

The Effect of Addition Red Passion Juice (*Passiflora Edulis*) on Fat Content, Protein Content, and Eastness of Mozzarella Cheese

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ABSTRACT

This research aimed to determine the effect of adding red passion fruit juice (*Passiflora edulis*) on fat content, protein content, and elongation of mozzarella cheese. This research used an experimental method with a Completely Randomized Design with 4 treatments, namely giving red passion fruit (*Passiflora edulis*) (0%, 6%, 8%, and 10%) with 4 repetitions. The research results on the average fat content for each treatment were, P0 (15.97%), P1 (15.33%), P2 (13.25%), and P3 (12.69%). protein is P0 (21.70%), P1 (22.29%), P2 (23.24%), P3 (23.86%). The results of the research on the average elongation are, P0 (66.50cm), P1 (83.50cm), P2 (85.25cm), and P3 (91.25cm). Based on the research results it can be concluded that giving red passion fruit juice (*Passiflora edulis*) has a very significant effect ($P < 0.01$) on fat content and protein content and was not significantly different ($P > 0.05$) on the elongation of mozzarella cheese. The best treatment was found in the treatment without the addition of red passion fruit juice (*Passiflora edulis*) for protein and fat content while the best elongation was obtained in the treatment with the addition of 10% red passion fruit juice (*Passiflora edulis*).

Keynote: mozzarella cheese; *Passiflora edulis*; fat content; protein content; elongation

INTRODUCTION

Milk is a white liquid whose natural content has not been reduced or added and has not received any treatment other than cooling (SNI, 3141-1-2011). Dairy cow's milk is a very important food ingredient in meeting people's nutritional needs, because milk has high nutritional value and has a complete nutritional composition with perfect nutritional ratios, so it has very strategic value (Utomo and Pertiwi, 2010). One of the dairy products is which is mozzarella cheese. Cheese is a food ingredient that is commonly used for various dishes that are

popular with the public, cheese has various types, one of which is mozzarella cheese. Mozzarella cheese originates from Italy with a soft texture that is not cooked in the manufacturing process or is called fresh cheese (Amurita & Sustiyah, 2014). Mozzarella cheese has an elastic, soft, and stringy texture. The characteristics of mozzarella cheese are based on the pressing process, soaking in hot water, and pulling (Purwadi, 2007). It can be done by using a bacterial starter culture to acidify the milk accompanied by the addition of rennet to

form curd or it can also be done by direct acidification.

Komar et al., (2009) states that the types of acids that can be used to make cheese by direct acidification include others are citric acid, vinegar acid, ascorbic acid, and others. Bunton (2005) states that the use of acid in making Mozzarella cheese is intended to get stretchy cheese. The acid for Mozzarella can be obtained from fruit, one of which is red passion fruit (*Passiflora edulis*). The passion fruit has vitamin A, vitamin C, β -carotene, flavonoid components, and fiber (Decuypere, 2002). The FAO (2003) states, 100 ml of passion fruit juice contains 1070 μ g of β -carotene. The content of antioxidant compounds in red passion fruit (*Passiflora edulis*) shows the potential of passion fruit as a source of natural antioxidants. Passion fruit also contains citric acid, the citric acid content in passion fruit ranges from 2.4 – 4.8% (Malaka, 2010). Therefore, red passion fruit (*Passiflora edulis*) can be used as a natural acidifying agent in making mozzarella cheese.

Making fruit juice is one way to combine the contents of fresh fruit with dairy products such as mozzarella cheese. Based on SNI (2014), fruit juice is a liquid produced from squeezing or crushing fresh, ripe fruit. Fruit juice is a liquid obtained

from squeezing fruit, either filtered or unfiltered, which does not undergo fermentation and is a fresh drink that can be drunk directly (Khairani et al, 2007). Research conducted by Widarta et al (2016) showed that the addition of starfruit extract had a very significant effect on the yield, water content, protein content, fat content, elasticity, and elongation of Mozzarella cheese. Rio (2017) also stated that the addition of starfruit juice had a significant effect on the total value of titratable acidity, water content, protein, and organoleptic values on the aroma, taste, and texture of mozzarella cheese. According to Wiedyantara et al (2017) using fruit as an acidifier can improve the taste of fresh mozzarella type cheese. It is hoped that the addition of red passion fruit juice (*Passiflora edulis*) in making mozzarella cheese can become a natural acidifying agent in making mozzarella cheese and improve the quality of mozzarella cheese products. To determine the effect of adding red passion fruit juice (*Passiflora edulis*) on the quality of fat content, protein content, and elongation of mozzarella cheese, further research is needed.

RESEARCH METHODS

The production of mozzarella cheese is done in Kejulasi, Lasi Tuo, Canduang District, Agam Regency, West Sumatra, and at the Animal Products Technology Laboratory, Andalas University, Padang for testing samples of Mozzarella cheese. The research was carried out using an experimental method using a completely randomized design with 4 treatments and 4 replications. The treatment consists of adding red passion

fruit juice (*passiflora edulis*) to the production of mozzarella cheese with the following concentration:

1. P0 = Red passion fruit juice 0%
2. P1 = Red passion fruit juice 6%
3. P2 = Red passion fruit juice 8%
4. P3 = Red passion fruit juice 10%

The variables measured were fat content, protein content, and elongation of mozzarella cheese

Research procedure

Red Passion Fruit Juice (*Passiflora edulis*)
Production (Muntafiah et., al 2019)

- a. The passion fruit skin is washed
- b. thoroughly to remove any dirt stuck to it.
- c. The flesh of the fruit is then filtered with a filter cloth to separate the seeds so that passion fruit juice is obtained.

Making Mozzarella Cheese

The procedure for making mozzarella cheese using the direct acidification method is carried out based on McMahan, Paulson, and Oberg (2005) with slight modifications and adapting to the measurements as follows:

- a. 25 liters of cow's milk that has been pasteurized at 61-65°C, cooled to 35°C
- b. Milk is divided into 4 containers of 6.25 liters each
- c. Plus red passion fruit essence according to treatment (0%, 6%, 8%, 10%)
- d. Stir for 5 minutes, and add 0.039 ml of rennet (which has been dissolved in water) to each treatment.
- e. The milk is stirred for 1 minute and left for 60 minutes
- f. After clumping of the casein (curding) occurs, separate the curd from the whey using a filter. The whey is allowed to drip and then pressed to release the water.

g. The curd obtained was added with 16.25

grams of salt

h. Melting is done by cooking the curd in a pan over boiling water i. After stretching by pulling and not breaking, the cheese is packaged in a sterile plastic container and placed in the freezer for 24 hours.

j. Then the fat, protein, and elongation levels of mozzarella cheese were tested in the Animal Products Technology Laboratory at Andalas University.

Elongation

Stretchability is an important part of determining the quality of Mozzarella cheese produced for making pizza and related to some ready-to-eat foods (Kuo and Gunasekaran, 2003). Purwadi,(2008) showed that mozzarella cheese can melt perfectly at a temperature of 232oC and the elongation level of the cheese is ≥ 3 inches. The way to measure elongation is to cut a certain size of cheese and put it in the

microwave for 20 minutes. Then the cheese is stretched using a fork and the level of stretch is measured using a ruler (Setyawardani 2017). Elongation testing is carried out manually using the working principle of a texture analyzer with ASTM (1997). The working principle is to heat the sample to a temperature of 800C for 1 minute, then the sample is pulled vertically until the sample breaks and the maximum length value of the sample is obtained using a ruler.

RESULTS AND DISCUSSION

Effect of Adding Red Passion Fruit Juice (*Passiflora edulis*) on the Fat Content of Mozzarella Cheese. The average value

of the fat content of mozzarella cheese with the addition of red passion fruit juice can be seen in Table 1

Table 1. Average Fat Content of Mozzarella Cheese with the Addition of Juice Red Passion Fruit (%).

Treatments	Fat	Protein	Elongation
P0	15,97 ^a	21,70 ^b	66,50
P1	15,33 ^a	22,29 ^{ab}	83,50
P2	13,25 ^b	23,24 ^a	85,25
P3	12,69 ^b	23,86 ^a	91,25

Description: Superscript (a,b) in the same column showed a highly significant effect (P<0.01)

Table 1 shows that the average fat content of mozzarella cheese produced by the addition of red passion fruit juice dose 12.69 – 15.97%. The results of the variance analysis showed that the addition of red passion fruit juice with different percentages had a high significant effect ($P < 0.01$) on the fat content of Mozzarella cheese, this was because the increasing percentage of red passion fruit juice reduced fat. The addition of red passion fruit juice to P3 gave the lowest fat content (12.69%), and the highest at P0 with a fat content of 15.97%.

This is because the citric acid content in red passion fruit juice can reduce fat bonds well in mozzarella cheese. By increasing the percentage of red passion fruit juice, it can increase the water content of the cheese, so that during the heating and ripening process the cheese loses fat content so the fat content decreases. In the cheese-making process, there is a possibility that fat will come out of the processed cheese during the heating process if the temperature is more than 80 °C, so the higher the heating temperature, the more fat will come out (Fox et al 2000). The results of this study are inversely proportional to research conducted by Widarta et al (2016) which used 5 - 8% starfruit extract which

had a high significant effect on increasing fat levels.

The significant effect on the treatments P0, P1, P2, and P3 in this study was due to the difference doses of 6 - 10% of red passion fruit juice, where the citric acid and glucose content in passion fruit juice influenced the fat content of mozzarella cheese. According to Ashurst (1995), passion fruit contains glucose, fructose, and sucrose. The Malaka (2010) state passion fruit contains 2.4 – 4.8% citric acid. Due to the presence of citric acid and glucose in red passion fruit juice, the acid content cannot increase the binding capacity of fat in mozzarella cheese, so the acid in red passion fruit causes the protein to not be denatured, thereby slowing down the coagulation process which causes fat to be reduced because the protein is in the outer layer of the globule. fat. The slow coagulation process by the acid of red passion fruit juice causes a decrease in the binding capacity of fat with the increasing addition of red passion fruit juice acidifying agent. This is by Daulay (1991), who reported that proteins are located in the outer layer of the fat globule membrane. The results of this research are the opinion of

Nindiyasari et al (2022) who used the zingiber enzyme as a milk coagulation agent to make mozzarella cheese get a decreasing fat content. This is due to the possibility of fat being lost in the mozzarella cheese during the heating process. According to SNI, the standard fat content contained in mozzarella cheese is a minimum of 25.0%, while the results of sample test analysis of the fat content obtained were 10.68%. Although there is a significant effect between treatments P0 and P1 and P2 and P3, the results of the fat content in the cheese mozzarella meet USDA standards (2013) where the standard fat content of mozzarella cheese is not less than 10.8%. Thus, the treatment of adding 6 – 10% red passion fruit juice produces mozzarella cheese with fat content according to USDA standards.

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Mozzarella Cheese Protein Content

The variant analysis results showed that adding red passion juice with different doses had a very significantly different effect ($P < 0.01$). This is because increasing the percentage of red passion juice affects increasing protein levels. This result is also inversely proportional to research conducted by Widarta et al (2016), which used 5 - 8% starfruit extract, which significantly reduced protein levels.

The effect of adding red passion juice is increasing in doses from (6 – 10%), this results in an increase in the percentage of curd in making mozzarella cheese. The higher the acidity level, the more optimal the curd can work in speeding up the coagulation process. Other factors that influence the quality of cheese are casein in milk, fat content, salt, pasteurization process, and so on stages of cheese making (Rahayu et al, 2009). The protein content of cheese plays an important role in maintaining the emulsion between liquid fats. The proteins are influenced by their solubility, and have high solubility (completely dissolved), and can bind fat well so that fat and water can be emulsified and dispersed evenly (Mangino, 1994).

The significantly different effect between treatments P0 and P1 and P2 and P3 is also caused by the difference in the percentage of red passion fruit juice used, the higher the percentage of acidity of red passion fruit juice, the more the pH content will decrease. Arifiansyah et al. (2015) that the tendency to decrease water content is caused by the high concentration of acid added and the effect on the pH being lower. Nugroho et al (2018) added that the lower the pH of the cheese, the softer the curd produced in the soft cheese, conversely, a high pH results in a denser and more flexible curd. Ong et al., (2012) that the pH value affects the proteolytic activity of milk due to the breakdown of the kappa casein macropeptide by rennet. The results of the research showed that there was an increase in the protein content of Mozzarella cheese with increasing concentrations of added red passion fruit extract. This is because acidification with red passion fruit juice produces a curd that can work optimally in helping the work of rennet thereby speeding up the coagulation process, therefore it can produce a curd that is compact and has a high yield.

Metzger et al., (2000) reported that initial acidification can affect the calcium, protein, and fat levels of cheese. Coagulation under acidic conditions that are optimal for the activity of the renin enzyme is able to produce a compact and firm curd, so that when the curd is cut, not much fat and casein is lost with the whey, the more fat that can be retained in the curd, the better the cheese can be produced.

Differences in cheese protein levels can also be influenced by the coagulation time in each different treatment. The less acid content of red passion fruit juice, the longer the coagulation process takes. In this study, the coagulation time was standardized to 30 minutes for each treatment. The use of acid will be greater if the coagulation temperature is lower and conversely, if the coagulation temperature is higher the need for acid will be relatively less. The heating temperature in making cheese by direct acidification must be higher than 85°C and the pH of the milk must reach 5.5 (Kalab and Kobieta in Purwadi, 2008).

The protein content in mozzarella cheese from 18-21% (Nindyasari et al, 2022). Thus, the treatment of adding 6-10%

juice is able to produce Mozzarella cheese with protein levels that meet standards.

Stretching Mozzarella Cheese

Table 1 shows that the average elongation of mozzarella cheese produced with the addition of red passion fruit juice ranges from 66.50 to 91.25 cm. The results of the variance analysis showed that the addition of red passion fruit juice with different doses had no significant effect ($P > 0.05$). The elongation was not significantly affected because the increase in red passion fruit juice did not affect the elongation power of the mozzarella cheese, however, an increase in the elongation length was obtained from 66.50 to 91.25 cm in each treatment. There is an increase in the stretch length of mozzarella cheese due to the addition of red passion fruit juice which causes direct acidification with a high concentration so that the average pH becomes low, namely 5.4 - 5.7. This pH value condition will produce a curd that is compact in binding water and fat, thus producing stretchability. the height is 91.25 cm. According to Fardiaz and Radiati (1991), the rennin enzyme in rennet is stable at pH 4.0 – 6.0 and at pH 5.0 can maintain maximum activity.

The increase in the elongation of Mozzarella cheese is also due to the coagulation process being quite optimal which causes more water to be bound in the curd and causes the elongation of the cheese to increase. The stretchability of Mozzarella cheese greatly influences the quality of the cheese produced, especially when used in food. Mozzarella cheese acts as a provider of stretchability on pizza in improving the quality of mozzarella cheese (Rusdan, 2011). Elongation occurs due to the stretching process of the curd which is separated from the whey. Hartono and Purwadi (2012) stated that the elongation of mozzarella cheese is the effect of stretching by heating at a temperature of 75 °C and the curd is pulled little by little until stretchy mozzarella cheese is formed. Apart from that, the elongation process occurs because the milk caseins adhere and bind to each other. Rosyidi et al (2007) that stretchy cheese is caused by the strong and compact casein chain bonds.

The different effects of the treatments on the elongation of mozzarella cheese were also due to the influence of the

addition of red passion fruit juice containing citric acid which influenced the formation of a stretchable curd, where the addition of red passion fruit juice in each treatment resulted in better elongation (66.50-91).25 cm), although the effect is not significantly different. The opinion of Widarta et al (2016) who state that good acidification can make rennet work perfectly and produce a compact curd, mozzarella cheese can stretch well. From the results, the stretch figures for mozzarella cheese added with red passion fruit juice were between 66.5 and 91.25 cm, which met the established standards. According to the USDA (2005), mozzarella cheese can be said to be stretchy if it reaches a length of >7.62 cm after being heated.

CONCLUSION

Giving red passion fruit juice (*Passiflora edulis*) had a very significant effect ($P < 0.01$) on fat content and protein content but had an effect ($P > 0.05$) on the elongation of mozzarella cheese.

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