

THE EFFECTS OF ADDING FOREST HONEY ON THE QUALITY OF SWEET CORN (ZEA MAYS L) YOGURT

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ABSTRACT

Research on corn has shown that corn is an important source of carbohydrates in the diet of the people in Indonesia. Sweet corn has the potential to be used as an ingredient in yogurt because of its content. Yogurt is a pasteurized milk product that is then fermented using *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria. The present study aims to determine the quality of sweet corn yogurt which has been added with forest honey with a concentration of 8%, 10%, and 12% through the Total Plate Number (ALT) test, pH test, and organoleptic test. The research was conducted at the Laboratory of Bina Mandiri University Gorontalo.

This research was an experimental method consisting of 4 treatments, namely the treatment without the addition of forest honey (Control or P0), the addition of forest honey with concentrations of 8% (P1), 10% (P2), and 12% (P3).

Research shows that the addition of forest honey with various concentrations meets the quality standards of yogurt according to the Indonesian National Standard (SNI) (01-2981-2009). For the addition of 8% honey; BAL 1.1×10^7 Cfu / ml, pH 4, 10% acceptability for honey 10%; BAL 1.4×10^7 Cfu / ml, pH 4 and 20% acceptability for adding 12% of honey; BAL 1.4×10^7 Cfu / ml, pH 4 and 60% acceptance. It can be concluded that the study has the effect of adding forest honey on the quality of sweet corn (*Zea Mays L*) yogurt.

Keywords: ALT, forest honey, organoleptic, pH, sweet corn yogurt

INTRODUCTION

Corn is an important source of carbohydrates in people's diets in Indonesia. Corn is also rich in functional food components, including fiber, isoflavones, essential fatty acids, anthocyanins, beta-carotene (provitamin A), minerals (Ca, Mg, K, Na, P, Ca and Fe), and the composition of essential amino acids that are needed. body. Currently functional food is starting to develop, along with the high demand for functional food and public awareness about health. With the increasing number of people with degenerative diseases and the elderly population, the development of

commercial products by utilizing functional food components continues to be improved.

Gorontalo is one of the largest maize producing areas. Gorontalo maize farmers are able to produce 1.5 million tons and export 113 thousand tons in 2018. The corn harvest in 2019 was attended by the 7th President of the Republic of Indonesia, Ir. H. Joko Widodo with an area of 1,392 hectares. Corn as a source of functional food is an attraction for consumers, especially for people who are concerned with healthy food. One of the varieties of corn that is in great demand by the public is sweet corn.

Sweet corn (*Zea mays* L. *saccharata*) is a type of corn that has not been known for a long time and has only recently been developed in Indonesia. Sweet corn is increasingly popular and widely consumed because it has a sweeter taste than regular corn, has a more fragrant aroma, and contains sucrose sugar and is low in fat, making it good for diabetics.

In general, people use corn as food, such as corn rice, corn soup, and corn cakes. In addition, corn is also commonly processed into corn flour and corn oil. It is necessary to diversify maize into other processed products so that they are more economically valuable and have greater benefits. One product that can be developed is yogurt.

Yogurt is a pasteurized milk product that is then fermented using *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria [1]. The content possessed by sweet corn, especially carbohydrates and reducing sugars, which is quite high, can be used as an ingredient for making yogurt. According to Setianty, the content contained in corn kernels is 10-11% starch, 5-6% reducing sugar, sucrose and polysaccharides. The reducing sugar contained in sweet corn can be functioned by *Streptococcus thermophilus* and *Lactobacillus bulgaricus* as an energy source [2].

The thing that needs to be considered in the fermentation process is the starter culture. In the process of making corn yogurt, the bacteria used as a starter are a combination or combination of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* bacteria. The combination produced by the two bacteria is the characteristics and taste of yogurt. Taste is formed from the products of metabolism such as the metabolism of lactic acid, acetic acid, acetyldehyde and diasteril [1]. Based on this, it is necessary to add nutrients for these bacteria. one of the best sources of sugar is honey.

Honey is a naturally sweet substance in the form of a thick liquid produced by bees using flower nectar as raw material. The sugar content in honey is very diverse, such as 35% glucose, 1.9% sucrose and 41% fructose. Other ingredients found in honey are vitamins such as vit. A, B, C, D, E, K and minerals such as sodium, magnesium, iron, calcium, potassium, chlorine, phosphorus and sodium as well as digestive enzymes and antibiotics, besides that there are also phenolic acids, nicotinic acids and flavonoids [3]. Honey has a sweet taste with a nice and fresh aroma. According to the USDA Nutrient database, there are nutritional values in 100 g of honey, energy 304 kCal, carbohydrates 82.4 g, sugar 82.12 g, water 17.10 g, vitamin C 0.5 mg (1%), calcium 6 mg (1%).), the addition of honey to the manufacture of corn yogurt can increase the nutritional value of the yogurt. This is supported by Nofrianti et al, that the addition of 2% - 10% honey can increase nutritional value and has met the standards of SNI 2981: 2009 [4].

Diversification of corn food into yogurt with the addition of honey is an alternative food product to prevent diabetes. Because it contains the fiber the body needs (dietary fiber) with a relatively low glycemic index (GI). Diet patients are also medically advised to consume corn-based snacks. Because corn fiber (especially soluble fiber) is able to reduce cholesterol levels in blood plasma by increasing the excretion of bile acids into feces, there is an increase in the conversion of cholesterol in the blood to bile acids in the liver. In addition, dietary fiber will bind cholesterol to be secreted into feces, thereby reducing cholesterol absorption in the intestine [5]. In addition, yogurt is also useful in preventing high cholesterol levels and diarrhea, as well as in being useful in healing cancer and the digestive process [6].

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Based on the description above, the researchers are interested in making an innovative yoghurt product added with honey which is made from corn which is expected to meet the nutritional needs of the community, especially those with degenerative diseases.

RESEARCH METHOD

This research is a descriptive study using the experimental method. The sample was divided into four treatments, while the four treatments were added forest honey with different concentrations. The four treatments were: P0: Control without the addition of honey, P1: 8% honey from the volume of corn extract, P2: 10% honey from the volume of corn extract, P3: 12% honey from the volume of corn extract. This research was carried out at the Bina Mandiri University Laboratory in July 2020. This research uses a blender, stove, filter, stirrer, basin, bunsen, sample cup, incubator, test tube, autoclave, Erleinmeyer, aluminum foil, label paper and other materials. used, namely sweet corn, water, forest honey, skim milk as much as one liter of pure culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria. The data from this research were analyzed descriptively by prioritizing the process related to the effect of adding forest honey on the quality of sweet corn yogurt through organoleptic testing.

FINDINGS

General Description

Universitas Bina Mandiri Gorontalo (UBMG) is a higher education institution located in Gorontalo City, Gorontalo Province. It is the result of the merger of STIM Bisnis Gorontalo and STIKES Bina Mandiri Gorontalo. Organized by the Bina Mandiri Gorontalo Foundation (YBMG) as a higher education legal entity Address: Jl. Prof. Dr. Aloei Saboe No. 173 Kode

Pos: 96128 Bone Bolango reGENCY of Gorontalo province.

Total Plate Number (ALT) of Lactic Acid Bacteria (LAB) in Sweet Corn Yogurt (*Zea mays L*) with the Addition of Forest Honey

The results show that the addition of forest honey was able to increase the number of lactic acid bacteria in sweet corn yogurt (*Zea mays L*). Basically, all treatments in this study had a total number of lactic acid bacteria not less than 1.0×10^7 CFU / mL. The results of lactic acid bacteria can be seen in the following table:

Table 1.
Plate Number (ALT) of Lactic Acid Bacteria (LAB) in Sweet Corn Yogurt (*Zea mays L*) with the Addition of Forest Honey

No	Concentration of forest honey	%
1	Control (P0) 0%	$1,1 \times 10^7$
2	P1 8%	$1,2 \times 10^7$
3	P2 10%	$1,4 \times 10^7$
4	P3 12%	$1,4 \times 10^7$

Source: Data Processed (2020)

The total number of lactic acid bacteria in sweet corn yogurt with the addition of forest honey has met the Indonesian National Standard (SNI). The total number of lactic acid bacteria in treatment A (P0) was 1.1×10^7 CFU / mL, treatment B (P1) 1.2×10^7 CFU / mL, treatment C (P2) 1.4×10^7 CFU / mL and treatment D (P3) has a total number of lactic acid bacteria of 1.4×10^7 CFU / mL. This shows that the more forest honey added to sweet corn yogurt is directly proportional to the number of total plate numbers of lactic acid bacteria in sweet corn yogurt, for more details it can be seen in Figure 1 below:

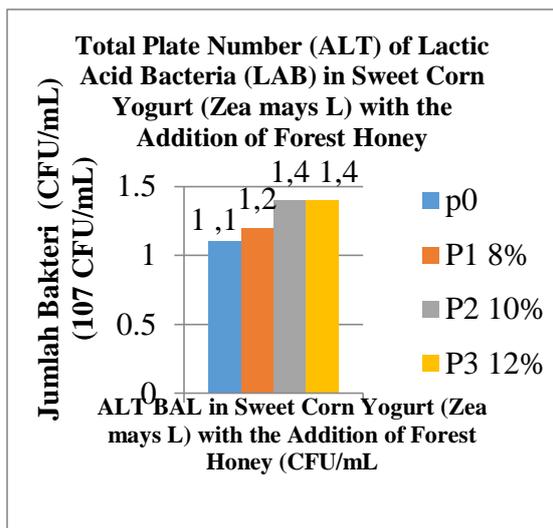


Figure 1. Diagram of Total Plate Number (ALT) of Lactic Acid Bacteria (LAB) in Sweet Corn Yogurt (Zea mays L) with the Addition of Forest Honey

The pH Value of Sweet Corn (Zea mays L) Yogurt with the Additional of Forest Honey

Table 2. The pH Value of Sweet Corn (Zea mays L) Yogurt with the Additional of Forest Honey

No	Concentration of Forest Honey	%
1	Control (P0) 0%	4,4
2	P1 8%	4,2
3	P2 10%	4,2
4	P3 12%	4,0

Source: Data Processed (2020)

Based on the research results, the pH value of sweet corn yogurt with the addition of forest honey in each treatment of this study has a pH value of 4.4 for P0 4.2 for treatment P1 and P2 and 4.0 for treatment P3, so it can be concluded that all treatments In this study, it still has a pH value that is in accordance with the quality requirements of the pH value of fermented drinks according to SNI, because according to Wardhani, et al, a good pH value for fermented drinks (yogurt) according to SNI ranges from 4.0 - 4.5 [7]. More details on the results of the

pH value of sweet corn yogurt with the addition of forest honey can be seen in Figure 2.

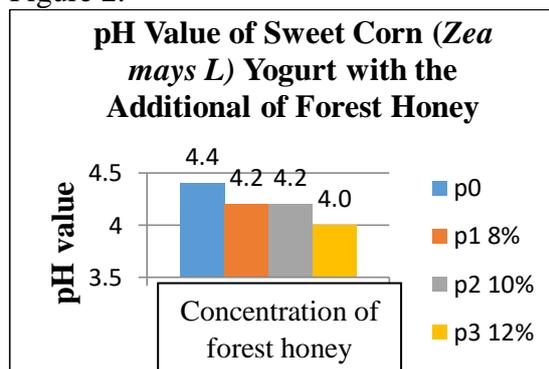


Figure 2. Diagram of pH Value of Sweet Corn (Zea mays L) Yogurt with the Additional of Forest Honey

Organoleptic Value of Swwet CornYogurt adding with Forest honey

Table 3. Organoleptic value of sweet corn yogurt adding with forest honey

No	Forest honey concentration	%
1	Control (P0) 0%	Suka 10%
2	P1 8%	Suka 10%
3	P2 10%	Suka 20%
4	P3 12%	Suka 60%

Source: Data Processed (2020)

The results showed that sweet corn yoghurt with the addition of forest honey as much as 12% (P3) obtained the greatest organoleptic value, which was 60%, then P2 treatment or the addition of 10% forest honey obtained an acceptability value of 20%. Meanwhile, for treatment P1 and P0 (control) each received an organoleptic value of 10%. Based on the results of the percentage of acceptance or organoleptic, it can be assumed that the more concentration of forest honey added to sweet corn yogurt is directly proportional to the level of preference or acceptance of sweet corn yogurt. The organoleptic value of sweet corn yogurt with the addition of forest honey can clearly be seen in Table 3 and Figure 3.

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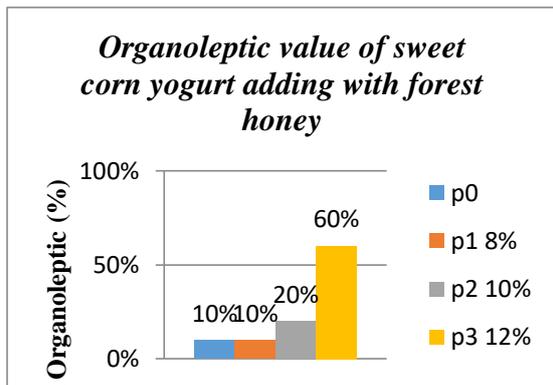


Figure 3. Organoleptic value of Sweet Corn (*Zea mays L*) Yogurt with the Additional of Forest Honey

DISCUSSIONS

Total Plate Number (ALT) of Lactic Acid Bacteria (LAB) in Sweet Corn Yogurt (*Zea mays L*) with the Addition of Forest Honey

According to Winarno, fermenter bacteria such as *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are able to suppress the growth of other bacteria because these two types of bacteria are capable of producing anti-bacterial compounds that can kill the bacteria that cause decay, the way these anti-bacterial compounds work is a way of working with anti-bacteriocytes, namely anti-bacterial compounds, which impairs the formation of other bacterial cell walls [8]. Widodo in his research results also explained that *Lactobacillus bulgaricus* was able to produce bulgarican, which is an anti-bacterial that effectively inhibits pathogenic bacteria [9].

The results of the research in Table 1 show that the addition of forest honey concentration in sweet corn yogurt is directly proportional to the total plate number of lactic acid bacteria, meaning that the more concentration of forest honey added will also be followed by the large number of lactic acid bacteria in sweet corn yogurt, this is This can occur because the addition of forest honey can provide good nutrition for lactic acid bacteria because forest honey contains

glucose which can be used as a source of nutrition or an energy source. This is in line with the results of Finarsih's research that honey contains sugars such as glucose, sucrose, lactose and fructose which can give yogurt a sweet taste, but besides being a sweet source, honey is also a good source of energy for microorganisms, especially those capable of fermenting glucose. these [10].

The existence of microorganisms in fermented drinks (yogurt) has a very important role, so that the presence and number of bacteria in yogurt must meet the quality requirements according to SNI. According to SNI 2981: 2009 the minimum number of microorganisms in yogurt is 1.0×10^7 CFU / mL, with reference to the quality requirements according to the SNI, the total plate number of bacteria in all treatments of this study still meets the criteria or is still in accordance with the quality requirements because on average the number of microorganisms is 1.2×10^7 CFU / mL. However, it needs to be noted again that the most bacteria found in yogurt are bacteria that are fermenters or bacteria that can carry out fermentation, such as *Lactobacillus bulgaricus* and *Streptococcus thermophilus* which usually produce lactic acid.

Lactobacillus bulgaricus and *Streptococcus thermophilus* bacteria in sweet corn yogurt are thought to be more abundant when compared to other bacteria, because these two types of bacteria are theoretically able to inhibit the growth of pathogenic bacteria.

Changes from lactose to lactic acid by *Streptococcus lactis* under anaerobic conditions. The sugar contained in milk is fermented by the bacterium *Sterptococcus lactis* to produce lactic acid which causes a decrease in pH so that it will precipitate "curd" milk. The acid produced from this fermentation in the presence of O₂ can be further broken down by fungi. If this

happens, the role of lactic acid as a preservative against other microbes will be reduced or lost [8].

According to Winarno and Fernandes, lactic acid bacteria that live in fermented milk products suppress the growth of other bacteria. Widodo said that lactobacillus produce bulgarican which is an effective antimicrobial to inhibit pathogenic organisms [9].

It can be concluded that increasing the amount of honey added will increase the solids in corn yogurt.

pH Value of Sweet Corn (*Zea mays* L) Yogurt with the Additional of Forest Honey

The degree of acidity (pH) of sweet milk corn yogurt with the addition of forest honey is influenced by the large amount of lactic acid produced by lactic acid bacteria. The number of lactic acid bacteria in yogurt is inversely proportional to the value of the degree of acidity of the yogurt, meaning that the greater the number of lactic acid bacteria will have an effect in reducing the value of the acidity (pH) of the resulting yogurt.

The results of this study show the same thing, where the P3 treatment or treatment with the addition of forest honey as much as 12% has a large number of bacteria when compared to other treatments but the P3 treatment has the lowest pH value when compared to other treatments. This usually happens because P3 treatment is the treatment with the most concentration of forest honey added so that it is sweeter than other treatments, the presence of more honey can be used by bacteria as a source of nutrition or a source of energy to ferment honey into lactic acid compounds.

According to Rafika, the pH value of fermented milk products is influenced by the increase in lactic acid products produced by lactic acid bacteria, or in other words, the greater the number of

lactic acid bacteria in fermented milk will result in an increase in the amount of lactic acid produced as well, meanwhile decreasing the value. pH is caused by lactic acid bacteria fermenting sources of sugar (sucrose, glucose and lactose) into lactic acid or other forms of organic acids [11]. During the fermentation process, lactic acid bacteria will use a carbohydrate source, in this case honey, to form lactic acid, causing a decrease in the pH value and an increase in acid [12]. However, it should be noted that the pH value affects the quality of the yogurt. Wardhani et al, in their research explained that a good pH value for fermented drinks (yogurt) according to SNI ranges from 4.0 - 4.5. Based on these quality requirements, it can be assumed that the pH value of all treatments in this study still meet the quality requirements according to SNI because the average pH value of yogurt is 4 [7].

Milk acid (lactic acid) is present as a result of the breakdown of various organic substances. The fermentation of carbohydrates, especially sugar by lactic acid bacteria to produce milk acid. The lactose sugar found in milk is a good substrate for *Streptococcus lactis* and *Lactobacillus*. The former produces 1% acidic milk before reaching a suppressing pH, the second produces milky acid up to 4% [13].

The decrease in pH after the addition of honey concentration in the manufacture of synbiotic yoghurt is due to the fulfillment of carbohydrate sources in honey which is caused by bacteria found in yogurt where these bacteria can break down lactose (sugar) in milk into lactic acid and growth in carbohydrates can lower pH media up to 3.5-5.0 [14]. According to Nofrianty et al., Lactic acid bacteria generally produce a large amount of lactic acid from fermentation of carbohydrate energy subtract. Lactic acid which is produced from carbohydrate

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metabolism will decrease the pH value of the growing environment and cause a sour taste [4]. Djaafar and Rahayu stated that during the fermentation process LAB will utilize existing carbohydrates to form lactic acid, resulting in a decrease in the pH value and an increase in acidity [15].

According to Schroder, et al., Stated that the growth of lactic acid bacteria during fermentation can result in an unfavorable environment for other microbes, due to the production of bacteriocins and a decrease in pH.

Organoleptic Value of Sweet Corn Yogurt adding with Forest honey

The organoleptic test results of sweet corn yogurt with the addition of forest honey show that the treatment with the addition of forest honey as much as 12% (P3) is the most preferred treatment or the treatment which has a higher percentage of acceptability value when compared to other treatments, namely 60% (like). The high value of acceptability (organoleptic) in this treatment is thought to be due to the addition of high concentrations of forest honey or more when compared to P2, P1 and P0 treatments, so that the P3 treatment has a slightly sweeter taste when compared to treatment P0, P1 and treatment. P2.

The smell of sweet corn yogurt is the distinctive aroma of yogurt, but there is still a slight effect of the added aroma of forest honey and the aroma of corn as the base ingredient. Based on the results of the organoleptic test research, all treatments fulfilled the SNI in terms of aroma, but when compared to P3 treatment was the treatment that received the highest value in terms of aroma. If based on SNI 2009, the criteria for testing the aroma of yogurt is normal or yogurt, the aroma of dairy products is influenced by the protein and fat content in the milk [10]. Apart from aroma and taste, treatment with the addition of forest honey concentration by 12% also had the highest

value in terms of texture, although there was no significant difference between each treatment. The texture of yogurt is thick liquid to solid, good yogurt is yogurt that is compact in thickness or is not gaseous and between solids and liquids together [11].

CONCLUSIONS

As the conclusions, it can be concluded that there is an effect of the addition of forest honey on the quality of sweet corn yogurt (*Zea Mays L*). The addition of forest honey with various concentrations meets the quality standards of yogurt according to SNI (01-2981-2009). For the addition of 8% honey; BAL 1.1×10^7 Cfu / ml, pH 4, acceptance likes 10%, 10%; BAL 1.4×10^7 Cfu / ml, pH 4 and 20% acceptance, while 12%; LAB $1,4 \times 10^7$ Cfu / ml, pH 4 and 60% acceptance. The organoleptic test of sweet corn yogurt with the addition of forest honey showed that the treatment with the addition of forest honey as much as 12% (P3) was the most preferred treatment or the treatment which had a higher percentage of acceptability value compared to other treatments, namely 60% (like).

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