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Article

Hedonic Test of *Garcinia dulcis* Extract Mask and Serum

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Abstract

The cosmetics industry is experiencing rapid growth as consumer awareness of the importance of safe and effective skincare products increases. This creates an excellent opportunity for natural ingredient cosmetics. *Garcinia dulcis* has been proven to have bioactive activities, such as antioxidants and anti-elastase, which can potentially be used for skin care, such as preventing premature aging and maintaining skin elasticity. This study evaluates consumer preference levels for peel-off masks and *Garcinia dulcis* extract serums. The method used was a hedonic test with parameters of aroma, skin feel, texture, color, absorption, viscosity, and drying time on a scale of 1-5. Data were analyzed using the Mann-Whitney U test. The results were that 33.85% of the panelists were neutral towards the serum's aroma, and 40% did not like the mask's aroma. A total of 41.54% of the panelists liked the serum's texture, and 33.85% of the panelists were neutral about liking the mask's texture. The skin taste parameter showed that 58.46% of the panelists liked the serum, and 36.92% were neutral about liking the mask. The serum and mask colors were liked by 46.15% and 44.62% of the panelists. The serum's absorption rate and the mask's drying time were liked by 36.92% and 33.85% of the panelists, respectively. A total of 33.85% of the panelists liked the serum's viscosity. The statistical test showed significant differences in aroma, taste, and absorption ($p < 0.05$). In conclusion, the mask and serum of *Garcinia dulcis* extract have good potential as skincare products, although further development is needed to improve the aroma, taste, and drying time.

Keywords: *Garcinia dulcis,* hedonic, peel-off mask, Mann-Whitney U, serum

1. INTRODUCTION

According to BPOM, cosmetics are one of the preparations used on the outer parts of the body, with the aim of cleansing, perfuming, altering appearance, improving body odor, or maintaining the body [1]. The development of the cosmetics industry has also skyrocketed; according to BPS data, the market volume in 2022 for personal care reached USD 3.18 billion, skincare USD 2.05 billion, cosmetics USD 1.61 billion, and fragrances USD 39 million [2]. The increasing cosmetics market and high public interest can provide opportunities to introduce natural-based cosmetics. Natural-based cosmetics can offer advantages, such as being safer for long-term skin care, more environmentally friendly, and containing abundant bioactive compounds to provide protective benefits and prevent damage from free radicals [3].

The *Garcinia dulcis* plant is rich in bioactive compounds. In the study by Ambarwati et al., it is mentioned that the extract of *G. dulcis* fruit was obtained using the MAE method with 70% ethanol as the solvent, an extraction time of 15 minutes, and a power of 120 watts. It has an IC_{50} value of 137.721 "μ" g/mL for antioxidants and 108.893 "μ" g/mL for anti-elastase [4]. Furthermore, the antioxidant and anti-elastase activities of the G. dulcis fruit extract are moderate [5]. Antioxidants and anti-elastase benefit the skin; antioxidants can protect skin cells from reactive oxygen species (ROS), thereby preventing premature aging and providing protection from sunlight [6]. Anti-elastase can maintain skin elasticity and give moisture to the skin [7].

Based on the potential, the researchers created mask and serum preparations with the active ingredient *G. dulcis* extract, which had previously undergone activity testing of the extract and preparations, resulting in preparations that retained antioxidant activity. A hedonic test was conducted to improve consumer acceptance of the product. The hedonic test will be conducted to observe consumer preferences regarding the characteristics of the cosmetic product. Hedonic testing includes aroma, skin feel, texture, color, viscosity, and drying/absorption time. The results will later serve as product evaluation and a strategic step for developing the formulation.

In the research conducted by Amanda *et al.*, a hedonic test was performed on a lip cream preparation with red betel leaf extract. The hedonic test was conducted on 20 panelists, and the results showed that the panelists preferred the color of the lip cream to be somewhat dark, and the most liked texture was formula two due to its ease of application [8]. The study by Kinzinger et al. explains that the results of testing the hedonic aspect play an important role in web tools and consumer enjoyment [9]. Those results can facilitate the development of formulations that the target market can like.

2. MATERIALS AND METHODS

2.1. Method

2.1.1.Research Design

The research was conducted using random sampling. The hedonic test approach evaluated the panelists' preference level for peel-off masks and masks based on *G. dulcis* extract.

2.1.2.Research Subjects

The sample size is determined based on the formula:

$$n = \frac{N}{Nd^2+1}$$

The value of n is the sample size, N is the population size, and d is the desired minimum efficacy of 10%. This study considers the dropout rate, adding 15%. This study uses multiples of 2, resulting in 65 panelists.

2.1.3 Inclusion Criteria

The inclusion criteria for this study include the following: female employees of Universitas Negeri Jakarta; aged 20-40 years; healthy; have normal/dry facial skin and signs of skin aging; discontinue the use of other facial products during the study; and willing to participate in the study by signing a statement after receiving an explanation (Informed consent).

2.1.4 Exclusion Criteria

The exclusion criteria for this study include the following: women with skin disorders such as acne and other skin diseases; pregnant; breastfeeding; using oral/topical medications that affect skin condition; menopausal women; smoking women; and unwilling to participate in the study.

2.1.5 Dropout Criteria

If the woman who is the sample does not return to the research site

2.2 Research Procedure

There were 65 panelists divided into four groups—each with a formula of cosmetic serum and peel-off face mask. Grouping is based on a balanced experimental design, where each sample was presented in a different order. The application locations were on the volar forearm areas of the right and left arms as substitutes for facial skin (for ethical reasons). The left volar forearm area was used as the control group, and the right was used as the treatment group. The panelists do not know the difference in the formulations. Each panelist evaluates the product by indicating acceptance of the cosmetic.

2.2.1 Assessment Parameters

Assessment was conducted on a 5-point scale.

1 = very dislike (0-20%)
2 = dislike (21-40%)
3 = neutral (41-60%)
4 = like (61-80%)
5 = very like (81-100%)

2.3 Data Analysis

The evaluation results were conducted using Kruskal-Wallis and Man.

2.4 Research Ethics

Panelists who follow the research procedures have reviewed and signed the Informed Consent form.

3. RESULT AND DISCUSSION

3.1. Hedonic Test Data

Here is the table of the Hedonic test results on the peel-off mask and serum preparations with *G. dulcis* extract, observed based on the parameters of aroma, skin feel, texture, color, viscosity, drying time for the peel-off mask, and absorption for the serum (Table 1).

The scale for the assessment is from 1 to 5. The average panelist rated the serum's aroma at 3.0, indicating that the panelists considered the serum's aroma neutral. This means that the aroma of the serum could be more appealing, but it is not bothersome either. The average aroma rating scored 2.3 in the peel-off mask, which falls within the dislike range. Panelists tend to dislike the aroma of the mask. This indicates that the characteristic smell of the natural extract ingredients has yet to be well masked in the peel-off mask formulation.

Table 1. Hedonic Test Data for Serum dan Mask Product

Product *G. dulcis* extract	Scale 1-5 ± SD					
	Aroma	Skin feel	Texture	Color	Viscosity	Drying time/ absorption
Serum	3.0 ± 1.1	3.6 ± 0.7	3.6 ± 0.8	3.9 ± 0.9	3.5 ± 1.2	4.0 ± 1.1
Peel off mask	2.3 ± 1.0	3.3 ± 0.9	3.4 ± 1.0	3.6 ± 0.9	-	3.2 ± 1.1

The serum's skin feel assessment scored 3.6, close to the liking range. This means that during the serum's use, the panelists thought it was soft and non-sticky, which was not bothersome but could be further optimized. The average score for the mask was 3.3, which falls within the neutral range. This means that the panelists feel comfortable, but further formula development can be done, such as optimizing the film-forming ingredients to provide a relaxed feel on the skin.

The assessment of the serum's texture is 3.6, indicating it is close to the like range. This means the serum's texture is appropriate, both too thick and too runny. The average score in the peel-off mask preparation is 3.4, which falls within the neutral to like range. The peel-off mask can undergo further formula development to reach a level preferred by the panelists. This can be achieved by adjusting the formula to obtain a mask texture that is easy to apply and does not easily break when dry.

The assessment of the serum's color-averaged a score of 3.9, indicating that the serum falls into the liked category. In contrast, the mask averaged a score of 3.6, also marking the liked category. However, the number of people who liked the serum was higher than those who wanted the mask. In terms of viscosity, the serum scored 3.5, indicating a neutral to favorable category. This means that the panelists relatively accept the serum's consistency, but its consistency is still not ideal.

In the drying/absorption time evaluation, the serum has a score of 4.0, which falls into the favorable category. Therefore, the serum has a quick absorption ability on the skin, making the sensation acceptable to the panelists after use. The mask has a score of 3.2, which indicates a neutral category. Therefore, the mask formulation still requires development to optimize the drying time, which can be achieved by adding drying agents and adjusting the formulation's viscosity. The drying time needed for mask preparation is 15 to 30 minutes [10].

3.1. Sensor Parameter Test

3.1.1 Aroma

The following is an image of the hedonic test evaluation of serum and mask with a rating from one to five.

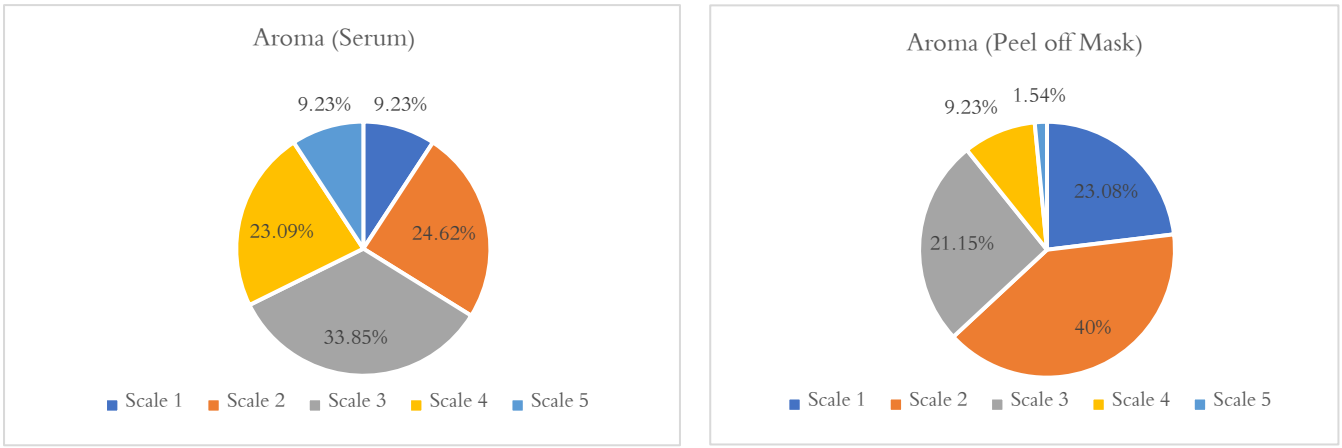

Figure 1. Hedonic Aroma Test on Serum and Peel off Mask

Sensory analysis is one of the strategic steps in the cosmetics industry, used for evaluating characteristics, product development, innovation, and marketing [11]. Aroma is one of the critical roles that can influence consumer preference perception towards a product. Maintaining a product's aroma and bioactive compounds is an important task. A product with a pleasing aroma can enhance the quality of the cosmetics and increase the product's appeal. Furthermore, acceptable aromas to consumers provide a good mood and relaxation [12]. Diagram 1 above shows that 33.85% of the panelists rated the serum aroma as 3 (neutral), and 40% rated the mask aroma as 2 (disliked). The next step that can be taken is to evaluate the serum and mask aromas and conduct an aroma preference survey among the target consumers to determine the most preferred aroma type. Natural fragrances with a mild intensity that do not overpower can be added to avoid disturbing user comfort. Then, aroma stability testing will be conducted to optimize the product's aroma during storage.

3.1.2 Skin Feel

The image below is the result of the hedonic test based on skin feel, which can be observed in Figure 2.

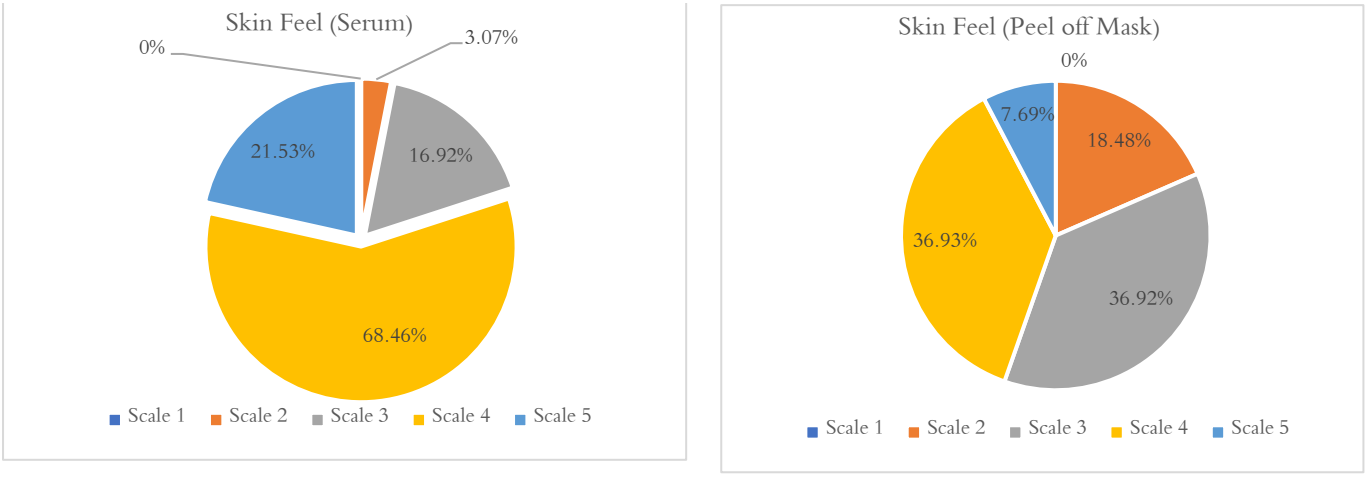

Figure 2. Hedonic Taste Test on Skin in Serum and Peel-off Mask

Showing the user's sensation after the product is applied to the skin. The sensory focus that needs to be considered for serum formulations is providing moisture to the skin without causing a sticky feeling. In contrast, mask formulations should have a film layer that is easy to peel off after drying and does not cause pain [13]. Additionally, it should provide a cooling sensation when applying the mask to the skin [14]. Figure 2 shows that 58.46% of the panelists gave a score of 4 (like) for the feel of the skin of the serum preparation, and 36.92% gave a score of 3 (neutral) and 4 (like) for the mask. The score for the serum reflects good product acceptance among the panelists, which can be an advantage for the product's competitiveness in the market. The mask preparation has yet to capture the panelists' attention fully, but it does not interfere with its use.

3.1.3 Texture

Texture is also one of the sensory attributes in cosmetics that can influence the user's level of preference for the product. Texture can affect user comfort, which is related to user satisfaction. The serum's texture is liquid and easily absorbed by the skin, as the viscosity is not too high, which enhances the serum's spreadability on the skin surface [15]. The mask preparation focuses on a texture with high adhesion, good spreadability, ease of application, removal, cleaning, and elasticity [16]. The results are shown in Figure 3. The hedonic test on the serum preparation showed that 41.54% of the panelists gave a score of 4 (like), while 22% of the panelists gave a score of 3 (neutral) and 4 (like) for the mask preparation. This indicates that further optimization is still needed for the mask preparation.

The image below is the result of the hedonic test based on texture, which can be observed in Figure 3.

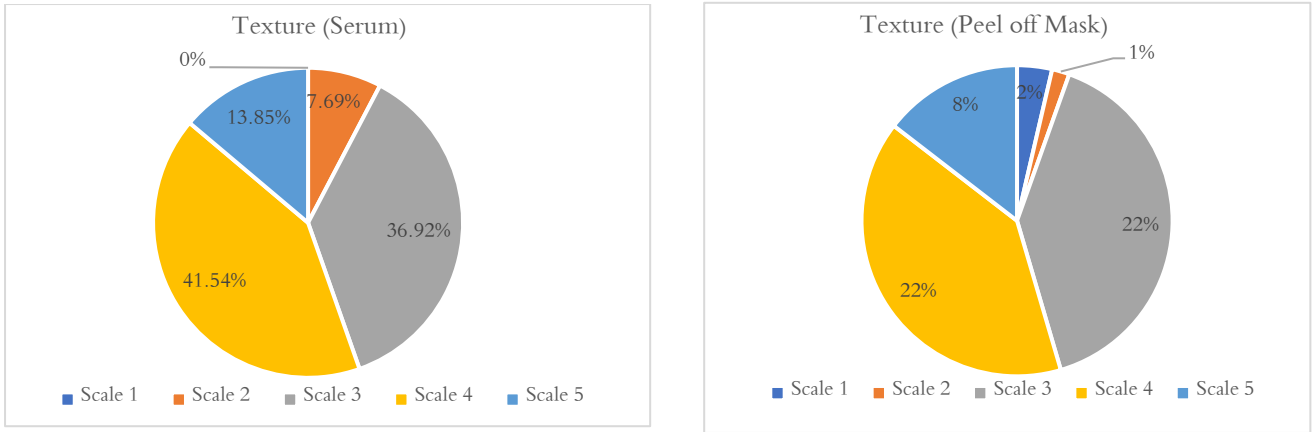

Figure 3. Hedonic Texture Test on Serum and Peel off Mask

3.1.4 Color

Color assessment evaluates the panelists' preference for the product's color. The product's color affects visual appeal and perception of product quality. Colors can be created to reflect benefits or key active ingredients. Color uniformity is also essential in formulations, indicating formulation quality with no spots or clumps. Color stability must also be considered to prevent changes during storage. The results are shown in Figure 4. The hedonic test on color showed that 46.15% of the panelists gave the serum a score of 4 (like). 44.62% gave a score of 4 (like) to the mask.
The image below shows the hedonic test result based on color, as shown in Figure 4.

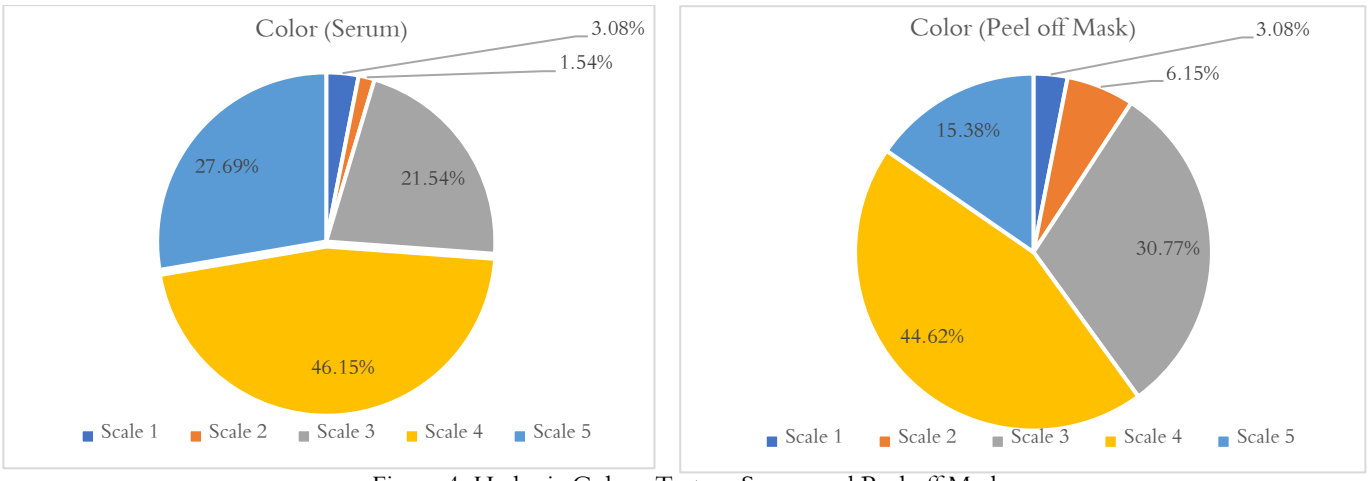

Figure 4. Hedonic Colour Test on Serum and Peel off Mask

3.1.5 Serum Viscosity

Viscosity is a physical characteristic that plays an essential role in serum products. The appropriate viscosity in serum can provide comfort during use, efficacy, and ease of use. The formulation's viscosity will affect the serum's spreadability and adhesion [15,17]. A good serum is neither too thin nor too thick. The viscosity requirement for the serum is 800 – 3000 cPS [18]. The results of the hedonic test can be seen in Figure 5, which shows that 33.85% of the panelists chose a score of 4 (like) for the serum viscosity.

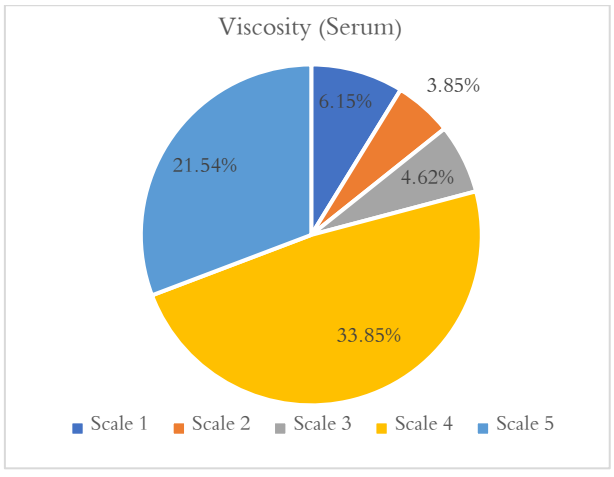

Figure 5. Hedonic test of viscosity on serum

3.1.6 Absorption and Dry Time

3.1.6.1 Absorption (Serum)

The absorption of a serum is the time it takes for the product to penetrate the skin after application. If the serum absorbs more quickly, it usually has a light consistency and does not leave a sticky residue. Water-based serums are absorbed more rapidly by the skin because the water content can hydrate the skin and has high penetration [19,20]. The adhesion to the

serum will affect absorption; the longer the adhesion, the better the absorption [21]. The results are shown in Figure 6. In this hedonic test, 36.92% of the panelists rated the serum's absorption with a score of 5 (very much liked). This indicates that the serum has good absorption performance and is favored by users.

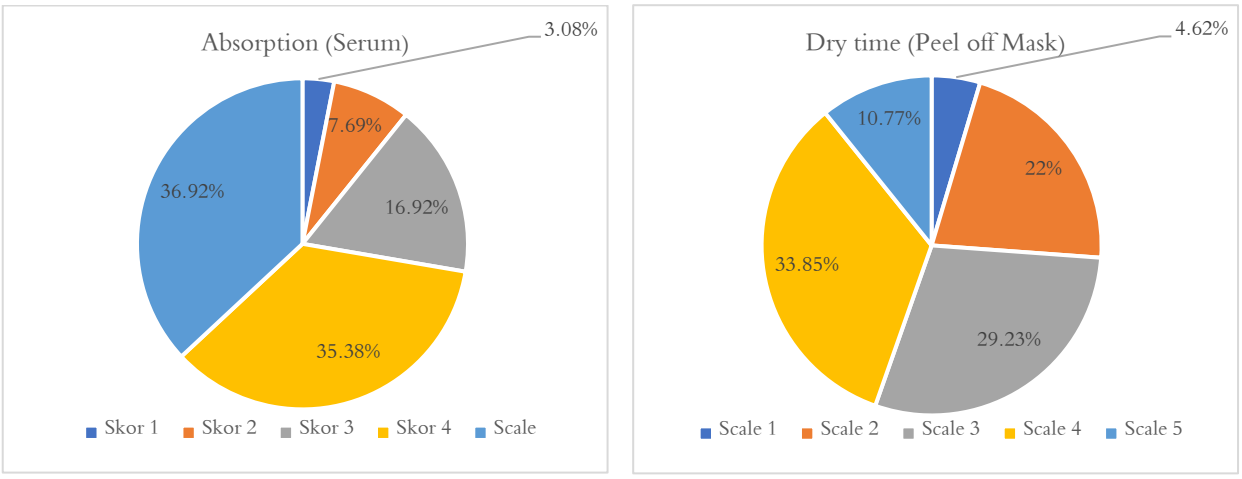

Figure 6. Hedonic test of Absorption serum and Dry time peel-off mask

3.1.6.2 Dry Time (Peel off Mask)

Drying time is required for the mask to transition from a liquid or semi-solid consistency to a solid layer. The formed layer will then be removed and rinsed off. However, during this process, it is essential to pay attention to moisture to prevent irritation after the mask is removed [22]. Masks with high water content usually take longer to dry. Ideally, peel-off masks take 10 to 30 minutes to dry [10]. Drying time that is too fast can make smoothing the mask difficult, but if it takes too long, it can cause skin irritation and inefficiency. The results are shown in Figure 6. In this hedonic test, 33.85% of the panelists gave a score of 4 (like) for the peel-off mask preparation drying time.

3.2 Data Analysis

3.2.1 Mann Whitney U Test

The Mann-Whitney U test compares the central tendency measures between groups without assuming normality [23]. This test will examine the significance of the difference between two independent samples. Aiming to compare two treatments or two perceptions [24]. The results of the Mann-Whitney U test on aroma, taste, and absorption/drying time indicate a significance value (p-value) of 0.000, which means there is a significant difference between the serum and mask groups.

Aroma, taste, absorption/drying power (p=0.000) <0.05. Therefore, the panelists concluded that there are significant differences in the characteristics of aroma, taste, and absorption/drying power between the mask and serum preparations. This indicates that the characteristics of the two formulations have different appeals to users. In terms of the absorption and drying ability of the mask, there is a difference due to the difference in mechanisms, where the serum absorbs faster than the mask because the mask takes longer to form a layer on the skin.

Table 2. Mann Whitney U Test

Test Statistics[a]					
	Aroma	Skin feel	Texture	Color	Absorption_dry time
Mann-Whitney U	1341.000	1250.000	1820.500	1700.000	1323.500
Wilcoxon W	3486.000	3395.000	3965.500	3845.000	3468.500
Z	-3.724	-4.311	-1.435	-2.049	-3.811
Asymp. Sig. (2-tailed)	.000	.000	.151	.040	.000

a. Grouping Variable: Cosmetics Form

Texture, with a significance value of 0.151 > p 0.05, indicates no significant difference in texture perception between the mask and the serum. This means that the consistency, when applied to the skin, is not significantly different between the two products. Color characteristics, with a significance value of 0.40 > 0.05, indicate no significant color difference between the mask and the serum. The statistical table can be seen in Table 2.

4. CONCLUSION

Hedonic tests are conducted to evaluate consumer preference for the product. Masks and serums from *Garcinia dulcis* extract show good potential as skincare products. Hedonic test results indicate that the parameters of aroma, texture, absorption, and drying time significantly differ between the serum and the mask. However, texture and color do not show substantial differences. Therefore, further development is needed to improve the mask's aroma, taste, and drying time. The optimization of the formulation is expected to enhance consumer appeal towards this product.

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