoserum can vary between users, so further testing with a larger sample size is important to obtain more representative results.

From the elasticity test results, an increase was obtained from 66.3% to 70.9%, which indicates that the use of Nano Serum Red Shoot Leaf Extract can help maintain and improve skin elasticity. The natural antioxidant content in red shoot leaf extract plays a role in protecting collagen and elastin fibers from damage caused by free radicals, so that the skin looks firmer and healthier. Although there was one panelist who did not experience an increase in elasticity, the overall results still showed a positive trend towards improving skin conditions [20,21]. Thus, it can be concluded that red shoot leaf extract nanoserum functions well as a moisturizer and balancer of the skin's natural oils and has the potential to improve skin elasticity, making it a promising product in natural ingredient-based skin care.

Clinical testing such as whitening, moisturizer, oil, and elasticity on red shoot leaf extract nanoserum before and after use is very important to assess the effectiveness and safety of the product scientifically [12]. Through this testing, real changes in skin condition can be seen, such as the level of brightness, moisture, oil content, and elasticity after using the product for a certain period of time [9]. The results of this test are the basis for determining whether the nanoserum formula actually provides benefits according to the claims made, while ensuring there are no adverse side effects on the skin. In addition, clinical testing also helps in the process of quality standardization and the development of more optimal formulations, so that the resulting product is not only safe and stable, but also proven effective based on accountable scientific data.

4.5 UV protection test

The results of the UV protection test using the Sunscreen UV Mirror (Built-in UV Camera) showed that the red shoot leaf extract nanoserum had excellent protection against ultraviolet light exposure. Before using the nanoserum, all panelists did not use skin protection products so that the initial examination results with the UV Camera showed that 20 people or 0% gave a silver color, which indicates that the skin has no protection against UV rays. This silver color indicates high reflection of ultraviolet rays which means the skin is susceptible to damage due to radiation, such as premature aging, hyperpigmentation, and skin irritation [1].

After applying the red shoot leaf extract nanoserum, the examination results showed a color change to black in all panelists (100%), which indicates a very strong skin protection ability against UV rays. The black color on the UV Camera Mirror display indicates that the nanoserum is able to absorb and block UV light exposure effectively. This proves that the active compounds in the red shoot leaf extract, such as flavonoids, tannins, and anthocyanins, play an important role as natural photoprotective agents that can protect the skin from damage caused by solar radiation. Thus, it can be concluded that the red shoot leaf extract nanoserum has the potential to be developed as an effective, safe, and environmentally friendly natural skin protection product as an alternative to synthetic sunscreen [22, 23].

Testing the UV protection capability of red shoot leaf extract nanoserum is very important to prove the effectiveness of the product in protecting the skin from ultraviolet radiation exposure that can cause skin damage [24]. Through this test, it can be determined to what extent the active compounds in red shoot leaf extract, such as flavonoids and anthocyanins, are able to function as natural photoprotective agents. This test also provides a scientific basis to support the product's claim as a skin protector from sunlight while ensuring the safety of its long-term use [25]. In addition, the results of the UV protection test help in the development of optimal formulations so that the nanoserum not only provides cosmetic benefits, but also plays a role in maintaining skin health from the negative effects of UV rays such as premature aging, hyperpigmentation, and irritation [26].

5. Conclusions

The Nanoserum Extract of Red Shoot Leaves (Syzygium myrtifolium Walp) showed great promise as a natural UV ray blocker that is both safe and effective, according to the study's findings. In terms of scent, texture, color, and comfort, the ideal formulation (0.28% extract) demonstrated strong nanoparticle stability, non-irritating qualities, and excellent user acceptability. According to clinical tests conducted with a skin analyzer, the nanoserum successfully reduced oil levels while increasing skin flexibility and hydration. Additionally, as demonstrated by the UV image's transformation from silver to black following application, the UV protection test validated its potent capacity to block ultraviolet rays. These findings imply that the nanoserum is a potentially effective herbal-based cosmetic product that can naturally moisturize, protect, and preserve the health of the skin.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contribu-tions must be provided. The following statements should be used "Conceptualization, methodology, Lestari Uce.; software, Sani Fathnur; validation, Lestari Uce; formal analysis, Sani Fathnur.; in-vestigation, resources and data curation Lestari Uce.; writing—original draft preparation, writing—review, editing visualization and supervision Lestari Uce; project administration Yuliana and Luri Mekeama; funding acquisition, University Jambi. All authors have read and agreed to the published version of the manuscript."

Funding: Please add: This research was funded by University of Jambi, grant number 288/UN21.11/PT.01.05/SPK/2025.

Informed Consent Statement: Written informed consent has been obtained from the patient(s) to publish this paper.

Conflicts of Interest: The authors declare no conflict of interest.

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