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THE EFFECT OF TILAPIA FISH SKIN COLLAGEN ADDITION LEVEL ON THE PHYSICAL-CHEMICAL QUALITY OF BODY CREAM

Pengaruh Tingkat Penambahan Kolagen Kulit Ikan Nila Terhadap Mutu Fisik-Kimia *Body Cream*

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ABSTRACT

An alternate raw material for the production of collagen is the skin of tilapia fish, which is a fishery waste. As a naturally occurring humectant that helps to keep skin moisture, collagen is frequently found in cosmetic goods like body cream. The goal of this study is to ascertain the ideal amount of tilapia skin collagen to add in order to produce body cream with the best physico-chemical quality. This work employed an experimental approach using a complete randomized design (CRD) that included five replications and four treatments of increasing the collagen concentration of tilapia skin: 0%, 3%, 3.5%, and 4%. Cream pH, cream homogeneity, cream spreadability, and cream wetness were among the parameters measured. While the cream's pH, spreadability, and moisture were statistically parametrically assessed using analysis of variance (ANOVA), the homogeneity of the cream was analyzed descriptively and compared. The study's findings indicated that 4% was the ideal amount of tilapia skin collagen to add to the cream. Cream containing 4% collagen from tilapia fish skin has uniform properties, a pH of 6.08, a spreadability of 5.88 cm, and the greatest moisture percentage of 68.7%.

Keywords: cosmetics, fishery waste, skin moisture

ABSTRAK

Kulit ikan nila merupakan limbah perikanan yang dapat digunakan sebagai bahan baku alternatif pembuatan kolagen. Kolagen banyak dimanfaatkan dalam produk kosmetik seperti *body cream* sebagai humektan alami yang berfungsi untuk mempertahankan kelembaban kulit. Penelitian ini memiliki tujuan untuk menentukan tingkat penambahan kolagen kulit ikan nila yang paling tepat sehingga dapat diperoleh mutu fisik-kimia terbaik dari *body cream*. Metode yang diterapkan dalam penelitian ini adalah metode eksperimental dengan menggunakan rancangan percobaan berupa rancangan acak lengkap (RAL) dimana terdapat empat perlakuan dengan tingkat penambahan kolagen kulit ikan nila: 0%, 3%, 3,5%, dan 4% dan lima kali ulangan. Derajat keasaman krim, homogenitas krim, daya sebar krim, serta kelembaban krim merupakan beberapa parameter yang diamati pada penelitian ini. Homogenitas krim dianalisis

secara deskriptif komparatif, sedangkan pH krim, daya sebar krim, dan kelembaban krim dianalisis secara statistik parametrik menggunakan analisis sidik ragam (ANOVA). Hasil penelitian menunjukkan bahwa krim dengan tingkat penambahan kolagen kulit ikan nila yang terbaik berada pada tingkat kolagen 4%. Krim dengan Tingkat penambahan kolagen kulit ikan nila sebesar 4% memiliki karakteristik yang homogen, nilai pH sebesar 6,08, nilai daya sebar 5,88 cm, serta persentase kelembaban sebesar 68,7%.

Kata kunci: kelembaban kulit, kosmetik, limbah perikanan

INTRODUCTION

One of Indonesia's leading freshwater fish products is tilapia. According to statistical data released by the Ministry of Maritime Affairs and Fisheries in 2022, tilapia production increased from the previous year. In 2020, 1.23 million tons of tilapia were produced and in 2021, this number increased to 1.35 million tons. Market demand and the fish processing sector have also increased along with the increase in tilapia production in Indonesia. In the processing business, tilapia is usually processed and exported in the form of fillets (Romadhon *et al*., 2019). Stomach contents, heads, fins, skin, scales, spines, and bones are waste generated from the processing of tilapia fillets (Sembiring *et al*., 2020). If fishery waste continues to be left unused, it can have an impact on environmental sustainability and balance. Processing is one way to overcome the problem of fishery waste. Collagen raw materials can be obtained from fish bones, scales, and skin (Romadhon *et al*., 2019). An alternative that can be used as a raw material for making collagen is waste from fish skin (Nurhidayah *et al*., 2019). Dried tilapia skin in a study according to Putra *et al*., (2013) has a proximate content with a protein content of 47.43%, a water content of 23.74%, a fat content of 1.68% and an ash content of 3.01%. The high protein content in tilapia skin shows that tilapia skin has high quality to be used as a raw material for making collagen. Compared to tilapia scales and bones, tilapia skin has the highest yield value (Romadhon *et al*., 2019). According to Nurhayati *et al*., (2013) based on the type of fish, extractant, and extraction technique used in making collagen, the collagen yield value contained in tilapia skin varies, ranging from 11-63%. Tilapia skin contains collagen with a yield value of around 27.8% (Abdelaal *et al*., 2020). In line with the statement from López *et al*., (2023) that tilapia skin is rich in collagen, a protein that helps improve skin regeneration and healing.

Collagen is the main protein component of living organisms which contributes 25-30% of the total protein and is responsible for maintaining the integrity of the biological structure of several tissues (Romadhon *et al*., 2019). Collagen is usually found in animal products such as mammals and poultry. However, the use of mammalian and poultry extracts often experiences problems such as infectious diseases that may be transmitted back to humans (Nurhidayah *et al*., 2019). Diseases in mammals include mad cow disease or bovine spongiform encephalopathy (BSE) and foot and mouth disease (FMD), while in poultry it is bird flu (Romadhon *et al*., 2019). Therefore, collagen from fish can be an alternative source of collagen.

Collagen has been widely used in various industries, including biomedical, pharmaceutical, food, and cosmetics. Among these industries, cosmetics are one of the industries that utilize collagen the most in their products (Stephanie *et al*., 2016). The purpose of adding collagen to cosmetics is to replace collagen that is damaged due to age or environmental factors (Putri *et al*., 2015). Harry & Rieger, (2000) stated that collagen acts as a natural humectant in cosmetics that functions to maintain skin moisture. One of the cosmetic products that uses collagen is body cream, cream is a semi-solid preparation, in the form of an emulsion consisting of suitable basic ingredients and containing no less than 60% water (Hasniar *et al*., 2015). Collagen in cream acts as an active substance and thickening agent. If

too much collagen is added to the cream, it will make the cream difficult to apply and less easily absorbed into the skin due to its nature as a thickening agent. Meanwhile, if too little collagen is added to the cream, the cream will not provide optimal benefits as an active substance that plays a role in moisturizing the skin (Hasniar *et al*., 2015). The level of collagen addition to the cream preparation affects the physical and chemical characteristics of the cream. These physical and chemical characteristics include pH, homogeneity, spreadability, and moisture. Therefore, research needs to be done to obtain the right level of collagen addition to produce a body cream with the best physical-chemical quality based on the SNI 16-4399-1996 quality standard.

RESEARCH METHODS

Place and Time

This research was conducted in July 2024. The research was conducted at the Fisheries Product Processing Technology Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University and the Biotechnology Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University.

Tools and Materials

The materials used were tilapia skin collagen, stearic acid, cetyl alcohol, triethanolamine (TEA), glycerin, methyl paraben, propyl paraben, distilled water, fragrance, and pH buffer solution. The tools used were digital scales, beaker glass, measuring cup, hotplate magnetic stirrer, spatula, dropper pipette, glass, petri dish, ruler, 100 gram metal weight, desiccator, polypropylene plastic, cream container, and stationery.

Methods

The method used in this study is experimental. Experimental is a research method that aims to prove how a treatment affects its results (Arib et al., 2024). Janitra et al. (2024) stated that experimental research is included in the type of quantitative research used to test hypotheses, theories, or the effectiveness of a treatment that has never been tested before. Experimental research also involves manipulation of variables, control of conditions (control), and observation of results to establish cause-and-effect relationships. This study conducted observations on four parameters, namely pH, homogeneity, spreadability, and moisture. The experimental design used for the parameters of cream pH, cream spreadability, and cream moisture was a completely randomized design (CRD) consisting of four treatments and five replications. The four treatments used in this study were based on preliminary tests that had been conducted by the previous author. Where from the four treatments that had been tested, namely 2.5%, 3.5%, and 4%, it was found that the results with the best characteristics were in the 3.5% treatment. Therefore, the four treatments used in the study include:

1) Treatment A: Control body cream with the addition of 0% tilapia skin collagen.
2) Treatment B: Body cream with the addition of 3% tilapia skin collagen.
3) Treatment C: Body cream with the addition of 3.5% tilapia skin collagen.
4) Treatment D: Body cream with the addition of 4% tilapia skin collagen.

Cream Making Procedure

The manufacture of tilapia skin collagen body cream in this study refers to the research conducted by Waehama (2016) with several modifications. The first stage in making the cream is that the ingredients to be used are weighed according to the formulation presented in Table 1. The ingredients are separated into two parts in two different beaker glasses, namely the water phase and the oil phase. The oil phase ingredients are stearic acid (emulsifier) and cetyl alcohol (emulsifier and thickener). The water phase ingredients are triethanolamine (emulsifier),

glycerin (humectant), methyl paraben (preservative), propyl paraben (preservative), and distilled water (solvent). The water phase and oil phase are each heated using a hot plate magnetic stirrer on different beaker glasses. After both phases have dissolved, the oil phase is slowly mixed into the water phase in a different beaker glass and stirred evenly at room temperature (±25°C). Collagen extract is slowly added to the cream base and stirred using a spatula until homogeneous. Add 0.5 ml of rose extract fragrance to disguise the fishy smell of fish skin collagen, then stir until homogeneous for ± 1 minute. Finally, the cream is placed in a cream container that has been provided and stored at a temperature of 25°C.

Observation Parameters

1. pH Test

   The purpose of observing the pH of the cream is to ensure that the cream preparation is safe to apply and does not cause skin irritation during use (Lumentut *et al*., 2020). The tool used in the test is a pH meter. The procedure for measuring the pH of the cream refers to the research of Safitri *et al*., (2014) where 1 gram of the cream preparation that has been weighed is dissolved in 10 ml of aquadest. After that, the pH of the cream preparation can be measured after calibration on the pH meter that will be used with a buffer solution of pH 4 and pH 7. After being calibrated, the pH meter can be directly dipped into the cream preparation that has previously been dissolved in aquadest and after the number listed on the pH meter is constant, the pH can be recorded directly.
2. Homogenity Test

   The purpose of observing cream homogeneity is to observe the ingredients in the cream preparation mixed evenly, which is useful for making the cream easy to apply to the skin (Juwita *et al*., 2013). The cream homogeneity test procedure refers to research according to Puspitasari *et al*., (2018) 0.1 grams of cream preparation is applied thinly to the glass evenly using a spatula. Observe the texture of the cream preparation that is visible on the glass.
3. Spread Power Test

   The purpose of observing the cream's spreadability is to determine the extent of the cream's spread on the skin, so that the ease of applying the cream to the skin can be seen (Azkiya *et al*., 2017). The procedure for observing the cream's spreadability refers to research according to Daud *et al*., (2018) 0.5 grams of cream preparation is placed in the middle position on two glasses or two petri dishes that have been turned over. A metal weight weighing 100 grams is placed on the glass for 1 minute, then the diameter of the cream is measured vertically and horizontally using a ruler. After obtaining the cream diameter values, calculate the average value of the cream diameter, the average value will be the cream's spreadability value.
4. Humidity Test

   Observation of cream moisture was carried out with the aim of determining the moisture content of the cream after the addition of fish collagen. The cream moisture test procedure refers to research by Pounikar *et al*., (2012) the cream preparation of each concentration was weighed as much as 2 grams. The 2 grams of cream preparation were placed in the middle of the polypropylene plastic then put into a desiccator and closed tightly. The cream preparation was stored for 24 hours in a desiccator. Then the weight of the cream was weighed again, then the percentage of moisture reduction was calculated using the formula below:

$$Humidity\ (\%) = \frac{Wn}{Wo} \times 100\%$$

Information:
Wo : Initial Weight of Cream (g)
Wn : Final Weight of Cream (g)

Data Analysis

The parameters of pH, dispersion power, and humidity will be analyzed statistically parametrically using analysis of variance (ANOVA) at a confidence level of 95% with the aim of determining the effect of each treatment on the observed parameters. If there is an effect, the analysis will be continued with the Duncan test, the aim is to determine the differences between treatments. Data obtained from the homogeneity parameters are analyzed descriptively. Data from all parameters are also analyzed descriptively comparatively with the quality of SNI number 16-4399-1996.

Table 1. Formulation for Making Tilapia Fish Skin Collagen Body Cream

Material Name	Body Cream Formulation			
	A (%)	B (%)	C (%)	D (%)
Tilapia fish skin collagen	0	3	3,5	4
Cetyl alcohol	4	4	4	4
Glycerin	15	15	15	15
Triethanolamine (TEA)	3	3	3	3
Stearic Acid	12	12	12	12
Methyl paraben	0,2	0,2	0,2	0,2
Propyl paraben	0,02	0,02	0,02	0,02
Rose Flower Extract Fragrance	0,5	0,5	0,5	0,5
Aquades up to	100	100	100	100

Source: Waehama (2016)

RESULT

Degree of Acidity (pH)

Analysis of variance of pH parameters produced in this study indicated that the level of addition of tilapia skin collagen to body cream had a significant effect ($P<0.05$) on the pH value of the body cream. Figure 1 below presents the results of the pH test on body cream.

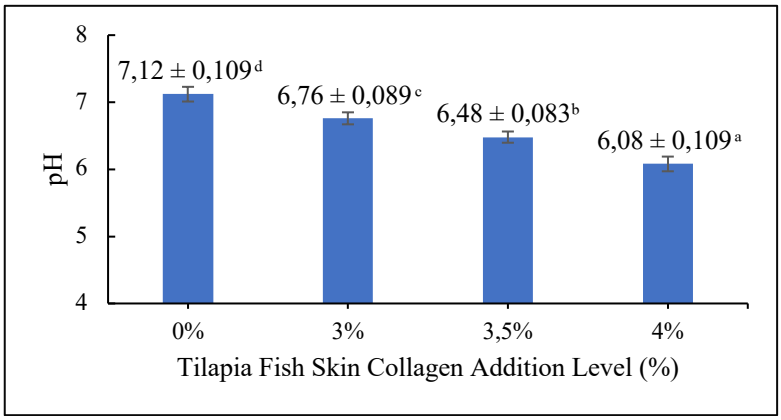

Figure 1. Average pH Test Value of Tilapia Fish Skin Collagen Body Cream

Homogenity

The results of observations of the homogeneity of the body cream listed in Table 2 indicate that all treatments of body cream with the level of collagen addition made from tilapia fish skin are classified as homogeneous, although with different levels of homogeneity.

Table 2. Tilapia Fish Skin Collagen Body Cream Homogeneity Test Results

Collagen Addition Level	Test				
	1	2	3	4	5
A (0%)	+++	+++	+++	+++	+++
B (3%)	++	++	++	++	++
C (3,5%)	++	++	++	++	++
D (4%)	+	+	+	+	+

Description: (+++) = very homogeneous, (++) = somewhat homogeneous, (+) = homogeneous

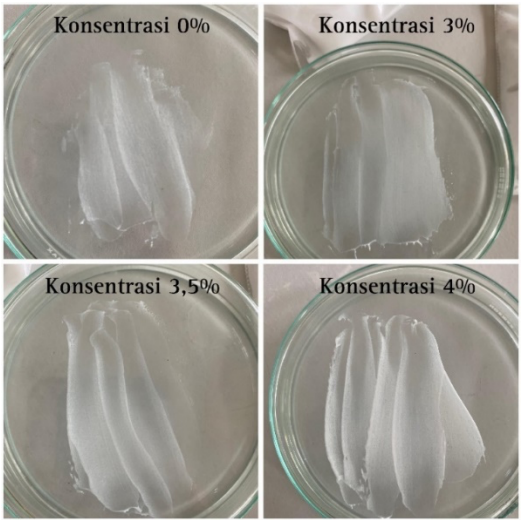

Figure 2. Tilapia Fish Skin Collagen Body Cream Homogeneity Test Results

Spread Power

Analysis of variance of the spreadability parameters produced in this study indicated that the level of addition of tilapia skin collagen to the body cream had a significant effect ($P<0.05$) on the spreadability value of the body cream. Figure 3 below presents the results of the spreadability test on the body cream.

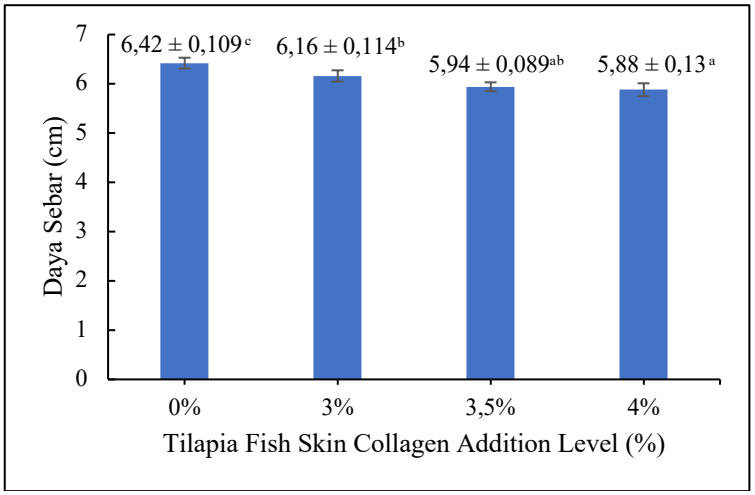

Figure 3. Average Value of Spreading Power Test of Tilapia Fish Skin Collagen Body Cream

Humidity

Analysis of variance of the moisture parameters produced in this study indicated that the level of addition of tilapia fish skin collagen to the body cream had a significant effect (P<0.05) on the moisture value of the body cream. Figure 4 below presents the results of the moisture test on the body cream.

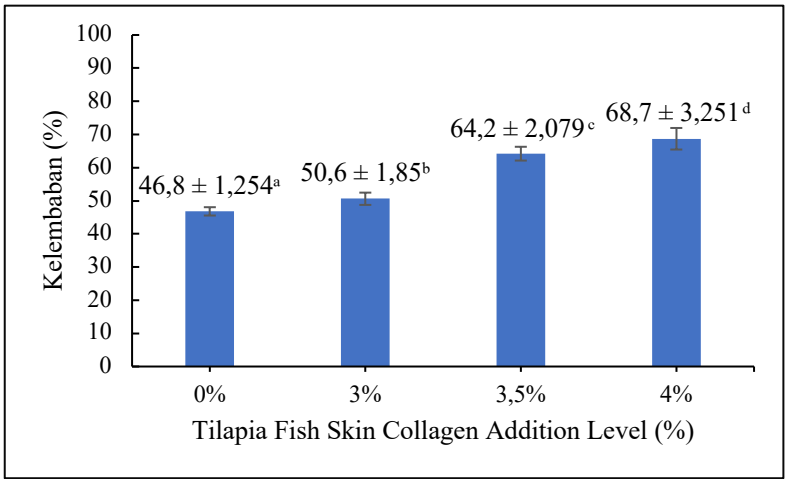

Figure 4. Average Value of Tilapia Fish Skin Collagen Body Cream Moisture Test

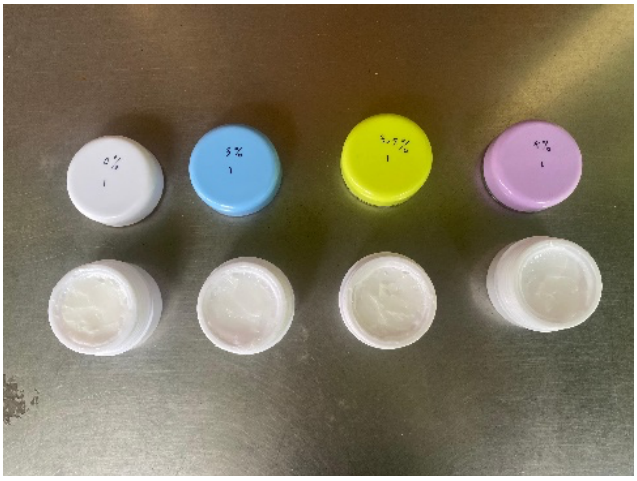

Figure 5. Body Cream Test Results

DISCUSSION

Degree of Acidity (pH)

The degree of acidity or potential of Hydrogen (pH) is one of the chemical characteristics of body cream which is one of the key parameters in this study. This is because the pH is tested to ensure that the cream is safe when used on the skin and will not cause side effects such as irritation to the user's skin (Lumentut *et al*., 2020). Creams that have a pH that is too low or very acidic can cause inflammation of the skin so that the skin can feel hot, sore, and red, while creams with a pH that is too high or very alkaline can make the skin very dry and cracked so that it looks scaly (Tari & Indriani, 2023).

Based on the results of the cream pH test shown in Figure 1, the average cream pH value from the four treatments ranged from 6.08-7.12. The highest average cream pH value was in the 0% treatment or treatment without the addition of collagen at 7.12 and the lowest average cream pH value was in the 4% treatment at 6.08. The test results showed that all cream treatments met the safety standards of SNI 16-4399-1996, which were in the range of 4.5-8.0. According to Pratasik *et al*., (2019) a good cream preparation must be in accordance with the physiological pH of the skin, which is in the range of 4.5-6.5. Cream without additional collagen concentration (0%) and cream with additional collagen concentration of 3% did not meet the physiological pH requirements of the skin because they had an average pH value of 7.12 and 6.76. Meanwhile, cream with additional collagen concentration of 3.5% and 4% met the physiological pH requirements of the skin with an average pH value of 6.48 and 6.08.

The analysis of variance of the pH parameters produced in this study indicated that the level of addition of tilapia skin collagen to the body cream had a significant effect ($P < 0.05$) on the pH value of the body cream. The significant effect found in the analysis of variance made the test continue to the Duncan's further test, the results of the Duncan's further test were that all treatments were significantly different. This indicates that the difference in the pH value of the cream is influenced by the addition of collagen. In line with research by Putri *et al*., (2015) which states that the level of collagen addition has a significant effect on the pH value of seaweed skin lotion. Also supported by research conducted by Wijaya *et al*., (2021) which proved that differences in the level of collagen addition derived from tilapia fish bones have a significant effect on the pH value of the cream. The study also produced a pH with a range of 6.10-7.24 where the higher the concentration of collagen added, the lower (more acidic) the pH value of the cream. Research according to Dewangga *et al*., (2021) on the addition of tilapia fish skin to lotion products produced a pH with a range of 6.35-7.35 where there was a decrease in the pH value of the lotion along with the increasing concentration of tilapia fish skin collagen added. The cause of the decrease in the pH value of the cream is due to the collagen extracted from fish skin producing a neutral pH that tends to be acidic. In this study, the pH value of tilapia fish skin collagen was 5.9 which indicates that the pH tends to be acidic. Romadhon *et al*., (2019) stated that collagen extracted from the skin, scales, and bones of fish has a pH value ranging from 4.38-6.49 which tends to be acidic and neutral. In the study by Wijayanti *et al*., (2021) a pH value range of 6.54-6.97 was also obtained from collagen derived from fish, where the pH obtained in this range was neutral tending to be acidic.

Homogenity

Homogeneity is an important parameter in this study because it can determine the effectiveness of the cream (Tari & Indriani, 2023). The purpose of testing the homogeneity of body cream is to observe whether the ingredients formulated in making body cream are well mixed so that when applied the cream can be easily applied to the skin (Juwita *et al*., 2013).

Based on the results of the cream homogeneity test listed in Table 2, all treatments showed homogeneous characteristics only at different levels. Treatment 0% is very homogeneous, treatments 3% and 3.5% are somewhat homogeneous, and treatment 4% is

homogeneous. The cream can be said to be homogeneous because there are no coarse grains or lumps when tested on glass. All homogeneous cream treatments indicate that the ingredients of the cream and tilapia skin collagen are well mixed. According to the Director General of POM (1979), the cream preparation should have a homogeneous composition, meaning there should be no lumps or coarse grains in it. The requirements for a good cream preparation based on SNI 16-4399-1996 are homogeneous.

According to Baskara *et al*., (2020) the homogeneity of body cream can be influenced by the stirring technique during the body cream making process. Cahyaningsih *et al*., (2021) added that the particle size in the cream preparation will get smaller with a longer stirring duration. The mixing technique in this study was carried out evenly at a consistent speed, in addition, when adding collagen, it was done slowly and little by little. Stirring properly and consistently can increase the homogeneity of a mixture (Baskara *et al*., 2020).

Spread Power

Spreadability can be defined as the ability of a cream preparation to spread when applied to the skin (Numberi *et al*., 2020). Cream can be applied more easily to the skin if it has a high spreadability, which means that the cream can be distributed evenly on the skin (Voight, 1995). Cream preparations that have too high a spreadability will make the cream layer too thin on the skin so that it will be easily lost and will not provide optimal benefits to skin areas that need moisture, while creams with too low a spreadability will be difficult to spread on the skin because the texture is too thick which will cause discomfort to the skin such as stickiness to the skin (Silvia & Dewi, 2022).

The results of the body cream spreadability test are presented in Figure 3, from the four treatments observed, the average value of the body cream spreadability was in the range of 5.88-6.42 cm. The 0% treatment or control treatment with an average spreadability value of 6.42 cm became the treatment with the highest average spreadability value while the 4% treatment with an average spreadability value of 5.88 cm became the treatment with the lowest average spreadability value. All treatments from the spreadability test results were proven to meet the range of 5-7 cm which is the range of good spreadability requirements for topical preparations according to Voight (1995). Spreadability affects the absorption of active ingredients in the cream into the skin (Sekarsari *et al*., 2022). Genatrika *et al*., (2016) stated that the absorption process of the contents of a preparation will take place quickly if the cream preparation has good spreadability which will allow for wide contact between the cream preparation and the skin.

The analysis of variance of the spreadability parameters produced in this study indicated that the level of addition of tilapia skin collagen to the body cream had a significant effect ($P < 0.05$) on the spreadability value of the body cream. The significant effect found in the analysis of variance made the test continued to Duncan's further test, the results of Duncan's further test were that the treatment with a collagen addition level of 0% was significantly different from other treatments. The treatment with a collagen addition level of 3% was not significantly different from the collagen addition level of 3.5% but was significantly different from other treatments. The treatment with a collagen addition level of 3.5% was not significantly different from the collagen addition level of 4%. This indicates that the level of collagen addition to the body cream affects the difference in the spreadability value of the preparation. The test results in this study indicate that the higher the level of collagen concentration addition, the lower the spreadability value. As stated by Wattimena *et al*., (2023) in his study, the proportion of the added substance, temperature, mixing technique, and the level of collagen addition are some aspects that affect the difference in the spreadability value of the preparation. Supported by research according to Wijayanti *et al*., (2021) on the addition of tilapia fish bone collagen at concentrations of 0%, 5%, 10%, 15% to skin cream which

produces a spreadability with a range of 3.45-4.13 cm, where the cream spreadability value decreases with the increasing addition of fish collagen. The decrease in the cream spreadability value is caused by collagen which has thickening properties. In accordance with the statement according to Said (2014), namely collagen has thickening properties, the thicker the cream, the more difficult it is to spread the cream.

Humidity

Humidity is a condition determined by the amount of water contained in the skin. Low humidity or water content contained in the skin will have an impact on the skin, namely making the skin dry (Tricaesario & Widayati, 2016). The humidity test aims to evaluate the extent to which the ability of active ingredients and components of the cream can inhibit water evaporation to help maintain water levels in the skin (Wattimena *et al*., 2023).

Based on the results of the humidity test shown in Figure 4, the average value of the cream moisture is in the range of 46.8-68.7%. The 4% treatment or treatment with the highest level of collagen addition has an average humidity value of 68.7% which is the treatment with the highest average humidity value while the 0% treatment or control treatment has an average humidity value of 46.8% which is the treatment with the lowest average humidity value. According to Hepni (2021), preparations with a moisture value of <40% are considered less moist, preparations of 40-60% are considered moist, and preparations of >60% are considered very moist. From the statement according to Hepni (2021), it can be said that in this study, creams with concentrations of 0% and 3% are considered moist, while creams with concentrations of 3.5% and 4% are considered very moist. Based on these results, it can be concluded that cream with a collagen addition level of 4% has the best moisture because it has the highest moisture value and is included in the very moist category. Research according to Ariyanti *et al*., (2019) on the addition of shell collagen concentration states that the cream with the best moisture is at the highest concentration, namely a concentration of 15%. In addition, it is also proven by the low weight loss after the cream is stored in a desiccator for 24 hours. This is in line with research according to Wattimena *et al*., (2023) where the cream with the best moisture is at the highest collagen concentration, namely a concentration of 20% with low weight loss.

The results of the analysis of variance indicate that the level of addition of tilapia skin collagen has a significant effect ($P<0.05$) on the moisture content of the cream. The results of Duncan's further test showed that all treatments were significantly different. According to Wattimena *et al*., (2023) the increase in cream moisture is caused by the addition of collagen. Based on the results of tests conducted by researchers, it was found that the moisture content of the cream increased with the increasing concentration of tilapia skin collagen. Supported by research according to Wijaya *et al*., (2021) on the addition of tilapia fish bones at concentrations of 0%, 5%, 10%, 15% to skin cream products produced moisture values ranging from 71.7-83.4%, where the higher the concentration added, the higher the moisture value of the cream. Other research according to Hepni (2021) on the addition of catfish bone collagen at concentrations of 0%, 1%, 1.5%, 2.5%, 3.5% to skin moisturizer products produced moisture values ranging from 39.8-53% where the moisture value of the cream increased with the increasing concentration of collagen added to the cream.

The increase in the moisture value of the cream is due to collagen being a humectant and occlusive material (Wattimena *et al*., 2023). According to Butarbutar & Chaerunisaa (2020), materials classified as humectants and occlusives are often used in skin moisturizers because they contain a mixture of fats that are effective in restoring skin moisture. According to Harry & Rieger (2000), in the field of cosmetics, collagen plays a role as a humectant that can form a layer on the surface of the skin so that it can maintain skin moisture effectively.

Tricaesario & Widayati (2016) stated that humectants and occlusives are types of moisturizers that can compensate for transepidermal water loss (TEWL) or evaporation of water on the skin.

Based on all the parameters observed in this study, moisture is the parameter that most determines the best quality of the cream. Skin moisture is a fairly important factor in skin health because the skin needs good hydration in order to have optimal elasticity, avoid irritation, and be resistant to external damage such as UV rays (Salsabila & Wardana, 2024). Cream is a topical preparation that is useful for moisturizing the skin and is suitable for dry, sensitive skin, or skin that requires intensive care (Thomas *et al*., 2024). Therefore, the moisture parameter is the parameter that most determines the quality of the cream, the higher the moisture content of the cream, the better the cream's ability to maintain skin hydration (Ekayanti *et al*., 2019). Therefore, in this study, the concentration of 4% tilapia skin collagen addition was the best concentration because it had the highest moisture value.

CONCLUSION

The addition of the right concentration of tilapia skin collagen to produce body cream with the best physical-chemical quality that meets the standards is a concentration of 4%. Based on the results of the evaluation of the physical-chemical characteristics of the cream, the cream with the highest level of tilapia skin collagen addition of 4% has homogeneous characteristics, a pH value of 6.08, a spread value of 5.88 cm, and has the highest moisture percentage of 68.7%.

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