Quality improvement of yogurt through the addition of corn and tomato juice

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Abstract. This research aims to determine the effect of the addition of corn and tomato juice concentrations on the quality of yogurt produced. The method used is factorial completely randomized design, which consists of two treatment factors. The first factor is the comparison of the concentration of corn juice with the S code, consisting of 4 levels, namely: S1 is 0%, S2 is 10%, S3 is 20% and S4 is 30%. The second factor is the ratio of tomato juice with password T, consisting of 4 levels, namely: T1 is 5%, T2 is 10%, T3 is 15% and T4 is 20%. The combination of treatment ratio concentrations of corn extract and tomato juice gave no significant effect on vitamin C and the number of bacteria, but was significantly different from the total acid and very significantly different from the total solids and organoleptic values. The best quality of yogurt obtained at 30% corn juice concentration and 5% sari tomato concentration.

Keywords : yoghurt, corn juice concentration, tomato juice concentration

1. Introduction

Fermentation is one of the most common and popular food processing processes worldwide. Fermentation has become popular because the process not only can change food to be more durable, but also provides taste, pleasant aroma and enhances the nutritional content of food [1-3]. Yogurt is a fermented milk product by lactic acid bacteria. With the formation of lactic acid, the acidity of the milk will increase or the pH will be lower, so the shelf life of milk processed into yogurt will be longer, thus producing a product with a semi-solid texture, having a distinctive aroma [4-7]. Yogurt comes from milk which is then added with bacteria that will form lactic acid. Bacteria commonly used in the process of making yogurt are Bifidobacterium sp, Lactobacillus sp or Streptococcus thermophilus and Lactobacillus bulgaricus bacteria. These bacteria which will trigger the fermentation process of milk, converts lactose in milk to lactic acid [8,9].

Yogurt characteristics such as sour taste and thick texture make some people do not like it. Diversification is needed in the manufacture of yogurt, namely by making yogurt products that are not too acidic by stopping the fermentation time at the desired acidity and texture that is not thick (watery) so that it is easy to drink which is commonly called drink yoghurt [10-12]. Some researchers have made yogurt from various raw materials in addition to cow's milk, buffalo milk, goat's milk and soy milk. Not only that, yogurt can be made from food such as corn and tomatoes [13,14].
Corn is a food that is popular with many people both young and old. The advantage of corn extract itself is to have good nutrients such as carbohydrates (starch, sugar, pentosan and crude fiber) and fat. Fat acids are composed of saturated fatty acids (palmitic and stearic) and unsaturated fatty acids (oleic and linoleic). Corn itself is very good in growing children, maintaining healthy skin and preventing cancer and stroke. In addition, corn also has phytochemical compounds in a bound form whose antioxidant strength is not inferior to other fruits and vegetables [15-18]. Tomato (*Lycopersicum esculentum*) is one type of vegetable that has been widely known by the public. Overall the content of tomatoes per 100 g is 30 kilo calories, vitamin C 40 mg, vitamin A 1500 SI, a number of iron, calcium [19,20]. Some researchers have conducted experiments in making yogurt from corn extract. However, almost no one applied it with the addition of tomato juice. The authors try to develop a variety of corn food products that are applied with tomatoes where the presence of these two foodstuffs can be found easily on the market.

2. Methods

The study was conducted at the Laboratory of Food Microbiology, Faculty of Agriculture, Universitas Katolik Santo Thomas, Indonesia. The implementation of this research was carried out for 2 months. The material used in this study was 1 N NaOH, alcohol, PP indicator and plate count agar (PCA). The tools used in this study are basins, blenders, sieves, filter paper, measuring cups, scales, measuring flasks, water heaters, erenmeyers, burettes, stirring rods, petridishes, ovens, markers, drop pipettes, packaging containers, cups and stoves. This research was carried out using factorial completely randomized design method consisting of two factors: the first factor was the concentration of sari corn (S), with levels namely: S1 is 0%, S2 is 10%, S3 is 20% and S4 is 30%. The second factor is comparison of tomato juice (T), consisting of 4 levels, namely: T1 is 5%, T2 is 10%, T3 is 15% and T4 is 20%. The research flow chart looks like in Figure 1 below.

![Research Flow Chart](image)

3. Results and discussion

In Table 1 it can be seen that the higher the concentration of corn extract, the total lactic acid, total solids and vitamin C increased, while the number of bacteria and organoleptic values decreased. This is due to the nutrients contained in corn affecting the nutrients contained in the final product of yogurt.
It can be seen that the greater the concentration of tomato juice, the total acid, total solids and vitamin C increased, while the number of bacteria and organoleptic values decreased.

**Table 1.** Effect of treatment comparison of concentration of sari corn and tomatoes on yogurt parameters observed

| Concentration of corn juice (%) | Total Acid (%) | Total Solid (%) | Vitamin C (%) | The total number of bacteria (%) | Organoleptic value (Score) |
|--------------------------------|----------------|-----------------|---------------|----------------------------------|---------------------------|
| S₁ = 0                         | 1.60           | 6.87            | 8.72          | 141.50                           | 2.60                      |
| S₂ = 10                        | 1.74           | 8.33            | 9.50          | 128.38                           | 2.59                      |
| S₃ = 20                        | 1.84           | 10.21           | 10.16         | 118.38                           | 2.53                      |
| S₄ = 30                        | 1.95           | 13.92           | 10.94         | 110.38                           | 2.41                      |

| Concentration of tomato juice (%) | Total Acid (%) | Total Solid (%) | Vitamin C (%) | The total number of bacteria (%) | Organoleptic value (Score) |
|----------------------------------|----------------|-----------------|---------------|----------------------------------|---------------------------|
| T₁ = 5                           | 1.74           | 8.96            | 9.40          | 388.75                           | 2.65                      |
| T₂ = 10                          | 1.76           | 9.46            | 9.68          | 278.75                           | 2.58                      |
| T₃ = 15                          | 1.80           | 10.17           | 10.08         | 198.50                           | 2.53                      |
| T₄ = 20                          | 1.83           | 10.75           | 10.17         | 131.25                           | 2.38                      |

The highest total acid content was found in S₄ treatment at 1.95% and the lowest in S₁ treatment at 1.60%. The highest total solids content was found in S₄ treatment, which was 13.92% and the lowest in S₁ treatment was 6.87%. From the results of variance showed that the higher the concentration of corn juice in making yogurt, the organoleptic value decreases. The highest organoleptic value was found in S₁ treatment, which was 2.60% and the lowest in S₄ treatment was 2.41%. From the results of variance it can be seen that the higher the concentration of corn extract in making yogurt, the higher the level of vitamin C. The highest levels of vitamin C were found in S₄ treatment which was 10.94% and the lowest in S₁ treatment was 8.72%.

From the results of variance for tomato juice showed that the highest total acid content was found in T₄ treatment which was 1.83% and the lowest in T₁ treatment was 1.74%. From the results of variance showed that the highest total solids found in T₄ treatment was 10.75% and the lowest in T₁ treatment was 8.96%. The highest organoleptic value was found in T₁ treatment, which was 2.65% and the lowest in T₄ treatment was 2.38%. The highest levels of Vitamin C were found in T₄ treatment that was 10.17% and the lowest in T₁ treatment was 9.40%.

Figure 2a shows that the higher the concentration of corn extract, the greater the total acid. Yogurt is a product with a relatively high viscosity, stiff and cohesive. Good quality yogurt products that have soft texture, no granules and have relatively high acid content. Figure 2b shows that the higher the concentration of tomato juice, the higher the total acid produced. This is caused by the amount of acid levels that are owned by tomatoes so that the total acid content in yogurt will also increase. Figure 2c shows that the higher the concentration of corn juice in making yogurt, the more total yogurt solids increases. Total yogurt solids are determined by the number of complex compounds in yogurt such as: carbohydrates, proteins and fats. During fermentation yogurt will experience breakdown of carbohydrates through a degradation of the monosaccharide sugar which is glucose to pyruvic acid. Figure 2d shows that the higher the concentration of tomato juice the total yogurt solids increases. The increase in total solids is caused by an increase in the viscosity of yogurt, so that the degradation of smaller complexes occurs.
Figure 2. (a) The relationship between the concentration of corn juice with yogurt lactic acid levels, (b) the relationship between the concentration of tomato juice and the total acid content of yogurt, (c) the relationship between the concentration of corn juice and the total amount of yogurt solids, (d) the relationship between concentration of tomato juice with a total level of yogurt solids.

Figure 3. (a) The relationship between the concentration of corn juice on the organoleptic value of yogurt, (b) The relationship between tomato juice concentration and organoleptic value of yogurt, (c) the relationship between the concentration of corn juice on vitamin C yogurt concentration, (d) the relationship between tomato juice concentration against vitamin C levels of yogurt.
Figure 3a shows that the higher the concentration of corn extract, the organoleptic value of yogurt decreases. This is because corn can give color, flavor and odor that is not good for the yogurt produced. Figure 3b shows that the higher the concentration of tomato juice on making yogurt, the lower the organoleptic value. This is because the acidity level of each treatment is proportional to the concentration of tomatoes given, so many panelists do not like the final result of yogurt. Figure 3c shows that the higher the concentration of corn juice in making yogurt, the more vitamin C yogurt increases. This is because corn increases levels of Vitamin C in yogurt. Figure 3d shows that the higher the concentration of tomato juice, the more vitamin C levels are contained. This is because the levels of Vitamin C contained in tomatoes will increase itamin C levels in yogurt.

Figure 4a shows that the increase in total acid is proportional to the concentration ratio carried out on corn extract and the concentration of tomato juice given. Figure 4b shows that the higher concentration of tomato juice, the total solids produced as in S1, S2, S3 and S4 will increase. The highest total solids obtained in S4 treatment was 15.33% and the lowest total solids were obtained in S1 treatment was 6.33%. Figure 4c shows that the higher concentration of tomato juice is given, the organoleptic value produced as in S1, S2, S3 and S4 will decrease. The most significant treatment experienced is a decrease in organoleptic values found in S1 treatment.

![Figure 3: Relationship between concentration of corn extract, tomato juice, and organoleptic value of yogurt.](image)

**Figure 3.** (a) Relationship between concentration of corn extract, tomato juice, and organoleptic value of yogurt.

**Figure 4.** (a) Relationship between tomato sari concentration and total lactic acid yogurt at various concentrations of sari corn, (b) relationship of percentage of tomato juice with total solids of yogurt at various concentrations of corn, (c) the relationship between sari tomato concentration and organoleptic value of yogurt at various concentrations of sari corn.

### 4. Conclusion

The higher the concentration of corn juice (0%, 10%, 20% and 30%), total acid, vitamin C and total solids increased, but the organoleptic value and number of microbes decreased. The number of bacteria and organoleptic values decreased with many concentrations of tomato juice, but Vitamin C levels, total acid and total solids increased.
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