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Effect of different of yeast genus as a starter for Duck egg fermentation

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Abstract
Yeast is an unicellular microorganism and can be added to food or beverages to increase quality value, create new products and extend shelf life. This research aims to study genus of yeast ability as a starter based on the total of yeast, pH and reducing sugar content of fermented duck eggs. Data on yeast total plate count, pH and reducing sugar content of fermented duck eggs were analyzed for minimum, maximum, standard deviation, and coefficient of variation. The yeast genus that has the best ability as a starter in fermented duck eggs is the Candida genus. The pH produced from the Candida genus was 5.69, the total yeast was 4.35 x 10^5, and the value of reducing sugar content was 0.05%.

Keywords: Genus *Candida*, *Debaryomyces*, total plate count, pH, reducing sugar

Introduction

Fermented eggs are eggs that have undergone changes in the protein part and changes in the composition of other ingredients. Fermentation is one of the oxidation-reduction reactions in biological systems that produce energy (Gusti *et al*, 2020) [3]. Fermentation can increase the shelf life of eggs because it reduces sugar, which is a source of metabolism for destructive microbes. The fermentation process will break down the sugar components in eggs into simpler compounds. Most egg fermentation is done by adding *Saccharomyces sp*. because of its easy use, and most other yeasts also have the ability to ferment by breaking down complex organic compounds into simpler molecules.

The ability of yeast as a starter for fermented duck eggs can be known when the application and calculation of total yeast count (TPC), measurement of pH levels, and reducing sugar levels are carried out. After fermentation of duck eggs is carried out, the presence of yeast is indicated by counting the number of yeast colonies. According to (Tournas *et al*., 2001) [15], the results of a dilution show colonies that are between 30 and 300 colonies. Fermentation starter for duck eggs is added after the duck eggs go through the pasteurization process with the aim of killing microbes contained in duck eggs, because to reduce microbial growth in these eggs, especially pathogenic microbes, pasteurization is necessary. Pasteurization itself is a heat treatment given to raw materials at temperatures below the boiling point. Pasteurization does not kill all microbes, but only those that are pathogenic and do not form spores.

Another important parameter in yeast growth is pH, because yeast can only grow in a certain pH range. For yeast, the optimal pH for growth ranges from 4.0 to 4.5, while according to Pratama *et al*. (2021) [10] the pH ranges that yeast can grow is between 2.5 and 8.5, so the product produced by yeast will tend to have acidic conditions because the pH is <7. Haslett (2011) [5] also added that the formation of lactic acid from lactose is used as a source of energy and carbon during bacterial growth in the fermentation process, so that the pH will decrease so, it can inhibit the growth of harmful microbes in fermented products. The decrease in pH causes the taste to become sour due to the formation of lactic acid as the main product of the metabolism of lactic acid bacteria. This shows that the pH indicator can be used as a reference to determine the optimal time for the end of the fermentation process.

Furthermore, the use of yeast as a starter also affects sugar content. Reduced sugar is used by spoilage microbes as one of the energy sources so that the process of sugar conversion by yeast can increase shelf life, and increase volume, and change the texture of fermented materials. Yeast has a set of enzymes known as zymase that plays a role in the fermentation of sugar compounds, such as glucose into ethanol and carbon dioxide (Hasanah, *et al*., 2012) [6]. The successful utilization of yeast in industrial products is determined by the quality of the yeast. Therefore, it is necessary to look for species that have the ability or high tolerance to the manufacture of fermented egg starter.

Material and Methods

Yeast Total Plate Count Test

The measurement standard for this fermented egg refers to the SNI standard for egg flour (1996) [12].

The Total Plate Count (TPC) method is one of the microbiological examinations used to see the number of microbes as a whole. Total Plate Count (TPC) testing is intended to show the number of microbes contained in a product by counting bacterial colonies grown on agar media. The method used is the Spread Plate method. After fermentation of duck eggs is carried out, the presence of yeast is indicated by counting the number of yeast colonies. According to (Tournas *et al*, 2001) [14], the results of a dilution show colonies that are between 30 and 300 colonies.

Measurement of pH

Measurement of pH levels in fermented duck eggs was carried out before the eggs were fermented and after fermentation. The pH measurement used a pH meter tool that had previously been calibrated using a pH 4 and pH 7 buffer solution.

Measurement of Reduced Sugar Levels

Determination of sample levels was carried out by adding 1 mL of sample extract solution with a concentration of 1.0

mg/mL. Reading of yeast glucose levels was done by adding 1 mL of sample extract solution of concentration 1.0 mg/mL with 1.0 mL of alkaline Cu reagent (Nelson reagent mixture A and B) and then heated in a waterbath for ± 20 minutes. After that, cool to room temperature and add 1 mL arsenomolybdat reagent, then divortex mixer. Added 7 ml of distilled water and divortex mixer again. Then analyzed by measuring the absorption at a wavelength of 540 nm (Fajariah *et al*., 2020) [2].

Data Analysis

The data obtained from the research results are presented descriptively in the form of qualitative data that can provide an overview of the data obtained in the form of the number of yeast colonies, characteristics and genus of yeast from duck eggs, pH levels and sugar levels of fermented duck eggs. Descriptive data analysis that will be used are: Mean, maximum and minimum values, standard deviation, coefficient of variation.

Results and Discussion

pH Value of Duck Egg Fermented

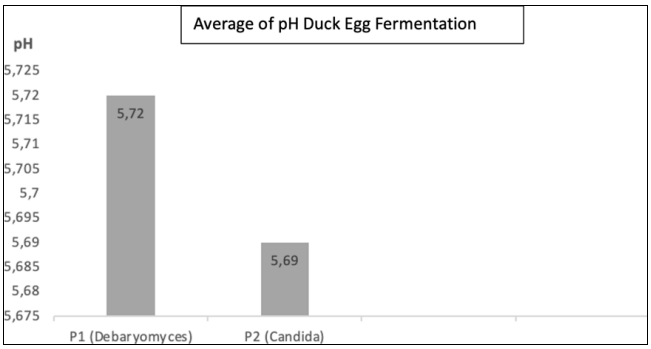

Fig 1: pH value of Duck Egg Fermentation

Based on the research shown in Figure 1, the pH value in P1 (*Debaryomyces*) has an average of 5.72 with a standard deviation of 0.02, a minimum value of 5.69, a maximum value of 5.75, and a coefficient of variation of 0.004%. P2 (*Candida*) has an average value of 5.69 with a standard deviation of 0.06, a minimum value of 5.63, a maximum value of 5.78, and a coefficient of variation of 0.01%. There was a decrease in pH value after the fermentation process For yeast, the optimal pH for growth ranges from 4.0 to 4.5 while according to Nahariah *et al*. (2024) [7] the decrease in pH value in eggs is caused by fermentation activity by yeast, reducing sugar is broken down into gluconic acid, so that the atmosphere of chicken eggs becomes more acidic and the pH becomes low. In the fermentation process, yeast can produce acids that affect the acidity and flavor of the egg. These acids are succinic acid and acetic acid, which are the main products of yeast carbohydrate metabolism through the Krebs cycle. The organic acid is used as a substrate by yeast to be oxidized into CO_2 aerobically (Kustyawati, 2018) [4].

This shows that the pH indicator can be used as a reference to determine the optimal time for the end of the fermentation process. The pH of fermented duck eggs with the addition of the *Candida* genus is not too different from the *Debaryomyces* genus. This is because the fermentation process by yeast always produces a pH in the range of 4.0-5.7, this is also related to the ability of yeast to create acidic conditions in foodstuffs resulting from carboxylic acid metabolism. The pH value of fermented duck eggs formed after the fermentation process indicates that yeast works to break down food chemicals into acids, the pH is in accordance with the pH of the environment suitable for yeast activity and reproduction, which is at pH 3.9-5.0 (Pasini *et al*., 2014) [9].

The calculation of the coefficient of variation of the pH of fermented eggs was obtained in the genus *Debaryomyces* by 0.004%, and in the genus *Candida* by 0.01%. This is in accordance with the statement according to Novianti *et al*. (2021) [8], that a set of data is considered uniform if it has a coefficient of variation below 20%. Conversely, a data set is considered diverse (non-uniform) if it has a coefficient above 20%. There is also a standard deviation calculation result which shows a value of 0.02 in *Debaryomyces* and 0.06 in *Candida.*

Total Yeast Value

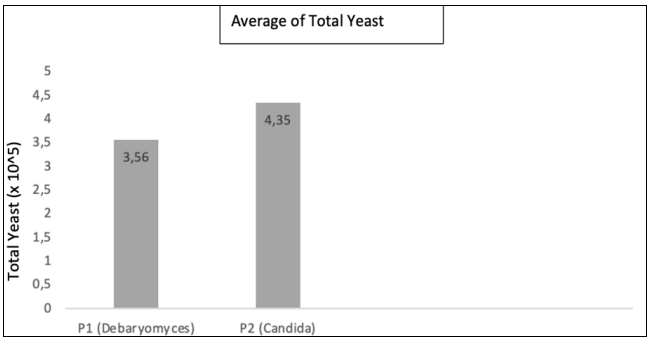

Fig 2: Average of Total Yeast Duck Egg Fermented

Figure 2 shows the total yeast or TPC in fermented duck eggs produced by P1 (*Debaryomyces*) averaged 3.56 x 105 CFU/mL with a standard deviation of 3.86, a minimum value of 1.52, a maximum value of 9.36, and a coefficient of variation of 1.08%. P2 (*Candida*) had an average value of 4.35 x 105, CFU/mL with a standard deviation of 3.65, a minimum value of 1.27, a maximum value of 8.8, and a coefficient of variation of 0.83%. The results showed that the treatment of adding yeast as a starter can grow and adapt in duck eggs. In this study, duck eggs have passed the pasteurization process before being fermented because the purpose of pasteurization itself is to kill some pathogenic bacteria contained in the eggs. The main pathogenic bacteria focused on were Salmonella, as these bacteria are commonly associated with eggs and egg products (Stadelman and Cotteril 1995) [14].

In this study, the highest number of yeasts was in duck eggs fermented using starters from the *Candida* genus, namely 4.35 x 105 compared to the *Debaryomyces* genus, namely 3.56 x 105. According to the statement of Ramos-Moreno *et al*. (2021) [11] stated that *Debaryomyces* is a yeast that has undoubted biotechnological importance. This yeast is a heterogeneous species and is able to grow in extreme conditions, such as high salt levels or relatively alkaline pH. The coefficient of variation results from the genus *Debaryomyces* and the genus *Candida* are different. The coefficient of variation generated from the *Debaryomyces* genus for fermented duck eggs is 1.08%. While the results of the coefficient of variation generated from the Candida genus for fermented duck eggs resulted in 0.83%. The results of the coefficient of variation produced in this study indicate that the data is uniform because the coefficient of variation produced is <20%. This is in accordance with the

statement according to Novianti *et al*. (2021) [8], that a set of data is considered uniform if it has a coefficient of variation below 20%. Conversely, a data set is considered diverse (non-uniform) if it has a coefficient above 20%.

Percentage of Reducing Sugar

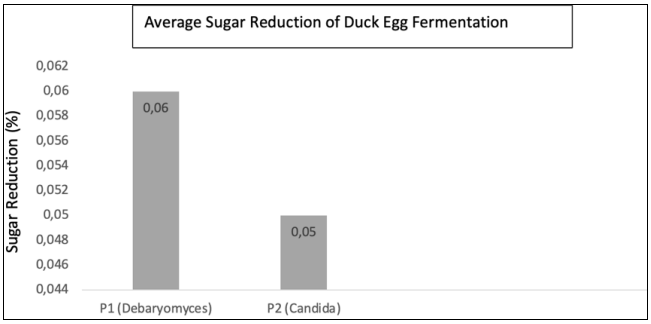

Figure 3: Average Sugar Reduction value of Duck Egg Fermented

P1 (*Debaryomyces*) has a mean value of 0.06% with a standard deviation of 0, a minimum value of 0.06%, a maximum value of 0.06%, and a coefficient of variation of 0%. P2 (*Candida*) has an average value of 0.05% with a standard deviation of 0.005, a minimum value of 0.05%, a maximum value of 0.06%, and a coefficient of variation of 0.09%. The quality requirements of egg flour according to SNI 01-4323-(1996) [12] for egg flour are pH value, moisture content, ash content, fat content, protein content, reducing sugar, total microbial contamination, and metal contamination. The reducing sugar content according to the SNI of egg flour itself is 0.5%, which means that the reducing sugar produced from fermented duck eggs can be used because the reducing sugar content is below 0.5%.

There are 0.37 grams of glucose in 100 grams of fresh eggs, which means that fresh eggs contain about 0.37% glucose (USDA, 2010) [15]. The results of the value of reducing sugar content that has been presented in fermented duck eggs show that there is a decrease in sugar in eggs. Sugar is the main source of carbon needed for the growth and ability of microorganisms to carry out the fermentation process (Sopandi *et al*, 2019) [13]. The results showed that the lowest value of reducing sugar content was found in fermented duck eggs with the addition of yeast starter from the genus Candida. According to the statement of Battcock and Ali (1998) [1], the special feature that strengthens Candida is its rapid nature in the fermentation process. This also makes Candida faster in the fermentation process than Debaryomyces. The value of reducing sugar content of the Debaryomyces genus and Candida genus is fairly uniform because the coefficient of variation produced is less than 20%. This is in accordance with the statement according to Novianti *et al*. (2021) [8], that a set of data is considered uniform if it has a coefficient of variation below 20%. Conversely, a data set is considered diverse (non-uniform) if it has a coefficient above 20%.

Conclusion

The yeast genus that has the best ability as a starter in fermented duck eggs is the Candida genus. The pH produced from the Candida genus was 5.69, the total yeast was 4.35 x 10^5, and the value of reducing sugar content was 0.05%.

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