

# The Effect of use of gelatine in Milk Candy Making on Organoleptic and Physicochemical Properties

## ABSTRACT

The making process of milk candy used many other additional ingredients, one of which is gelatine. Gelatine is a livestock product obtained from processing livestock bones and skin. This research uses gelatine as an additional ingredient for making milk candy. The purpose of this research was to affect addition gelatin on organoleptic and physic chemistry in milk candy. The research material used milk, gelatine, and sugar. The 4 treatments with five replications used 0%, 10%, 20%, and 30% of gelatine. Variables were organoleptic, water content, pH, water activity, texture (toughness), protein content and reducing sugar. The result of the study showed addition gelatine had a highly significant different ( $P < 0.01$ ) in organoleptic (color) and had a significant different ( $p < 0.05$ ) in organoleptic (aroma). Milk candy used 10% of gelatine produced with a clear color, milky aroma. The conclusion showed that the addition of gelatine to cow's milk candy had a significant effect on organoleptic and physicochemical so the best value of milk candy can use the additional as much as 10% of gelatine.

*Keywords: Caramel, concentration, gelatin, milk candy, taste*

## 1. INTRODUCTION

Livestock farming is a sector that has an important role in meeting people's food needs. Many products from the livestock sector have high utility value for direct consumption or through further processing into other products. Milk is one of the livestock products that are widely known to the public. In general, milk is a white liquid produced from the secretions of the animal's udder glands. Milk is a liquid obtained from healthy and clean udders of dairy cattle and obtained by correct milking methods in accordance with applicable regulations [1]. Milk can be milked from mammals such as cows, goats, horses and buffalo. The chemical characteristics of good quality cow's milk consist of a minimum protein content of 2.8%, a minimum fat content of 3 %, and a non-fat dry matter content of 7.8% [2].

The high value of the benefits of milk apparently does not mean that milk consumption figures in Indonesia are higher compared to other countries. In Indonesia the milk consumption figure has been recorded at 16.23 liters/capita/year [3]. This figure is lower compared to other countries in the Southeast Asia region such as Malaysia whose milk consumption is 50.9 liters/capita/year, Brunei 129.1 liters/capita/year, Vietnam 20.1 liters/capita/year, and Singapore at 46.1 liters/capita/year, so that under these conditions efforts should be made to increase the interest in milk consumption of Indonesian people.

There are many efforts that can be made to increase interest in milk consumption in Indonesia, one of which is by making innovations in processing milk into other processed products that can attract public interest. Many innovations in processed products derived from milk have been carried out to date, one of which is milk candy products. The process of making milk candy can be an alternative answer to the problem of using milk other than processing it into yogurt and cheese. Processing milk into candy can extend the shelf life of milk, and can also increase the selling value of milk. The process of making milk candy mostly uses cow's milk as an ingredient. Cow's milk is easier to obtain, better known to the public and more accepted among consumers. Milk can use to make it a long-lasting product can be done by processing milk into candy [4]. Candy is also a product that many people like, so making candy made from milk can indirectly increase the fulfillment of people's animal nutritional needs.

In the process of making milk candy, many ingredients are added to improve the quality of milk candy, one of which is gelatine that can be used in making milk candy. Gelatine is a livestock product. Gelatin is made from livestock by-products, usually from livestock bones and skin. This by-product is usually rarely used further as a food ingredient, even though it can still be processed into gelatin. Gelatin is a protein obtained from the partial hydrolysis process of animal skin and bone collagen [5]. Gelatin is generally used as a raw material in making jelly candy. Gelatine has the characteristics of being clear, translucent, colorless, and brittle when dry, and tasteless or tasteless. Gelatine has been widely used and spread in the food and beverage industry, becoming an ingredient in making candy, ice cream, jelly, marshmallows and panna cotta [6]. In making jelly candy the use of gelatine aims to inhibit crystallization, change the liquid into an elastic solid, and improves the shape and texture of the resulting jelly candy [7]. Milk contains many nutrients and benefits, then the use of gelatine which has potential and prospects in the future will be the main supporting factor for this research to be carried out by using different types of gelatines as a variation of addition to making milk candy. The parameters observed in this research are the organoleptic and physicochemical properties of milk candy with the addition of gelatine in the process of making a product.

## **2. MATERIAL AND METHODS**

### **2.1 Materials**

The process of making milk candy samples was carried out at the PSDKU Universitas Brawijaya Kediri Laboratory. The analysis process for milk candy samples was carried out at the Laboratory of the Faculty of Agricultural Technology and the Animal Products Technology Laboratory, Universitas Brawijaya, Malang. The organoleptic test process was carried out in two cities consisting of Kediri and Malang. The process of making and analyzing milk candy samples was carried out on March 1-August 30 2023.

The raw materials used in making milk candy are full cream UHT cow's milk, granulated sugar, and gelatine. Equipment used for making milk candy includes Teflon, wooden spatula, stove, stopwatch, refrigerator, candy molds made from Food grade silicon, measuring cup and plastic clip. Other equipment used is a pH meter (Eddo PL- 600), Aw meter (Paw kit Pullman 99163), oven, analytical balance (Aces), desiccator, porcelain cup, thermometer, elasticity test equipment using a warner-brazier (shear), Kjeldahl distillation apparatus, digestion apparatus, burette, Erlenmeyer, volumetric pipette, volumetric flask, electric heater, upright cooler, thermometer, and boiling stone.

### **2.2 Method**

The research method used was an experimental method. Organoleptic test data was collected by administering an assessment questionnaire to the panelists using a liking or hedonic test for milk candy samples. This research consisted of 4 treatments with the addition of gelatine at 0% (P0), 10% (P1), 20% (P2), and 30% (P3) with 5 repetitions of each treatment. Each research sample was observed according to the research variables. Research variables consist of organoleptic tests, water content, pH, Aw, texture (toughness), protein content, and reducing sugar. Milk candy formula with the addition of gelatine [25], which was modified as follows:

1. P0: 100 ml UHT milk, 0 grams of gelatine, 50 grams of granulated sugar.
2. P1: 100 ml UHT milk, 10 grams of gelatine, 50 grams of granulated sugar.
3. P2: 100 ml UHT milk, 20 grams of gelatine, 50 grams of granulated sugar.
4. P3: 100 ml UHT milk, 30 grams of gelatine, 50 grams of granulated sugar.

### **2.3 Research Procedure**

The research implementation procedure is divided into several stages, including the following preparing the tools and materials to be used. The equipment used includes a heater (stove), Teflon, candy molds, spatulas, measuring cups, scales and thermometers. The ingredients used include UHT milk, gelatine and sugar. UHT milk was added as much as 100 ml of UHT cow's milk to Teflon, 50% of sugar was added, gelatine was dissolved in treatments P0 (without adding gelatine), P1 (10%), P2 (20%), and P3 (30%) with cow's milk UHT as much as 50 ml. Gelatine is added to the mixed solution according to the treatment. The ingredients are stirred at a temperature of  $\pm 99$  °C, cooking for 8 minutes, the cooked mixture is cooled and placed in candy molds. Milk candy products are stored in the refrigerator, packaged using plastic cups continue with analyzing process with organoleptic and physicochemical tests.

### **2.4 Variables**

Research variables include organoleptic and physicochemical properties. The following is the test method used to test milk candy with the addition of gelatine. The variables were organoleptic testing [8], water content testing [9], pH testing [10],

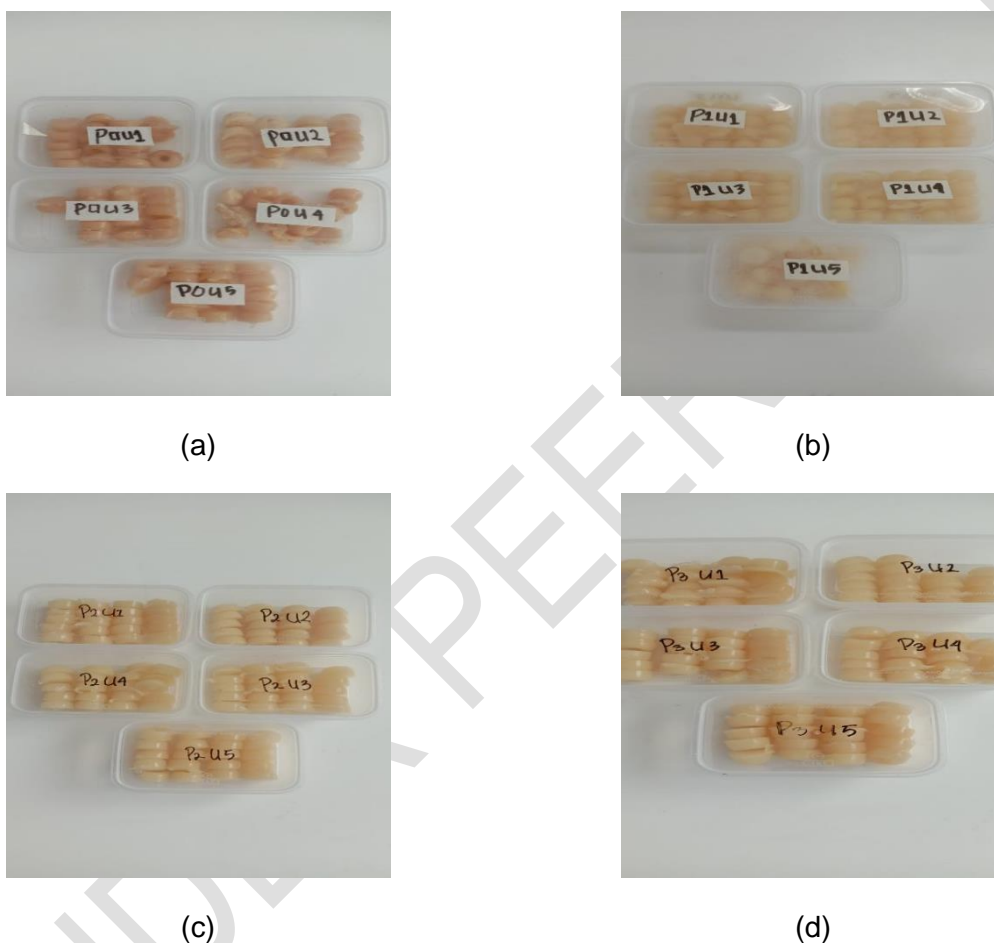
testing water activity levels [11], texture testing (toughness) [12], protein content testing according to the Kjeldahl method [13], and testing of reducing sugar [14].

## 2.5 Statistical Analysis

The experimental design used in this research used a completely randomized design using four treatments and five repetitions. Based on the data obtained from tests that have been carried out on milk candy, the data analysis method used is the data analysis method of variance (ANOVA) using the help of Microsoft Excel in the calculations, then if there are significant differences then it will be continued using the Duncan's Multiple Range Test method (DMRT).

## 3. RESULTS AND DISCUSSION

The milk candy that has been produced with the addition 0% of gelatine, 10% of gelatine, 20% of gelatine, and 30% of gelatine with 5 replications. The results of milk candy products can be seen in figure 1.



**Fig. 1. Results of milk candy with various treatments**

Remarks: (a) Photo of milk candy sample treated P0 (0% gelatine), (b) Photo of milk candy sample treated P1 (10% gelatine), (c) Photo of milk candy sample treated P2 (20% gelatine), (d) Photo of sample P3 treated milk candy (30% gelatine)

Milk is a white liquid obtained from mammals and can be utilized or used as a healthy food ingredient, without adding or subtracting other ingredients [15]. The types of milk commonly consumed by humans come from cows, goats and buffalo. Milk can be processed into various products, one of which is candy. The processing fresh milk into candy is an effort that can be made to utilize milk into long-lasting products [4]. Candy is a product that is liked by people of various age groups. The development of making milk candy has given rise to the latest innovations in making milk candy products, including adding certain ingredients or mixtures during the process of making milk candy, one of which is gelatine. Gelatine is a protein resulting from the hydrolysis of bone and skin collagen. Specifically, in the food and non-food industries, the use of gelatine is very widespread [16]. This research carried out the addition of various concentrations of gelatine, such as the addition of 0% gelatine (control), the addition of 10% gelatine, the addition of 20% gelatine, and the addition of 30% gelatine

in making milk candy, which would then be tested on milk candy products. Testing of milk candy includes organoleptic testing (texture, taste, aroma and color), water content, pH level, Aw level, texture (toughness), protein content and reducing sugar content. Data on test results from milk candy with the addition of gelatine are shown in Tab. 1. For organoleptic tests and Tab. 2 for physicochemical tests.

### 3.1 Organoleptic

Organoleptic testing is an effective test carried out to measure consumers subjective attitudes towards a product based on the properties of the product including color, texture, aroma, taste, acidity level and viscosity level. The level of liking for the product is the result that will be obtained [17]. Organoleptic testing is an evaluation that relies on human sensory abilities, and sometimes this research can produce very accurate assessments, even exceeding the sensitivity level of the most sensitive devices [18]. The average organoleptic test results for milk candy with the addition of gelatine can be seen in Table 1.

**Table 1. Average organoleptic test results for milk candy with the addition of gelatine**

Treatment	Organoleptic Test			
	Taste	Texture	Aroma	Color
P0	3.67 <sup>b</sup> ± 0.08	2.75 <sup>b</sup> ± 0.17	3.33 <sup>c</sup> ± 0.83	2.80 <sup>bc</sup> ± 1.02
P1	2.67 <sup>b</sup> ± 0.15	2.62 <sup>b</sup> ± 0.16	2.50 <sup>b</sup> ± 1.01	2.88 <sup>c</sup> ± 0.72
P2	2.42 <sup>ab</sup> ± 0.15	2.55 <sup>ab</sup> ± 0.15	2.48 <sup>ab</sup> ± 0.88	2.75 <sup>b</sup> ± 0.74
P3	2.27 <sup>a</sup> ± 0.14	2.22 <sup>a</sup> ± 0.14	2.45 <sup>a</sup> ± 0.82	2.53 <sup>a</sup> ± 0.96

Explanation: Different notations in the same column indicate highly significant differences ( $P < 0.01$ ) between one treatment and another

#### 3.1.1 Taste

Taste is an organoleptic test that mostly involves the five senses of the tongue. Human tastes are very diverse, making taste more difficult to understand completely. Food generally consists of a combination of various integrated flavors and does not only consist of one group of flavors, so that it can give rise to a delicious food taste. One way a person's acceptance of food is influenced by taste [19]. Based on the results of the ANOVA test that has been carried out, it is known that the addition of gelatine has a highly significant effect ( $P < 0.01$ ) on the taste of milk candy. The control treatment (P0) had the highest mean value ( $3.67 \pm 0.08$ ) when compared with the gelatine addition treatment P1 ( $2.67 \pm 0.15$ ), P2 ( $2.42 \pm 0.15$ ), and P3 ( $2.27 \pm 0.14$ ). The average value of the milk candy taste test was 2.27-3.67 (a little like it). This is different from research on jelly candy made from shark skin gelatine (*Chiloscyllium punctatum*) with the addition of carrageenan and seaweed used 4 treatments including treatment G101 (1.75% gelatine and 1.75% carrageenan), L102 (1.75% gelatine and 3.50% carrageenan), P103 (1.75% gelatine and 1.75% seaweed), and J104 (1.75% gelatine and 3.50% seaweed) [20]. The results of the preference test for jelly candy showed that the most preferred jelly candy sample was L102 treated jelly candy with the addition of 1.75% shark skin gelatine (*Chiloscyllium punctate*) and 3.50% carrageenan. The average taste value of L102 jelly candy is 7.50 (like). The panelists like L102 jelly candy because the taste of the jelly candy is not too sweet. The concentration of added gelatine also influences the level of panelist assessment of milk candy. The research which used beef bone gelatine and red dragon fruit juice (*Hylocereus polyrhizus* L.) as additions to making jelly candy which obtained a research average of 3.64-4.29 (a little like it) with the dragon fruit juice mixture formula. red 45% and gelatine 18% got the highest score, while the mixture of red dragon fruit juice 40% and gelatine 18% got the lowest score [21]. Based on this data, it is known that the higher the gelatine concentration makes the panelists dislike the taste of the resulting product.

#### 3.1.2 Texture

Texture is the sensation of pressure that can be observed using the mouth (when biting, chewing, and swallowing). One of the important physical properties of food ingredients is the texture [22]. Based on the results of the ANOVA tests that have been carried out, it is known that the addition of gelatine to the manufacture of milk candy has a highly significant effect ( $P > 0.01$ ) on the texture of the milk candy. P0 (control) had the highest mean value ( $2.75 \pm 0.17$ ), while other treatments had lower mean values including P1 ( $2.62 \pm 0.16$ ), P2 ( $2.55 \pm 0.15$ ), and P3 ( $2.22 \pm 0.14$ ). The average value in this study is lower than the average value in research made marshmallow products using basic ingredients from chicken claw gelatine (P1) and beef bone gelatine (P2) [23]. The dosage for adding gelatine to both treatments was the same with 30 grams each. The results of research on the elasticity of the texture of marshmallows show that the addition of two types of gelatines did not have a significant effect ( $P > 0.01$ ) on the elasticity of the texture of marshmallow products. For P1, the average value

was 3.12 and for P2, the average value was obtained. Of 3.27. The chewy texture of milk candy is caused by the use of gelatine, which is one of the gelling ingredients in food. The process of making gelatine from camel skin stated that gelatine is used as an ingredient in the food industry and non-food industry as a gelling, stabilizer, thickener, emulsifier and film-forming agent [24].

### 3.1.3 Aroma

Gelatine concentration based on the results of analysis of variance showed that the concentration of gelatine had a highly significant effect ( $P < 0.01$ ) on the organoleptic properties of the aroma of milk candy. The mean score for aroma organoleptic parameters ranged between 2.40-3.33. The highest aroma organoleptic properties score was produced by P0 with a mean score of 3.33 and the lowest aroma organoleptic properties score was produced by P3 with an average score of 2.45. The very real influence of gelatine on the aroma of milk candy is shown by the decrease in individual respondents scores in assessing the aroma parameters of milk candy, shown in Tab. 1. The effect of gelatine shows that the greater the percentage of gelatine (the largest percentage is 30%) added to milk candy is directly proportional to the decrease panelist's average score in organoleptic aroma test parameters.

If the gelatine concentration continues to increase (high gelatine concentration), the impact on the distinctive aroma of goat's milk will become fainter due to more amino acids reacting with the reducing sugar components [25]. The distinctive aroma of goat's milk, which becomes faint or diminishes, is further strengthened by the Maillard reaction, in the form of a reaction between reducing sugars and amino acids with heating [26]. The stages in the Maillard reaction consist of 3 parts; the first part is the formation of glycosylating. The second part is that the glycosylamine compound undergoes a dehydration process which produces furan derivatives, reductions, and various other carbonyl compounds. The final stage involves the transformation of furans and carbonyls into compounds that give the substance its taste and color [26].

### 3.1.4 Color

Gelatine concentration based on the results of analysis of variance showed that the concentration of beef bone gelatine had a significant effect ( $P < 0.05$ ) on the organoleptic properties of the color of cow's milk candy. The average score for color organoleptic parameters ranged between 2.50-2.80. The highest color organoleptic property score was produced by P1 with a mean score of 2.88 and the lowest color organoleptic property score was produced by P3 with a mean score of 2.53. The real influence of gelatine on the color of cow's milk candy is shown by the addition of gelatine to cow's milk candy which can cause the candy to become clear because of the physicochemical properties of gelatine which play a role in gel formation and dominate the color of the final product of cow's milk candy.

Organoleptic color test on goat's milk candy with the addition of the highest concentration of gelatine (25%) caused the color of the goat's milk candy product to become clear yellowish, in accordance with the results of the research in the form of cow's milk candy fortified with the highest concentration of beef bone gelatine (30%) having a color clear brownish yellow, it can be seen that the higher the gelatine concentration (30%) causes the color of the cow's milk candy to become clearer and the original color of the cow's milk fades. Gelatine in milk acts as a gel-forming agent, while sugar can affect the properties of the gelatine gel, so that when the heating process is carried out there is an interaction between sugar and gelatine which can affect the physicochemical properties of milk, including color and texture [25]. Heating can also affect the color change in milk. Research on buffalo milk candy, it was found that temperature and cooking time had significantly different effects on the color of the candy, this shows that the heating process can also influence color changes in milk products containing sugar and gelatine [27].

## 3.2 Physicochemical

Data on test results from milk candy with the addition of gelatine are shown in Table 2.

**Table 2. Average results of physicochemical testing of milk candy with the addition of gelatine**

Treatment	Physicochemical Test					
	Water Content (%)	pH	Aw	Texture (Toughness) (N)	Protein Content (%)	Reducing Sugar (%)
P0	7.56 <sup>a</sup> ± 0.44	6.00 <sup>a</sup> ± 0.08	0.79 <sup>a</sup> ± 0.004	25.62 <sup>b</sup> ± 3.38	3.12 <sup>a</sup> ± 0.17	3.38 <sup>b</sup> ± 0.24
P1	27.65 <sup>b</sup> ± 0.57	6.41 <sup>b</sup> ± 0.03	0.83 <sup>ab</sup> ± 0.024	16.68 <sup>a</sup> ± 2.28	7.33 <sup>b</sup> ± 1.54	3.22 <sup>b</sup> ± 0.10
P2	33.32 <sup>c</sup> ± 0.49	6.21 <sup>b</sup> ± 0.01	0.89 <sup>b</sup> ± 0.014	13.00 <sup>a</sup> ± 0.84	12.23 <sup>c</sup> ± 1.13	2.40 <sup>a</sup> ± 0.22
P3	37.34 ± 0.54 <sup>d</sup>	6.06 <sup>ab</sup> ± 0.01	0.90 <sup>b</sup> ± 0.016	25.38 <sup>b</sup> ± 3.87	17.34 <sup>d</sup> ± 0.57	2.12 <sup>a</sup> ± 0.15

Explanation: Different notations in the same column indicate highly significant differences ( $P < 0.01$ ) between one treatment and another

### **3.2.1 Water Content**

Water is an important component of food. Animal foods and plant foods contain water in varying amounts [28]. Based on the test results, it is known that the average water content value of milk candy is  $7.56 \pm 0.44\%$  -  $37.34 \pm 0.54\%$ . Testing the water content of milk candy with the addition of gelatine using ANOVA showed highly significant different results ( $P < 0.01$ ). So, it can be seen that the addition of gelatine to the manufacture of milk candy has a highly significant effect on the water content of milk candy. Based on testing, it is known that the highest water content is found at P3 ( $37.34 \pm 0.54\%$ ) and the lowest water content is at P0 ( $7.56 \pm 0.4$ ). The average water content of milk candy in this study is higher if compared with SNI 3547.2-2008; it is known that the SNI for soft candy without jelly has a maximum water content of 7.5%. The lowest water content in this study was 7.56%, which is still not in accordance with SNI because the value is slightly higher compared to the standard. Maximum with SNI soft sugar flowers [14]. The high water content is due to the higher concentration of added gelatine. The process of making red dragon fruit (*Hylocereus polyrhizus*) marshmallow candy, the more beef bone gelatine added will increase the water content, this is because gelatine has the ability to bind water so that the more gelatine added, the more water will be bound and cause the water content in the candy to increase [29]. The water content of marshmallow candy products in this study ranged from 18.09-22.97 %, treatment G1 (added 6% gelatine) got an average of 18.09%, treatment G2 (added gelatine 8%) got an average of 19.81%, treatment G3 (addition of 10% gelatine) got an average of 21.56%, and treatment G4 (addition of 12% gelatine) got an average of 22.97%. The water content in a product can influence the freshness, durability of the product and quality. The factor that determines the shelf life of a product is water content. Food products that have higher water content will result in the product becoming more fragile and having a relatively short shelf life [30].

### **3.2.2 pH**

pH measurements need to be carried out to determine the level of acidity or alkalinity of the product and its relationship to the shelf life and safety of the product. If it is related to product quality, the pH value is an important factor in it. Based on the test results, it is known that the average pH level of milk candy is  $6.00 \pm 0.08$  -  $6.41 \pm 0.03$  (acid). The lowest mean value was obtained by the P0 treatment 6.00 and the highest average value was obtained by the P1 treatment 6.41. The addition of various concentrations of gelatine to the manufacture of cow's milk candy had a very significant effect ( $P < 0.01$ ) in the ANOVA test. The process of making jelly candy with the addition of fish scale gelatine using 4 treatments, consist of A (without adding gelatine), B (adding tawes (*Barbonymus gonionotus*) fish scale gelatine), C (adding milkfish (*Chanos chanos*) fish scale gelatine), and D (addition of kurisi (*Nemipterus nematophorus*) fish scale gelatine), it is known that the average pH value is 4.40-5.53 [31]. The highest average value was obtained from jelly candy D and the lowest was obtained from jelly candy A. The addition of gelatine to jelly candy can increase the pH value. This can be seen from the value of the control jelly candy with the jelly candy containing fish scale gelatine. The pH value resulting from the entire treatment is included in acidic conditions because the pH value is below 7 (neutral). The normal pH value is 7, if the pH value is  $> 7$  it indicates that the substance has alkaline properties, whereas if the pH value is  $< 7$  it has acidic properties [32]. This condition allows microorganisms to grow so this also affects the pH value of milk candy. The activity of microorganisms causes the pH value to change [32]. This condition is because several types of organisms can grow at various levels of acidity, including yeast (pH 2.5-8.5) and mold (pH 5-7).

### **3.2.3 Water Activity**

Water activity is water that is neither bound nor free in a system that can support biological and chemical reactions [33]. Based on the test results, it is known that the average  $A_w$  content of milk candy consists of  $0.79 \pm 0.004$ - $0.90 \pm 0.016$ . The lowest average was obtained at P0 (0.79) and the highest average was obtained at P3 (0.90). Then in the ANOVA test it was discovered that the addition of gelatine to the manufacture of milk candy had a very significant effect ( $P < 0.01$ ) on the water activity content of cow's milk candy. The test results show that the average water activity content has a very significant effect on the addition of gelatine, the greater the concentration of added gelatine, the higher the  $A_w$  content value. Based on the results of tests carried out on cow's milk candy with the addition of gelatine, it is known that the average  $A_w$  content value is still quite high, above 0.7. The smaller the water activity values of a product, the longer the shelf life of the product because mold and microorganisms cannot live under certain  $A_w$  conditions [34]. The growth of bacteria and mold requires a minimum water activity of 0.7 so that under these conditions, milk candy products of all treatments are still at risk of having a short shelf life due to the high levels of water activity from each treatment.

### **3.2.4 Texture (Toughness)**

Gelatine concentration based on the results of analysis of variance shows that gelatine concentration has a very significant effect ( $P < 0.01$ ) on the texture of milk candy. The average score for texture parameters (toughness) ranges from 13.00-

25.70 N. The highest texture (toughness) score was produced by P0 with a mean score of 25.62 N and the lowest texture (toughness) score was produced by P2 with a mean score of 13.00 N. The proteins and fats in cow's milk, such as gelatine, play a role in forming the texture of goat's milk jelly candy in the same way as cow's milk jelly candy and have a positive impact on the formation of the texture characteristics of the candy [25]. The addition of gelatine from beef bones significantly affects the chewiness of red dragon fruit (*Hylocereus polyrhizus*) marshmallow candy, which is part of the texture characteristics [29]. The more gelatine added (highest concentration 30% gelatine), the chewier the resulting candy. This is because a high amount of gelatine (the highest concentration is 30% gelatine) will produce a strong gel, making the candy harder and chewier. On the other hand, if the gelatine concentration is less than optimal (the smallest concentration is 10% gelatine), the candy will become soft and difficult to mold.

### **3.2.4 Protein Content**

Gelatine concentration based on the results of analysis of variance showed that the concentration of gelatine had a highly significant effect ( $P < 0.01$ ) on the protein content of milk candy. The average score for protein content parameters ranges from 3.11-17.35%. The highest protein content score was produced by P3 with an average score of 17.34% and the lowest protein content score was produced by P0 with an average score of 3.12%. Based on the results of analysis of variance data, it means that the addition of gelatine to the manufacture of milk candy can increase the protein content in milk candy. This increase in protein value has a positive side in that it can fulfill the body's protein needs, with safe consumption limits. The role of milk protein is to provide aroma, color characteristics and determine the texture of milk candy [35].

The highest protein content score was produced by P3 with an average score of 17.34 % indicating that the protein content score in the study exceeded the protein content value. The manufacture of goat's milk jelly candy with different concentrations of cow's gelatine (5%, 10%, 15%, 20%, and 25%) where the protein content is 5.65% in goat's milk candy [25]. The protein content was 1.5% in Etawa goat's milk candy [36]. The highest average value of protein content was 5.72 % found in P1 with 0.6% ginger flour treatment in caramel flavored candy ginger and ginger [37]. The milk hard candy contains 0.70% protein; caramel milk candy contains 0.58% protein and ginger milk soft candy contains 2.37% protein [4].

### **3.2.5 Reducing Sugar**

Gelatine concentration based on the results of analysis of variance shows that gelatine concentration has a highly significant effect ( $P < 0.01$ ) on the reducing sugar content of milk candy. The highest reducing sugar content was produced by P0 with an average score of 3.38% and the lowest reducing sugar content was produced by P3 with an average score of 2.12%. Reducing sugar can be formed from the process of cooking candy dough until the dough becomes thick and smooth. The higher the candy dough heating temperature ( $\pm 90-100$  °C), the more reducing or inversion sugar is formed. For example, heating sucrose at 20 °C produces inversion. As much as 72% of the total sugar, while at a heating temperature of 30 °C, inversion reaches 80% [36].

Reducing sugar is an important component that needs to be considered in making candy. Reducing sugars come from glucose syrup and sucrose inversion. The level of reducing sugar greatly influences the characteristics of the product, high reducing sugar means the product tends to be sticky. Based on the data in Tab. 2, it is known that P0 (3.38%) and P1 (3.21%) are the samples with the highest reducing sugar content, where the higher the reducing sugar content (3.38 %) the stickier the product texture will be. The reducing characteristics of a sugar molecule depend on the presence of a reactive aldehyde group (CHO), where glucose which is a type of sugar has one aldehyde group (C-O-H) where one hydrogen atom is bonded to one oxygen atom then bound in the carbon framework of organic molecules, in comparison, sucrose is non-reducing where the two free anomer atoms bond with each other [35].

Limits on the reducing sugar content of soft candy have been regulated in SNI, the reducing sugar content of non-jelly soft candy is a maximum of 20.0% and soft jelly candy is a maximum of 25.0% [14]. The process of making goat's milk jelly candy with different cow gelatine concentrations (5%, 10%, 15%, 20%, and 25%) reducing sugar content in goat's milk candy corresponds to the SNI value of 13.56 % [25]. Based on the reducing sugar content in the study with an average range of 2.12-3.38% was appropriate, met and did not exceed the standards set for soft candy.

## **4. CONCLUSION**

The addition of gelatine to the manufacture of milk candy affects the organoleptic and physicochemical quality of cow's milk candy. Milk candy with 10% of gelatine had some value of organoleptic contain of taste 2.67, texture 2.62, aroma 2.50, and color 2.88, physicochemical contain of water content 27.68%, pH 6.41, Aw 0.83, texture (toughness) 16.68 N, protein content 7.33%, and reducing sugar 3.38%. Based on the research results, it is known that the treatment of this study can be suggested that making milk candy is better if use the addition of gelatine as much as 10%.

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