Effectiveness Test of *Garcinia dulcis* (Roxb.) Kurz - based Serum and Clay Mask on Skin Texture

Neneng Siti Silfi Ambarwati[1], Sri Irtawidjajanti[1], Mari Okatini Armandari[1], Elsa Fitri Ana[2], Yulia Triyani[3]

[1]Department of Cosmetology, Faculty of Engineering, Universitas Negeri Jakarta, Jl. Rawamangun Muka, Pulogadung, Jakarta Timur, Jakarta, 13220, Indonesia

[2]Department of Community Education, Faculty of Education, Universitas Negeri Jakarta, Jl. Rawamangun Muka, Pulogadung, Jakarta Timur, Jakarta, 13220, Indonesia

[3]Department of Pharmaceutical Biology, Faculty Pharmacy and Science, Universitas Muhammadiyah Prof. Dr. Hamka, Jl. Delima II, Duren Sawit, Jakarta Timur, DKI Jakarta, 13460, Indonesia

Abstract— *Reactive Oxygen Species can be exposed to blue light from gadgets, UV radiation, or oxidative stress. Left unchecked and frequently exposed, it can damage skin cells or accelerate aging. Preventing premature aging can be done by inhibiting ROS. Plants like G. dulcis (Roxb.) Kurz have antioxidant activity, with an IC50 value of 137.721 µg/mL in fruit extracts. G. dulcis (Roxb.) Kurz was developed into cosmetic preparations such as clay masks and serums based on that potential. This research examined the effectiveness of G. dulcis (Roxb.) Kurz clay mask and serum on different skin conditions and textures. The method used was an allergy test. Applied to the back of the ear or the arm and left to sit. The effectiveness test was conducted using the serum every night for one month, with testing on the first and 30th days. The effectiveness test of the clay mask was conducted by applying the clay mask twice a week for four weeks. Observations were conducted from the first to the eighth observation. Data analysis was performed using the Paired Sample and Wilcoxon Signed Rank Test. The results obtained were that no volunteers experienced allergies, allowing the testing to proceed. The effectiveness test of the clay mask showed significant differences before and after the application of the preparation for different facial conditions. Based on the treatment and skin conditions observations, the anti-aging serum efficacy test results were significantly different before and after the test. The conclusion is that maximizing the formulation can be done by adding ingredients that can control sebum production.*

Keywords— *Anti-aging, clay mask, effectivity, G. dulcis (Roxb.) Kurz, serum.*

I. INTRODUCTION

Based on the Global Organic Personal Care and Cosmetic Products Market report, Asia has become the fastest-growing cosmetics market. The increasing consumer interest in using organic ingredients in cosmetic and personal care products supports this trend. The fulfilment of these needs is supported by consumer surveys, the design of innovative formulations, and manufacturers' launches of products focusing on specific skin issues. Some popular organic ingredients, such as Vitamin C, fruit extracts, honey, and other natural substances, are believed to benefit skin health and beauty [1]. significantly. According to the BPOM press release, local cosmetics dominated the products notified in 2023 with a contribution of 68.78%. In addition, the trend of cosmetic market growth is becoming more apparent, where in the last five years, more than 50% of products have been registered with BPOM [2].

Premature aging is one of the common skin problems that various factors, including gadgets, can cause. Based on data from the Central Statistics Agency, the proportion of personal gadget ownership in Indonesia in 2023 reached 67.29 %[3]. This ownership impacts gadget use duration, contributing to blue light exposure. The blue light emitted by gadgets can reduce cell proliferation and increase TRPV1. Additionally, blue light can also increase the production of Reactive Oxygen Species (ROS), which in excessive amounts can damage skin cells, accelerate aging, and cause hyperpigmentation. This exposure also triggers matrix metalloproteinase (MMP) enzymes, which can break down collagen and accelerate the aging process [4][5]. In addition, ROS can also be caused by UV exposure or oxidative stress [6].

Antioxidants can work by inhibiting intracellular ROS, preventing premature aging [7]. The extract of *Garcinia dulcis* (Roxb.) Kurz fruit shows antioxidant activity with an IC50 value of 137.721 µg/mL [8]. In addition, the extract of *Garcinia dulcis* (Roxb.) Kurz leaves has an antioxidant inhibition percentage of 86.89% (after 24 hours of maceration) [9]. Previous research shows that *Garcinia dulcis* (Roxb.) Kurz has potential as a cosmetic product because it has antioxidant activity that can play a role in skin beauty care.

This aligns with the increasing consumer interest in natural ingredient cosmetics and the continuously growing cosmetics market. This is one of the reasons for choosing *Garcinia dulcis* (Roxb.) Kurz as an innovation in cosmetic products. This study will test the effectiveness of clay mask and serum formulations with *G. dulcis* (Roxb.) Kurz as the main ingredient.

The test will analyze skin conditions using the Lemon8 application. Lemon8 develops the skin test technology [10]. The skin test utilizes AI-based algorithms. The results displayed can include before and after skin treatment [11]. The feature can provide information about skin type (dry, oily, or combination), skin colour, and skin issues. This technology can be employed for skin analysis and to compare skin conditions before and after product use.

II. METHODS

An allergy test is conducted before starting the efficacy test. The allergy test is performed on all respondents. The preparation can be applied on the back of the ear or the arm, after which it is spread and left to sit.

The effectiveness test was conducted by applying the serum to the face every night for one month. Measurements were taken from the first day (before applying the serum) and after 30 days (after applying the serum).

The effectiveness test of the clay mask is conducted by applying the clay mask twice a week. Conducted for 4 weeks. A total of 8 applications. Measurements were taken on the first day (before applying the clay mask) and after using the clay mask. The assessment is in the form of a score indicated by parameters that can be seen in Table 1.

TABLE 1. Skin Condition Assessment

Research Guidelines	Score
It needs improvement; there are fine lines.	1-5
The skin texture is good, and there are a few fine lines.	5-6
The skin is very nice, and there are a few fine lines.	6-10

Data analysis testing was conducted using SPSS version 27. For the effectiveness of the clay mask, the Normality test and Paired t-Test were used. On the effectiveness of the serum, the Wilcoxon test was used.

III. RESULTS AND DISCUSSION

This study was conducted in combination with normal and oily skin conditions. Oily skin is a skin condition with excessive sebum content. This condition causes the skin to be overly shiny and the pores to enlarge [12]. Normal skin has a smoother texture and good elasticity. People with normal skin have pores of medium size and produce sebum in sufficient amounts [13]. Combination skin is a skin condition that combines dry and oily skin [14].

Healthy skin conditions can determine signs of skin aging. These signs are observed based on the texture of the skin [15]. Clay mask preparations are suitable for moisturizing the skin [16]. In general, clay masks can reduce skin problems such as acne and can absorb oil. This is due to the large surface area with ionic charge. The formulation of kaolin or bentonite added to the mask can regulate the skin's moisture balance and prevent excessive sebum production [17]. The results of treatments one to eight are in Table 2.

TABLE 2. Results of the *G. dulcis* (Roxb.) Kurz clay mask study. Treatment: 1

No.	Samples	Skin test Lemon8	Skor by Garnier Skin Coach	
			Before	After
1.	A	Combination	5.5	6.1
2.	B	Combination	3.5	5.5
3.	C	Normal	4.3	6.6
4.	D	Oily	3.5	6.5
5.	E	Combination	4.1	3.8
6.	F	Normal	4.8	4.4
7.	G	Nomal	6.4	4.0
8.	H	Combination	7.3	7.2
9.	I	Normal	6.1	6.1
10.	J	Normal	4.1	5.5

A total of 10 volunteers underwent a skin test to determine their skin type using the Lemon8 application. The analysis shows that four people have a combination skin type, one has an oily skin type, and 5 have a normal skin type. The skin texture test was conducted in two stages: before and after using a clay mask based on *Garcinia dulcis* (Roxb.) Kurz extract.

For volunteers with oily skin types, the skin texture score before using the clay mask was 3.5, indicating that the skin condition needed improvement due to fine lines. After using the clay mask, the score improved to "very good," with only a few fine lines remaining. This indicates an improvement in skin texture after using the clay mask made from *G. dulcis* (Roxb.) Kurz. Of the four volunteers with combination skin:

a. Two volunteers showed "very good" skin condition with slight fine lines after using the clay mask.
b. One volunteer experienced an improvement in skin texture from a score of 3.5 to 5.5, indicating a significant improvement in skin condition.
c. However, one volunteer experienced a decreased skin texture score from 4.1 to 3.8, indicating that the skin condition requires further improvement.

In five volunteers with normal skin:

a. Three volunteers improved skin texture to "good" or "very good" after using the clay mask.
b. One volunteer experienced a decreased skin texture score from 4.8 to 4.4, indicating that the skin still needs improvement due to fine lines.

These results indicate that clay masks based on *G. dulcis* (Roxb.) Kurz extract can improve skin texture, particularly for oily and combination skin. However, the results vary depending on their initial skin condition.

TABLE 3. Results of the *G. dulcis* (Roxb.) Kurz clay mask study. Treatment: 2

No.	Samples	Skintest Lemon8	Skor by Garnier Skin Coach	
			Before	After
1.	A	Combination	5.0	5.1
2.	B	Combination	5.3	5.2
3.	C	Normal	4.3	5.0
4.	D	Oily	4.1	3.8
5.	E	Combination	4.6	4.8
6.	F	Normal	3.9	3.7
7.	G	Nomal	6.1	5.5
8.	H	Combination	5.1	4.7
9.	I	Normal	4.9	4.9
10.	J	Normal	3.8	4.2

The results of the clay mask observation in treatment two can be seen in Table 3. The interpretation of the results is as follows, good skin texture is only present in 2 people with combination skin, and good skin is present in 1 person with standard skin type. After using the clay mask, there was a decrease in skin texture condition across all skin types. The dominant results of the analyzed skin texture still require improvement because fine lines are visible. .

In the third treatment (Table 4), volunteers with oily skin type had poor skin texture, namely 2.4 (needs improvement and has fine lines). After using the clay mask, there was an improvement in the oily skin condition, with the skin texture becoming 6.1 (perfect texture, slight fine lines).

TABLE 4. Research results of *G. dulcis* (Roxb.) Kurz clay mask. Treatment: 3

| No. | Samples | Skintest Lemon8 | Skor by Garnier Skin Coach | |
			Before	After
1.	A	Combination	3.9	4.5
2.	B	Combination	5.5	5.7
3.	C	Normal	3.9	4.6
4.	D	Oily	2.4	6.1
5.	E	Combination	5.2	5.7
6.	F	Normal	5.0	5.5
7.	G	Nomal	5.5	6.4
8.	H	Combination	3.0	5.5
9.	I	Normal	4.3	4.6
10.	J	Normal	4.8	5.5

The improvement in skin texture after using the clay mask is also observed in all skin types. Three people experienced an improvement in skin texture, and one still needs improvement in combination skin condition. There are two people with naturally good skin texture, one with perfect texture, with slight fine lines, and one who needs improvement in normal skin condition.

TABLE 5. Results of the *G. dulcis* (Roxb.) Kurz clay mask study. Treatment: 4

| No. | Samples | Skintest Lemon8 | Skor by Garnier Skin Coach | |
			Before	After
1.	A	Combination	5.0	4.1
2.	B	Combination	5.8	6.6
3.	C	Normal	4.6	4.5
4.	D	Oily	7.2	7.4
5.	E	Combination	4.9	4.6
6.	F	Normal	4.5	4.8
7.	G	Nomal	7.7	6.2
8.	H	Combination	4.7	4.5
9.	I	Normal	5.1	5.7
10.	J	Normal	5.1	5.9

Treatment four yielded results showing an increase in sample B with combination skin (from 5.8 to 6.6), in sample D with oily skin (from 7.2 to 7.4), in sample F with normal skin (from 4.5 to 4.8), and in samples I and J with normal skin (from 5.1 to 5.7) (from 5.1 to 5.9). The results can be seen on Table 5.

TABLE 6. Results of the *G. dulcis* (Roxb.) Kurz clay mask study. Treatment: 5

| No. | Samples | Skintest Lemon8 | Skor by Garnier Skin Coach | |
			Before	After
1.	A	Combination	4.9	5.2
2.	B	Combination	6.2	6.2
3.	C	Normal	4.5	5.0
4.	D	Oily	4.5	4.7
5.	E	Combination	4.0	4.6
6.	F	Normal	5.0	5.8
7.	G	Nomal	7.7	6.2
8.	H	Combination	5.3	5.4
9.	I	Normal	5.0	5.6
10.	J	Normal	5.5	4.8

In treatment six, an increase was observed in sample A with combination skin (from 4.9 to 5.2), sample D with oily skin (from 4.5 to 4.7), and sample E with combination skin (from 4.0 to 4.6). In sample F with normal skin (5.0 to 5.8). In sample

I with normal skin (5.0 to 5.6). The results can be seen on Table 6.

TABLE 7. Research results of *G. dulcis* (Roxb.) Kurz clay mask. Treatment: 6

| No. | Samples | Skintest Lemon8 | Skor by Garnier Skin Coach | |
			Before	After
1.	A	Combination	4.1	4.8
2.	B	Combination	5.2	5.5
3.	C	Normal	4.2	4.1
4.	D	Oily	5.2	6.2
5.	E	Combination	3.9	4.0
6.	F	Normal	4.4	4.9
7.	G	Nomal	5.7	5.8
8.	H	Combination	5.0	5.0
9.	I	Normal	4.5	5.3
10.	J	Normal	4.9	4.9

In the results of treatment 6, sample A with a combination skin (4.1 to 4.8). In sample B with combination skin (5.2 to 5.5). In sample D with oily skin (5.2 to 6.2). In sample E with combination skin (3.9 to 4.0). In sample F with normal skin (4.4 to 4.9). In sample G with normal skin, (5.7 became 5.8). In sample I with normal skin (4.5 to 5.3). The results can be seen in Table 7.

TABLE 8. Research results of *G. dulcis* (Roxb.) Kurz clay mask. Treatment: 7

| No. | Samples | Skintest Lemon8 | Skor by Garnier Skin Coach | |
			Before	After
1.	A	Combination	5.5	6.1
2.	B	Combination	5.8	5.2
3.	C	Normal	4.2	4.6
4.	D	Oily	5.2	5.5
5.	E	Combination	4.5	4.3
6.	F	Normal	4.3	4.2
7.	G	Nomal	5.5	6.4
8.	H	Combination	5.1	5.1
9.	I	Normal	5.5	5.1
10.	J	Normal	4.2	4.1

In the research results for treatment 7. In sample A with combination skin (5.5 to 6.1). In sample C with normal skin (4.2 to 4.6). In sample D with oily skin (5.2 to 5.5). In sample G with normal skin (5.5 to 6.4). The results can be seen on Table 8.

TABLE 9. Results of the *G. dulcis* (Roxb.) Kurz clay mask study. Treatment: 8

| No. | Samples | Skintest Lemon8 | Skor by Garnier Skin Coach | |
			Before	After
1.	A	Combination	5.0	5.1
2.	B	Combination	5.5	6.0
3.	C	Normal	4.1	4.0
4.	D	Oily	5.6	4.8
5.	E	Combination	4.5	4.4
6.	F	Normal	5.1	4.6
7.	G	Nomal	5.9	5.2
8.	H	Combination	3.8	4.0
9.	I	Normal	4.9	4.3
10.	J	Normal	4.6	5.3

In the research results for treatment 8, the sample that experienced an improvement in skin texture was sample A with combination skin (5.0 to 5.1). Sample B used a combination skin type (5.5 to 6.0). In sample H with combination skin (3.8

to 4.01). In sample J with normal skin (4.6 to 5.3). The results can be seen on Table 9.

Based on observations from treatments one to eight. Normal skin conditions tend to experience more changes in skin texture for the better, marked by increased scores. On normal skin, samples C and J tend to experience an increase in skin texture scores from before using the clay mask to after its application. The mask can provide a smoother and softer effect on normal skin. Normal skin has a sufficient sebum production capacity, so using a clay mask can help maximize the cleaning of pores from dirt and dead skin cells more effectively [18].

On combination skin, samples A and B tend to experience an increase in skin texture scores from before application to after application. Combination skin generally has oily areas in the T-zone and dry areas on the cheeks. Clay masks can work evenly on oily and dry areas, resulting in a more uniform skin texture. In oily skin conditions, there tends to be an increase in the texture score before and after use, except for treatment two and treatment eight. The mechanism for oily skin is that a clay mask can absorb excess oil and cleanse the pores. Efforts can be made in the formulation to maximize further pore cleansing on oily skin [17]. Can be made formulations for oily skin. It can be done by adding concentrations of bentonite and kaolin [19], as well as additional ingredients that address bacteria, soothing the skin, and controlling sebum production.

TABLE 10. Normality Test of *G. dulcis* (Roxb.) Kurz Clay Mask

One-Sample Kolmogorov-Smirnov Test

		Sample	Score Before	Score After
N		80	80	80
Normal	Mean	5.50	4.916	5.166
Parameters[a,b]	Std. Deviation	2.890	.9398	.8255
Most Extreme	Absolute	.106	.105	.071
Differences	Positive	.106	.105	.071
	Negative	-.106	-.067	-.058
Test Statistic		.106	.105	.071
Asymp. Sig. (2-tailed)[c]		.025	.030	.200[e]
Monte Carlo	Sig.	.024	.030	.402
Sig. (2-tailed)[d]	99% Confidence Interval	Lower Bound	.020	.025	.389
		Upper Bound	.028	.034	.414

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 334431365.
e. This is a lower bound of the true significance.

The normality test results on the pre-and post-test assessments and the clay mask preparation effectiveness test show standard data in the sample variations, pre-scores, and post-scores. The results can be seen on Table 10. In statistics, the Kolmogorov-Smirnov test is a non-parametric method used to test the similarity of continuous probability distributions, which can be applied to samples [20]. Interpretation is conducted if the p-value is more significant than 0.05, indicating a normal data distribution; if the p-value is less than 0.05, the data is not normally distributed [21]. Based on this normality assumption, it describes the sample observations that are symmetrically distributed around the mean [22].

TABLE 11. Paired Sampel Test SPSS Version 27

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
1	Treatment – Score Before	-.4162	2.4435	.2732	-.9600	.1275	-1.524	79	.132
2	Treatment – Score After	-.6663	2.5728	.2877	-1.2388	-.0937	-2.316	79	.023
3	Face condition- Score Before	-3.2162	1.1506	.1286	-3.4723	-2.9602	-25.001	79	.000
4	Face condition – Score After	-3.4663	.9915	.1109	-3.6869	-3.2456	-31.270	79	.000

The paired t-test is a statistical technique used to compare the means of two related samples from the same subjects [23]. The results can be seen on Table 11. This test can be applied when data is measured on the same subjects, such as before and after treatment [23]. Interpretation is conducted if the significance value is <0.05, indicating a significant difference, whereas if the significance value is >0.05, there is no significant difference [24].

In treatments one to eight, there was no significant difference in the test results obtained before applying the clay mask. Treatments one to eight after being given the clay mask and tested also showed no significant difference. There was a significant difference in facial condition variations before and after applying the clay mask.

This study shows that differences in initial facial conditions can also yield different results after using a clay mask. In observations that have not yet demonstrated significant differences, this can be addressed by increasing the duration of use, improving the formulation by increasing the concentration of active ingredients, and increasing the frequency of clay mask use. It can also be done by increasing the sample size to provide more representative results.

Next is the assessment of the *G. dulcis* (Roxb.) Kurz anti-aging serum. The evaluation was conducted at the beginning and end of the treatment. The assessment results can be observed in Tables 12 and 13.

TABLE 12. The Use of Anti-aging Serum on Facial Skin Texture. Treatment 1

No.	Samples	Skintest Lemon8	Skor by Garnier Skin Coach	
			Before	After
1.	A	Normal	6.5	4.0
2.	B	Normal	6.5	6.8
3.	C	Combination	3.4	3.7
4.	D	Combination	3.5	5.5
5.	E	Normal	7.8	8.2
6.	F	Normal	3.4	3.3
7.	G	Combination	4.7	4.9
8.	H	Combination	5.1	5.0
9.	I	Combination	5.6	5.9
10.	J	Combination	5.4	5.2

TABLE 13. The Use of Anti-aging Serum on Facial Skin Texture. Treatment 8

No.	Samples	Skintest Lemon8	Skor by Garnier Skin Coach	
			Before	After
1.	A	Normal	6.2	6.1
2.	B	Normal	5.1	5.3
3.	C	Combination	3.5	4.4
4.	D	Combination	4.9	4.6
5.	E	Normal	6.6	5.2
6.	F	Normal	4.5	4.7
7.	G	Combination	4.6	4.9
8.	H	Combination	5.7	5.2
9.	I	Combination	3.6	5.0
10.	J	Combination	5.6	0.0

The use of anti-aging serums has become one of the popular methods to improve the quality of facial skin texture. Based on data analysis using the Lemon8 and Garnier Skin Coach applications, the results show that the effectiveness of anti-aging serums varies depending on the individual's skin type. The skin types observed include normal and combination skin, each having a different response to the serum treatment.

TABLE 14. Ranks Wilcoxon SPSS Version 27

Ranks		N	Mean Rank	Sum of Ranks
Before Test – Treatment	Negative Ranks	0[a]	.00	.00
	Positive Ranks	20[b]	10.50	210.00
	Ties	0[c]		
	Total	20		
After Test - Treatment	Negative Ranks	1[d]	1.00	1.00
	Positive Ranks	19[e]	11.00	209.00
	Ties	0[f]		
	Total	20		
Before Test – Face condition	Negative Ranks	0[g]	.00	.00
	Positive Ranks	20[h]	10.50	210.00
	Ties	0[i]		
	Total	20		
After Test – Face condition	Negative Ranks	1[j]	2.00	2.00
	Positive Ranks	19[k]	10.95	208.00
	Ties	0[l]		
	Total	20		

a. Before Test < Treatment
b. Before Test > Treatment
c. Before Test = Treatment
d. AfterTest < Treatment
e. AfterTest > Treatment
f. AfterTest = Treatment
g. BeforeTest < Facecondition
h. BeforeTest > Facecondition
i. BeforeTest = Facecondition
j. AfterTest < Facecondition
k. AfterTest > Facecondition
l. AfterTest = Facecondition

The results of the observation of *G. dulcis* (Roxb.) Kurz extract serum usage were conducted in the first and eighth treatments. Observations were made on the differences in facial conditions, namely standard and combination skin. In the first treatment, the skin texture scores of several samples increased after using the serum, such as in sample D on combination skin (from 3.5 to 5.5) and in sample E on normal skin (from 7.8 to 8.2).

In the eighth treatment, the results showed a more complex pattern. Samples that showed an increase were sample C on combination skin (3.5 to 4.4) and sample F on normal skin (4.5 to 4.7).

The interpretation of the ranks above is that there were no lower values after the treatment compared to before the test, and there was an increase in all data after the treatment and in the differences in facial conditions. The results can be seen in Table 14. There is one lower value in the pre-test treatment, and there is an increase in 19 data points after the test across all facial condition differences.

TABLE 15. Wilcoxon Signed Ranks Test SPSS Version 27
Test Statistics[a]

	Before Test-Treatment	After Test-Treatment	Before Test-Face condition	After Test-Face condition
Z	-3.922[b]	-3.884[b]	-3.921[b]	-3.847[b]
Asymp. Sig. (2-tailed)	.000	.000	.000	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

The Wilcoxon signed ranks test was conducted to measure the significance of the difference between 2 groups with paired ordinal or interval scale data with a non-normal data distribution [25]. The results can be seen in Table 15. The results indicate that the treatment difference with the texture score of *G. dulcis* (Roxb.) Kurz is significant (0.000). After the test and treatment, substantial results were obtained (0.000). The difference in facial conditions before and after the test also showed a significant difference (0.000).

In addition, an allergy test was also conducted, with the result that no volunteers experienced allergies. Overall, the results of this study indicate that the effectiveness of anti-aging serums is individual and highly dependent on the user's skin type and initial condition. Statistical analysis is needed to determine the significance of changes before and after using the serum to obtain a more decisive conclusion. Additionally, further research with stricter variable controls is required to evaluate factors that could influence the results, such as the duration of use, the concentration of active ingredients in the serum, and the subjects' adherence to the application protocol.

IV. CONCLUSION

The testing was conducted through observation. In the clay mask preparation, a person's facial condition significantly impacts the face both before and after using the clay mask. Applying a clay mask affects combination, regular, and oily skin. However, formulation development can be carried out to maximize dirt absorption from the pores. The application of anti-aging serum shows a significant difference before and after the test in terms of treatment differences and facial conditions. No volunteers have allergies.

REFERENCES

[1] Mordorintelligence, "Organic Personal Care and Cosmetic Products Market Size."

[2] Badan Pengawas Obat dan Makanan, "Siaran Pers Nomor HM.01.1.2.08.24.46 Kolaborasi BPOM dengan Lintas Sektor, Majukan Industri Wellness Indonesia," *https://www.pom.go.id/siaran-pers/siaran-pers-nomor-hm-01-1-2-08-24-46-tanggal-2-agustus-2024-tentang-kolaborasi-bpom-dengan-lintas-sektor-majukan-industri-wellness-indonesia*, 2024.

[3] B. P. Statistik, "Proporsi Individu yang Memiliki Telepon Genggam (Persen) 2021-2023," 2024. [Online]. Available: https://www.bps.go.id/id/statistics-table/2/MTIyMSMy/proporsi-individu-yang-menguasai-memiliki-telepon-genggam-menurut-provinsi.html

[4] J. A. Yoo, E. Yu, S.=H. Park, S. W. Oh, K. Kwon, S. J. Park, H. Kim, S. Yang, J. Y. Park, J. Y. Cho, Y.-J. Kim, and J.Lee, "Blue Light Irradiation Induces Human Keratinocyte Cell Damage via Transient Receptor Potential Vanilloid 1 (TRPV1) Regulation," *Oxid. Med. Cell. Longev.*, vol. 2020, 2020, doi: 10.1155/2020/8871745.

[5] J. Kumari, K. Das, M. Babaei, G. R. Rokni, and M. Goldust, "The impact of blue light and digital screens on the skin," *J. Cosmet. Dermatol.*, vol. 22, no. 4, pp. 1185–1190, 2023, doi: 10.1111/jocd.15576.

[6] C. Andrés Juan, J. Manuel Pérez de la Lastra, F. J. Plou, E. Pérez-Lebeña, and S. Reinbothe, "Molecular Sciences The Chemistry of Reactive Oxygen Species (ROS) Revisited: Outlining Their Role in Biological Macromolecules (DNA, Lipids and Proteins) and Induced Pathologies," *Int. J. Mol. Sci*, vol. 22, p. 4642, 2021, doi: https://doi.org/10.3390/ijms22094642.

[7] Ju. S. Koernienko, I. S. Sminorva, N. A. Pugovkina, Ju. S. Ivanova, M. A. Shilina, T. M. Grinchuk, A. N. Shatrova, N. D. Aksenov, V. V. Zenin, N. N. Nikolsky, and O. G. Lyublinskaya, "High doses of synthetic antioxidants induce premature senescence in cultivated mesenchymal stem cells," *Sci. Rep.*, vol. 9, no. 1, pp. 1–13, 2019, doi: 10.1038/s41598-018-37972-y.

[8] N. S. S. Ambarwati, N. T. Sukma, A. A. Yesi Desmiaty, M. A. Setia Budi, and I. Ahmad, "*Garcinia dulcis* (Roxb.) Kurz and Garcinia forbesii King Fruit peel Extract : Secondary metabolite composition , antioxidant , and elastase inhibitory activity evaluation," *J. Adv. Pharm. Technol. Res.*, vol. 15, no. 1, pp. 8–12, 2024, doi: 10.4103/japtr.japtr.

[9] S. Widodo, N. M. Yusa, and P. Timur Ina, "Pengaruh Waktu Maserasi Terhadap Aktivitas Antioksidan Ekstrak Daun Mundu (*Garcinia dulcis* (Roxb.) Kurz (Roxb.) Kurz)," *J. Ilmu dan Teknol. Pangan*, vol. 10, no. 1, p. 14, 2021, doi: 10.24843/itepa.2021.v10.i01.p02.

[10] Lemon8, "Fitur Lemon8," 2022. https://www.lemon8-app.com/lemon8_tutorial/7099736682093707778?region=id

[11] Lemon8, "Pemeriksaan Masalah Kulit dengan AI Scanning," 2023. https://www.lemon8-app.com/@lemon8indonesia/7254053304873878017?region=id

[12] P. M. B. G. Maia Campos, M. O. Melo, and D. G. Mercurio, "Use of advanced imaging techniques for the characterization of oily skin," *Front. Physiol.*, vol. 10, no. MAR, pp. 1–9, 2019, doi: 10.3389/fphys.2019.00254.

[13] S. Saiwaeo, S. Arwatchananukul, L. Mungmai, W. Preedalikit, and N. Aunsri, "Human skin type classification using image processing and deep learning approaches," *Heliyon*, vol. 9, no. 11, p. e21176, 2023, doi: 10.1016/j.heliyon.2023.e21176.

[14] R. S. Wahyuningtyas, Tursina, and H. S. Pratiwi, "Sistem Pakar Penentuan Jenis Kulit Wajah Wanita Menggunakan Metode Naïve Bayes," *J. Sist. dan Teknol. Inf.*, vol. 1, no. 1, 2015.

[15] M. Langeveld, L. S. Van De Lande, J. A. Van Dongen, E. O. Sullivan, and B. Van Der Lei, "Skin measurement devices to assess skin quality : A systematic review on reliability and validity," *Ski. Res. Technol.*, vol. 28, no. 2, pp. 212–224, 2022, doi: 10.1111/srt.13113.

[16] E. Kumalasari, R. A. Wulandari, N. Aisyah, and D. R. Febrianti, "Formulasi Sediaan Masker Clay dari Ekstrak Daun Pidada Merah (Sonneratia caseolaris) sebagai Antioksidan," *J. Insa. Farm. Indones.*, vol. 6, no. 1, pp. 55–64, 2023, doi: 10.36387/jifi.v6i1.1363.

[17] X. Zhang *et al.*, "Comprehensive assessment of the efficacy and safety of a clay mask in oily and acne skin," *Ski. Res. Technol.*, vol. 29, no. 11, pp. 1–7, 2023, doi: 10.1111/srt.13513.

[18] Y. Febriani, S. Sudewi, and R. Sembiring, "Formulation And Antioxcidant Activity Test Of Clay Mask Extracted Ethanol Tamarillo (Solanum betaceum Cav.)," *Indones. J. Pharm. Sci. Technol.*, vol. 1, no. 1, p. 22, 2022, doi: 10.24198/ijpst.v1i1.36432.

[19] R. Tungadi, N. A. Thomas, M. A. Paneo, and R. Putri, "Formulasi dan Evaluasi Sediaan Masker Lumpur Ekstrak Bunga Rosella (Hibiscus Sabdariffa L .) menggunakan Basis Bentonit dan Kaolin," *Indones. J. Pharm. Educ.*, vol. 4, no. 2, pp. 336–345, 2024, doi: 10.37311/ijpe.v4i2.18040.

[20] A. Quraisy, "Normalitas Data Menggunakan Uji Kolmogorov-Smirnov dan Saphiro-Wilk," *J-HEST J. Heal. Educ. Econ. Sci. Technol.*, vol. 3, no. 1, pp. 7–11, 2022. doi: 10.36339/jhest.v3i1.42.

[21] A. Ghasemi and S. Zahediasl, "Normality tests for statistical analysis: A guide for non-statisticians," *Int. J. Endocrinol. Metab.*, vol. 10, no. 2, pp. 486–489, 2012, doi: 10.5812/ijem.3505.

[22] M. Tsagris and N. Pandis, "Normality test: Is it really necessary?," *Am. J. Orthod. Dentofac. Orthop.*, vol. 159, no. 4, pp. 548–549, 2021, doi: 10.1016/j.ajodo.2021.01.003.

[23] D. Syafriani, A. Darmana, F. A. Syuhada, and D. P. Sari, *Statistik Uji Beda Untuk Penelitian Pendidikan (Cara Dan Pengolahannya Dengan SPSS)*, 1st ed. Purbalingga, 2023.

[24] W. Haryanti, A. Adisel, F. S. Syafir, and S. Suryati, "Pengaruh Media Dua Dimensi Terhadap Pemahaman Konsep Matematika," *J. Elem. Sch.*, vol. 4, no. 2, pp. 160–165, 2021, doi: 10.31539/joes.v4i2.2808.

[25] Triwiyanti, T. Ardina, and R. Maghfira, "Wilcoxon Test , Dependent Test and Independent Test," *Univ. Gajah Mada*, p. 28, 2019, doi: 10.13140/RG.2.2.34721.07525.