Original Research Article

EFFECT OF ADDITION TILAPIA SKIN COLLAGEN CONCENTRATION TO LOTION CHARACTERISTICS

ABSTRACT

Tilapia skin has high protein content so it has good quality to be used as raw material for collagen.Collagen can be used as a raw material in the cosmetic industry such as lotions. Collagen acts as an active ingredient in lotions that provide many benefits for the skin. The purpose of this research is to determine the best concentration of tilapia skin collagen addition to obtain the characteristics of the lotion in accordance with the established standards.Parameters observed included pH, viscosity, spreadability, weight loss, homogeneity and organoleptic (appearance, color, scent, texture). The conclusion from this research is that the addition of 7% tilapia skin collagen concentration was the best treatment with a homogeneous appearance, slightly yellowish white color, slightly lavender scent and slightly thick texture. The lotion has a pH value of 6.35, viscosity of 7.197 cP, 5.74 cm spreadability and a weight loss of 2.8%.

Keywords : Collagen, Tilapia fish skin, Addition, Lotion, Characteristics

1. INTRODUCTION

Processed fishery products are the main source of animal protein in the world apart from processed land livestock meat, eggs and milk[22]. The volume of processed fishery products in 2019 reached 6.85 million tons with the number of micro and small-scale fish processing units amounting to 62,389 units and 670 units of medium and large scale [4].Processed products that are very popular both at home and abroad are tilapia fish products. The development of the tilapia processed industry will have an impact on the increase in the waste produced, namely waste in the form of fish heads, bones, scales, entrails and fish skin[15].

Fish waste can be a potential alternative to be used as raw material for collagen, one of which is fish skin [9]. The results of the proximate test of dried tilapia skin contained a protein content of 47.43%; water 23.74%; fat 1.68%; and 3.01% ash. The high protein content of tilapia skin indicates that tilapia skin has good quality to be used as raw material for collagen[12].

Collagen is the main structural component of white connective tissue which covers almost 30% of the total protein in vertebrate and invertebrate organ tissues [6].Collagen can be used as a raw material in the cosmetic and pharmaceutical industries. One of the cosmetic products that use collagen as raw material is lotion. Collagen acts as an active substance in lotions that can provide many benefits for the skin, such as preventing wrinkles, increasing skin moisture, protecting skin from free radicals, and maintaining skin elasticity [18].

Lotion is a preparation in the form of a suspension, solution, or emulsion for use on the skin, lotion can also be defined as a runny cream. Lotions are emulsions but have lower wax and oil

content than creams [23].The use of fish skin collagen in lotion is an alternative to replace the use of commercial collagen, because collagen is usually obtained from cow skin, pig skin, or chicken skin so that its use is not appropriate due to religious considerations and biological contamination [17].Therefore, the addition of collagen concentration is very important in the manufacture of collagen lotions so that the addition of collagen concentrations in the manufacture of lotions will be investigated in this research.

2. MATERIALS AND METHODS

The research was conducted from March 2021 – June 2021. The research consisting of collagen isolation, lotion making, lotion pH testing, lotion homogeneity, lotion dispersion and lotion organoleptic was carried out at the Fishery Product Processing Technology Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University. Collagen drying using a freeze dryer was carried out at the Central Laboratory of Padjadjaran University. Viscosity testing was carried out at the Faculty of Mathematics and Natural Sciences Laboratory, Padjadjaran University.

2.1 Tools and Materials

The tools used in the research consisted of a knife, cutting board, beaker glass, analytical balance, measuring cup, measuring flask, filter, refrigator, pH meter, funnel, filter paper, freeze dryer,spatula, hot plate stirrer, plastic container, questionnaire sheet, petri dish, 100 gram weight, ruler, HDPE plasticand Brookfield viscometer.The ingredients used consisted of tilapia skin, NaOH 0,05 M, CH_3COOH 0,15 M, Aquades, NaCl 0,9 M, stearic acid, cetyl alcohol, liquid paraffin, glycerin, triethanolamine, lavender fragrance.

2.2 Research Methods

The method used in this research is experimental. The experimental design used was a completely randomized design (CRD) consisting of 5 treatments and 4 replications. The treatments used in this research consist of:

- Treatment A (control) = Lotion with the addition of 0% concentration of tilapia skin collagen.
- Treatment B = Lotion with the addition of 4% concentration of tilapia skin collagen.
- Treatment C = Lotion with the addition of 5% concentration of tilapia skin collagen.
- Treatment D = Lotion with the addition of 6% concentration of tilapia skin collagen.
- Treatment E = Lotion with the addition of 7% concentration of tilapia skin collagen.

2.3 Research Stages

This research consists of three stages, the first stage is collagen isolation [14].The second stage is making lotion [13]. The last stage was the observation with the parameters of lotion pH, lotion viscosity, lotion spreadability, lotion weight loss, lotion homogeneity and lotion organoleptic.

2.3.1 Collagen Isolation

Fish skin cleaned with clean water and cut into small sizes. Then 50 g of fish skin is soaked with a solution of NaOH 0,05 M in a glass beaker with a ratio of 1:10 (w/v) for 4 hours.Then the fish skin is separated from the NaOH solution and cleaned using running water until the pH is close to neutral. Then the fish skin was soaked in 0.15 M acetic acid in a ratio of 1:10 (w/v) for 1 hour at a temperature of ± 4°C.The extract solution was separated from the raffinate (extraction residue) then added 0.9 M NaCl, stirred until homogeneous and white lumps would form in the solution. The white globules were filtered using filter paper to obtain wet collagen.Collagen was washed using 100 ml of distilled water three times until the pH was close to neutral.The collagen was then dried using a freeze dryer [14].

2.3.2 Lotion Making

Table 1.Lotion making formulation

Ingredients	Treatment				
	A (%)	B (%)	C (%)	D (%)	E (%)
Stearic acid	3,5	3,5	3,5	3,5	3,5
Cetyl alcohol	1,5	1,5	1,5	1,5	1,5
Liquid paraffin	3	3	3	3	3
Glycerin	3	3	3	3	3
Triethanolamine	1	1	1	1	1
Lavender fragrance	0,5	0,5	0,5	0,5	0,5
Aquades	87,5	83,5	82,5	81,5	80,5
Tilapia fish skin collagen	0	4	5	6	7

The formulation for making 50 g lotion preparations with the addition of tilapia skin collagen (Table 1). The principle of making lotion is mixing accompanied by heating and stirring. The material is separated into two parts, namely the preparation of the oil phase (stearic acid, cetyl alcohol, liquid paraffin) and aqueous phase (glycerin, triethanolamine, aquades). The oil phase material was put into a 250 ml glass beaker heated using a hot plate stirrer for ± 10 minutes to a temperature of 70-75^{o}C then stirred until homogeneous. The aqueous phase material is mixed into a 250 ml glass beaker heated using a hot plate stirrer for ± 25 minutes to a temperature of 70-75^{o}C then stirred until homogeneous. The oil and water phase ingredients are mixed at a temperature of ± 70^{o}C and then stirred. Then the fragrance is added at a temperature of 35oC and then stirred until homogeneous for ± 1 minute. Collagen was added slowly according to the concentration of the treatment then homogenized.Then the lotion is left on for ± 30 minutes and then put into a container [13].

2.4 Observation Parameters

The parameters observed in this research are lotion pH [1], lotion viscosity [1], spreadability of lotion [21], lotion weight loss [19], homogeneity of lotion [3] and organoleptic (appearance, color, scent and texture) of lotion [1].

2.5 Data Analysis

The data from the lotion homogeneity test were analyzed descriptively. The data from the lotion pH test, lotion spreadability, lotion weight and lotion viscosity were analyzed by parametric statistics

using Analysis of Variance (ANOVA) at a 95% confidence level, if there is a significant difference, then proceed with Duncan's test at a 95% confidence level.

The data obtained from the lotion organoleptic test were analyzed by non-parametric statistics Friedman test, multiple comparison testis performed if $H \leq \chi^2_{\alpha(k-1)}$ which means there is a significant difference (H_0 is rejected).

Determination of the best treatment using the Bayes method. Bayes method is one of the techniques that can be used for making the best decisions from a number of alternatives with the aim of producing results that consider various criteria. The results of the Bayes calculation will show the highest priority value which will be determined as the best treatment [7].

3. RESULTS AND DISCUSSION

3.1 Lotion pH

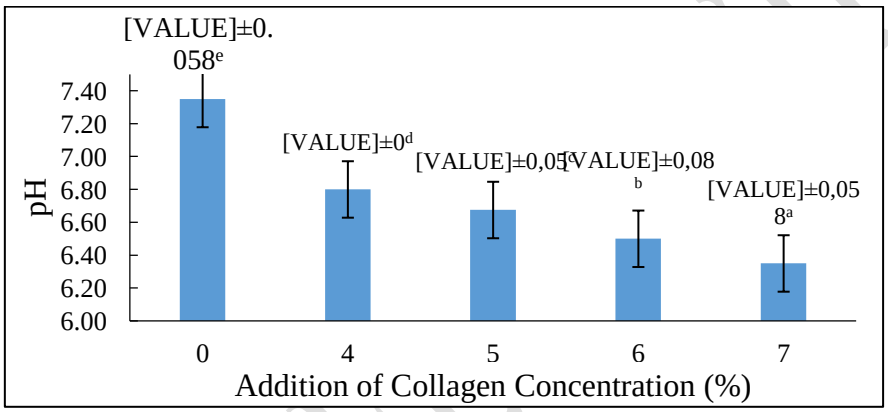

Fig. 1.Lotion pH test results

Based on the test results (Fig 1), the pH value of the lotion ranged from 6.35 - 7.35, with the lowest pH value in the treatment with the addition of 7% collagen concentration of 6.35 and the highest pH value in the treatment with the addition of 0% collagen concentration of 7.35. The results of the pH test showed that the lotion complied with the SNI 16-4399-1996 standard as a lotion quality requirement, which ranged between 4.5-8 [1]. The recommended lotion pH range is between 4.5 - 6.5 according to the skin's natural pH [20], so the lotion with the addition of collagen concentrations of 6% and 7% is a treatment with a pH that is suitable for the skin's natural pH.

The results of the Duncan test showed that the treatment with different concentrations of the addition of tilapia skin collagen gave a significantly different effect on the pH of the lotion. The decrease in pH value is caused by the addition of collagen which can lower the pH of the lotion. The higher the addition of collagen concentration, the lower the pH level of the lotion.The added tilapia skin collagen has a neutral pH value which tends to be acidic [5].

3.2 Lotion Viscosity

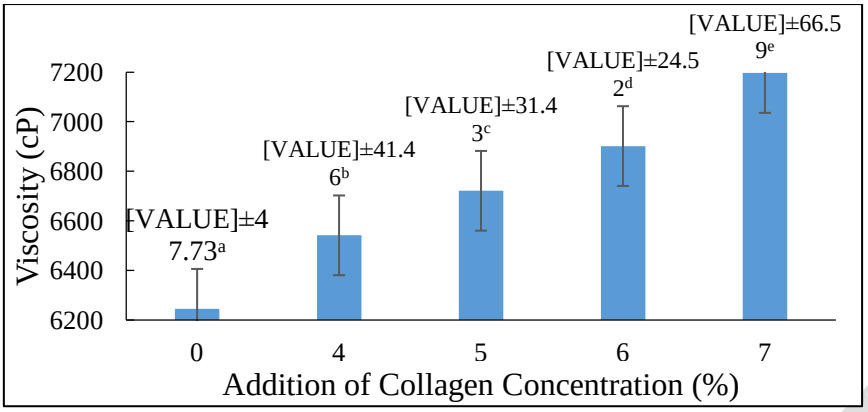

Fig. 2. Lotion viscosity test results

Based on the test results (Fig 2), the lotion viscosity value ranged from 6,245-7,197 cP, with the lowest viscosity value in the treatment of adding 0% collagen concentration of 6245 and the highest viscosity value in the treatment of adding 7% collagen concentration with a value of 7,197 cP. The results of the viscosity test show that the lotion complies with the standard of SNI 16-4399-1996 as the lotion quality requirement, which is in the range of 2,000-50,000 [1]. The viscosity of a good lotion has a high value, because the higher the viscosity, the more difficult the movement of particles so that the lotion will become stable or no emulsion separation occurs [16]. Based on this statement, the addition of a collagen concentration of 7% is a treatment with a viscosity that is the most suitable for the standard.

The results of the Duncan test showed that the different treatment of addition of collagen concentration in tilapia skin gave a significantly different effect on the viscosity of the lotion. The increase in viscosity value was influenced by the addition of collagen concentration in the lotion. The higher the addition of collagen concentration, the higher the lotion viscosity value. The increase in the viscosity value occurs because the water content in the lotion tends to decrease and decrease due to the nature of collagen which can bind water, so the lotion will become thicker and the viscosity value will increase [5].

3.3 Loss Weight Lotion

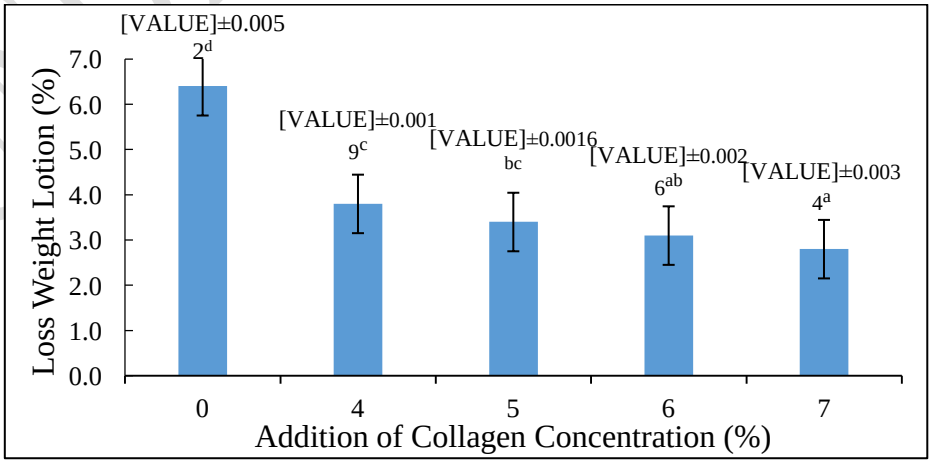

Fig. 3. Lotion weight shrinkage test results

Based on the test results (Fig3), the lotion weight shrinkage value ranges from 2.8 to 6.4%, with the lowest weight loss value in the addition of 7% collagen concentration treatment of 2.8% and the highest weight loss value in the 0% collagen concentration addition treatment with a value of 6.4%. The results of the weight loss test showed that lotion with the addition of a concentration of 7% collagen was a better treatment than other treatments according to the statement of [19], a good lotion has a small percentage of weight loss or no weight loss.

The results of the Duncan test showed that the treatment with the addition of 0% collagen concentration was significantly different from the other treatments. The addition of 4% concentration of collagen was not significantly different from the addition of 5% concentration. The addition of 5% collagen concentration was not significantly different from the addition of 6% concentration. The addition of 6% collagen concentration was not significantly different from the addition of 7% concentration.

The decrease in the value of the lotion weight loss was influenced by the addition of the collagen concentration in the lotion. The higher the addition of collagen concentration, the lower the lotion weight loss value. This is because collagen plays an important role in binding one compound to another. In connection with the function of collagen, the addition of collagen can help bind water to the lotion [2].

3.4 Lotion Homogeneity

Table 2. Lotion homogeneity test results

Addition of Collagen Concentration	Replications			
	1	2	3	4
0%	H	H	H	H
4%	H	H	H	H
5%	H	H	H	H
6%	H	H	H	H
7%	H	H	H	H

Description: H = Homogeneous

Based on the results of the lotion homogeneity test (Table 2), it shows that all treatments have homogeneous characteristics, because at the time of testing there were no coarse particles or lumps in each lotion treatment.This shows that the ingredients that make up the lotion and collagen are dissolved and mixed well. Based on these results, the lotion is in accordance with the standard, a lotion that has good homogeneity if there are no fine grains or clumping particles[3].

The addition of collagen to the lotion does not affect the homogeneity of the lotion, this is because the addition of collagen is carried out slowly and the stirring is carried out until evenly distributed. The homogeneity of the lotion is influenced by the technique or method of mixing carried out and the tools used in the lotion making process [11].

3.5 Organoleptic Lotion

Table 3.Test results description organoleptic lotion

Addition of Collagen Concentration	Appearance	Color	Scent	Texture
0%	Homogeneous	White	Scent of lavender	Diluted
4%	Homogeneous	Slightly yellowish white	Scent of lavender	Slightly diluted
5%	Homogeneous	Slightly yellowish white	Slightly lavender scent	Slightly diluted
6%	Homogeneous	Slightly yellowish white	Slightly lavender scent	Slightly thick
7%	Homogeneous	Slightly yellowish white	Slightly lavender scent	Slightly thick

3.5.1 Appearance

Based on the results of the description test of the appearance of the lotion (Table 3) in all homogeneous treatments. The lotion is said to have a homogeneous appearance because at the time of testing there were no coarse particles or lumps of uniform color and there was no phase separation. Homogeneous lotion is caused by the stirring rate during the manufacture of the lotion is stable so that the ingredients are evenly mixed. Besides the stirring rate, the most important factor in stabilizing an emulsion is the physical properties of the emulsifying layer produced by the lotion agent[8].

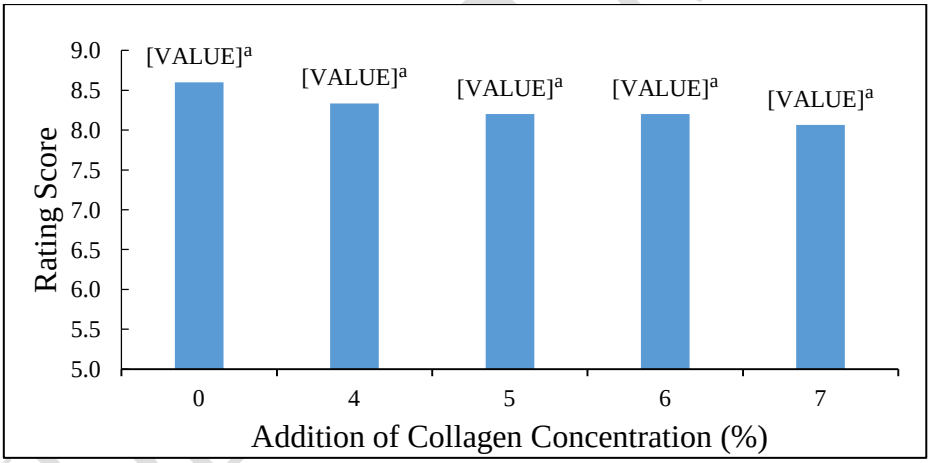

Fig. 4. Lotion appearance hedonic test results

Based on the results of the hedonic test, the appearance of the lotion (Fig 4) shows a preference value ranging from 8.1 to 8.4 which means it has a liking value. The lowest value was in the addition of 7% concentration treatment and the highest value was in the 0% concentration addition treatment. The results of the multiple comparison test (Fig 4) showed that the treatment with different concentrations of collagen had no significant effect on the appearance of the lotion. The level of preference for the appearance received by the panelists was a homogeneous lotion.

3.5.2 Color

Based on the results of the description test of the color of the lotion (Table 3), the addition of 0% concentration treatment had a white color, while the 4%, 5%, 6% and 7% treatments had a slightly yellowish white color. The difference in color between 0% treatment and other treatments was due to

the addition of collagen affecting the color of the lotion. Collagen can affect the color of a final product that is added with collagen. Tilapia skin collagen has less brightness and is yellowish white [14].

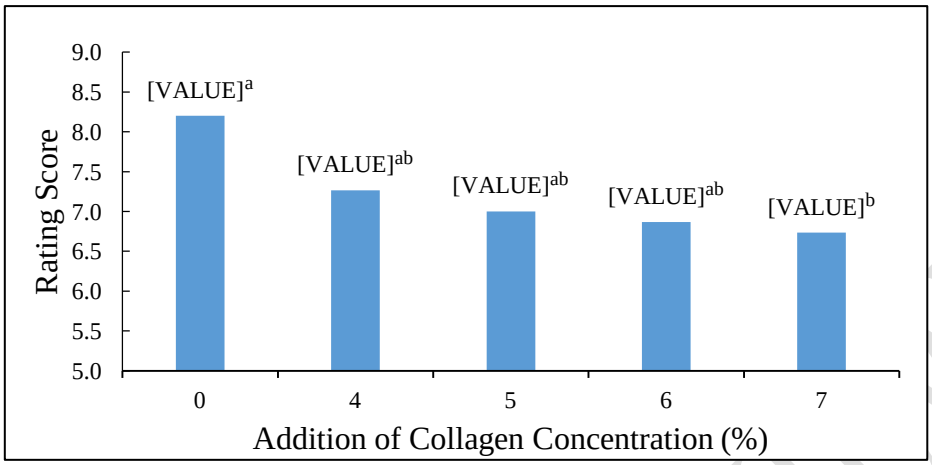

Fig. 5. Lotion color hedonic test results

Based on the results of the hedonic test for color (figure 5), the preference value ranges from 6.7 to 8.2, which means it has a neutral-like value. The lowest value was in the addition of 7% concentration treatment and the highest value was in the 0% concentration addition treatment. The results of the multiple comparison test (Fig 5) show that the treatment with the addition of 0% concentration was not significantly different from the treatment with the addition of 4%, 5% and 6% concentrations. The treatment with the addition of 0% concentration was significantly different from the treatment with the addition of a 7% concentration.The treatment with the addition of 4% concentration was not significantly different from the addition of 5%, 6% and 7% concentrations. The level of color preference received by the panelists was white lotion and slightly yellowish white.

3.5.3 Scent

Based on the test results of the description of the lotion scent (table 3), the addition of 0% and 4% concentration treatments had a lavender scent, 5% and 6% 7% had a slightly lavender scent. The scent of lavender in the lotion is caused by the fragrance added to the lotion. The decrease in the lavender scent in the lotion is caused by the addition of collagen in the lotion. Collagen tends to have a less pleasant scent so that it can reduce the scent produced in cosmetic products [5].

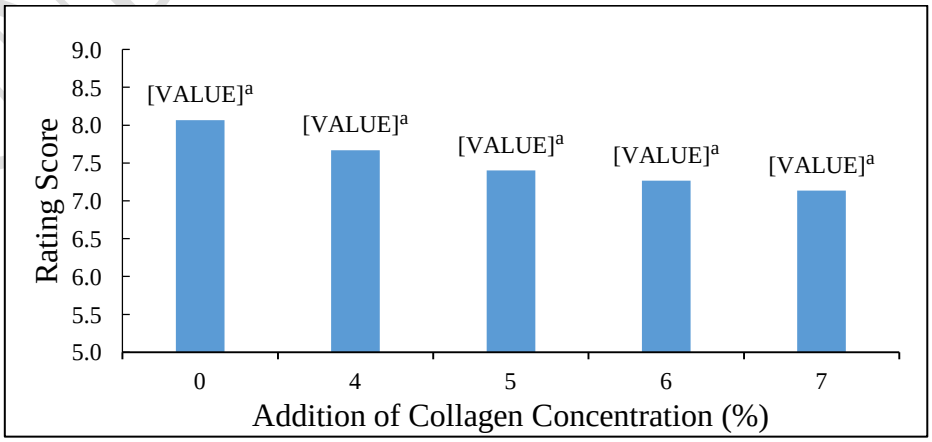

Fig. 6. Hedonic scent lotion test results

Based on the results of the hedonic test on scent (Fig 6), the preference value ranges from 7.1 to 8.1, which means it has a rather like - like value. The lowest value was in the addition of 7% concentration treatment and the highest value was in the 0% concentration addition treatment. Hasil uji perbandingan berganda (Fig 6) menunjukkan bahwa perlakuan penambahan konsentrasi kolagen tidak berbeda nyata terhadap scent losion. The level of preference for the scent received by the panelists was a slightly lavender-scented lotion and a lavender scent.

3.5.4 Texture

Based on the results of the lotion texture description test (Table 3), the addition of 0% concentration treatment had a runny texture, 4% and 5% treatments had a slightly runny texture, while 6% and 7% had a slightly thick texture. Determinants of lotion texture are influenced by constituent ingredients classified in the oil phase such as stearic acid, cetyl alcohol and additives[10].

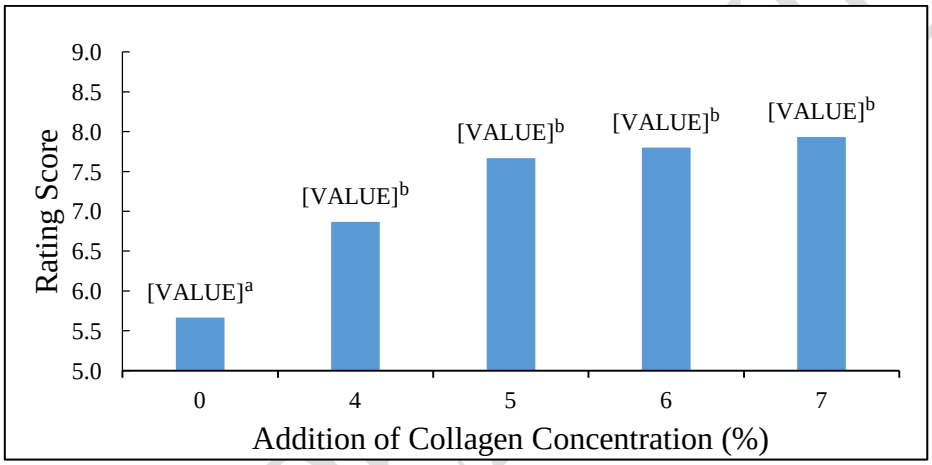

Fig. 7.Lotion texture hedonic test results

Based on the results of the hedonic test on texture (Fig 7) shows the preference value ranges from 5.7 to 7.9 which means it has a neutral-like value. he lowest value in the addition of 0% concentration treatment and the highest value on the addition of 7% concentration treatment. The results of the multiple comparison test (Fig 7) showed that the 0% treatment was significantly different from the collagen addition treatment, while the difference in the addition of collagen concentration had no significant effect on the lotion texture preference value.The level of texture preference accepted by the panelists was that the lotion was slightly runny and slightly thick.

3.6 Decision Making with Bayes Method

Bayes method is one of the techniques used to perform analysis in making the best decisions from alternatives or treatments by considering the criteria.Parameters weighted in this method include objective parameters (pH, viscosity, spreadability, weight loss and homogeneity) and subjective parameters (appearance, color, scent and texture) [7].Based on the results of calculations using the Bayes method, the results of the lotion treatment with the addition of a collagen concentration of 7% have alternative values and the highest priority of 3.41 and 0.209.Lotion with a concentration of 0% collagen addition has the lowest alternative and priority values of 3.13 and 0.191.

4. CONCLUSION

Based on the results of the research, it can be concluded that the addition of the best concentration of tilapia skin collagen to produce a lotion that meets the standards and is preferred by the panelists is 7%. The lotion has a homogeneous appearance, a slightly yellowish white color, a slightly fragrant scent and a slightly thick texture with a pH value of 6.35, a viscosity of 7.197 cP, a spreadability of 5.74 cm and a weight loss of 2.8%.

CONSENT

As per international standard or university standard, respondents' written consenthas been collected and preserved by the author(s).

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