Identification of Proximate Composition of Fermented Chicken Eggs by Using Lactobacillus plantarum with Different Incubation Times

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ABSTRACT

Eggs that have a balanced amino acid content can fulfill protein that needs in humans, However, eggs have a low shelf life so they were easily damaged. Fermentation technology on foodstuffs by using microbes has been widely carried out, among others using Lactobacillus bacteria. The type of Lactobacillus bacteria commonly used in egg fermentation is Lactobacillus plantarum. This study was conducted experimentally by using a completely randomized design (CRD) with 3 treatments and 3 replications each. The treatment was carried out by fermentation with an incubation temperature of 37 °C with different incubation times of 0, 48, and 96 hours with research parameters water content, crude fat, crude fiber, BETN and ash content. The results showed that different incubation time treatments on fermented chicken eggs had a significant effect (P<0.05) on water content, crude fat, crude fiber, BETN and ash content. The nutritional composition of fermented eggs by using L. plantarum could be seen from the decrease in water content, crude fiber and BETN and an increase in crude fat and ash content with increasing incubation time. The value of water content, crude fat, crude fiber, BETN and optimum ash content at an incubation temperature of 37 °C for 96 hours of incubation time.

Keywords: eggs, fermentation, L. plantarum, proximate analysis

ABSTRAK

Telur yang memiliki kandungan asam amino yang seimbang dapat memenuhi kebutuhan protein pada manusia, namun telur memiliki daya simpan yang rendah sehingga mudah mengalami kerusakan. Teknologi fermentasi pada bahan pangan dengan menggunakan mikroba telah banyak dilakukan antara lain dengan menggunakan bakteri jenis Lactobacillus. Bakteri jenis Lactobacillus yang umum digunakan pada fermentasi telur adalah Lactobacillus plantarum. Penelitian ini dilakukan secara eksperimental dengan menggunakan Rancangan Acak Lengkap (RAL) dengan 3 perlakuan dengan masing – masing 3 kali ulangan. Perlakuan tersebut dilakukan fermentasi dengan suhu inkubasi 37 °C dengan waktu inkubasi yang berbeda yaitu 0, 48, dan 96 jam dengan parameter penelitian kadar air, lemak kasar, serat kasar, BETN dan kadar abu. Hasil penelitian menunjukkan perlakuan waktu inkubasi yang berbeda yaitu 0, 48, dan 96 jam dengan parameter penelitian kadar air, lemak kasar, serat kasar, BETN dan kadar abu. Komposisi Nutrisi Telur Fermentasi menggunakan L. plantarum dapat diketahui dari penurunan kadar air, serat kasar dan BETN dan terjadi peningkatan lemak kasar dan kadar abu sehingga meningkatnya waktu inkubasi. Nilai kadar air, lemak kasar, serat kasar, BETN dan kadar abu optimum pada suhu inkubasi 37 °C selama 96 jam waktu inkubasi.

Kata kunci: analisis proksimat, fermentasi, L. plantarum, telur
INTRODUCTION

Eggs provide the largest contribution of animal protein to the community because apart from relatively cheap prices and easy availability of eggs. Eggs that have a balanced amino acid content can fulfill protein that needs in humans, but the presence of abundant eggs causes side effects for the eggs themselves. Eggs will be damaged if the shelf life is too long. There are various ways that can be done so that the shelf life of eggs can be extended, one of them is fermentation.

Fermentation technology is carried out to obtain benefits as functional food that is good for health, facilitates digestive absorption and extends product shelf life. Fermentation technology in foodstuffs by using microbes has been widely carried out, among others, using Lactobacillus bacteria. Lactobacillus type bacteria commonly used in egg fermentation is Lactobacillus plantarum. These bacteria can grow by requiring the nutritional value contained in the growth medium.

L. plantarum bacteria are proteolytic bacteria that can convert protein compounds into simpler compounds (Nahariah et al. 2015). L. plantarum bacteria grows in one medium if the ability to metabolize nutrients is well developed and during growth the ability to break down proteins into amino acids is maintained for cell proliferation (Nisa et al. 2008). During the fermentation process, L. plantarum will produce metabolites such as lactic acid, hydrogen peroxide, and bacteriocins that function as antibacterial compounds (Mahon et al. 2015). Bacteriocins are peptides or protein compounds that are released into the extracellular by lactic acid bacteria and have a bactericidal effect towards harmful bacteria that are closely related phylogenetically (Urnemi et al. 2011). The presence of this antibacterial activity can be used to prevent the development of pathogenic bacteria.

Bacteriocins have long been identified by researchers and are considered natural products in the form of proteins or peptides from bacteria in fermentation products. Lactobacillus plantarum is one of the lactic acid bacteria that has ability to produce lactic acid and degrade the nutritional content of eggs thus, it has the ability to produce bacteriocins which also have antibacterial properties. The purpose of this study was to identify the proximate contents of fermented chicken eggs by using L. plantarum bacteria.

MATERIALS AND METHODS

Material

The equipment used in this study were sample tubes, erlenmeyer, micropipette, tip, syringe, analytical balance, measuring cup, incubator, spatula, autoclave, magnetic stirrer, vortex, lamina air flow, hot plate, kheedjal flask, fume hood, measuring flask, distillation flask, centrifuge, spectrophotometer (Thermo Genesys 20). The materials were mass chicken eggs, Lactobacillus plantarum bacterial culture, MRS (Man Rogosa Sharpe) broth, aluminum foil, tomato juice, distilled water, alcohol, H2SO4, distilled water, H3BO3, NaOH, TCA, lowry reagent, folin reagent, BSA solution.

This study was conducted experimentally by using a completely randomized design (CRD) with 3 treatments and 3 replications each. The treatment was carried out by fermentation with an incubation temperature of 37 °C with different incubation times of 0, 48, and 96 hours.

Methods

Culture Propagation

Lactobacillus plantarum was stored on De Man Ragosa Sharpe (MRS) agar. Propagation of culture by making sub-cultures. Sub-culture was made by transferring the culture stock into liquid medium of MRS broth (OXOID CM0359) to which 20% tomato juice was added and incubated for 24 hours (Framono et al. 2003). Cultures that had been stored in MRS broth media were inoculated as much as 10% into egg whites containing 20% tomato juice to produce working cultures (Nahariah et al. 2013).

Sample Preparation

Egg samples were cleaned using clean water. The eggs were then fumigated by using Calcium Permanganate (CP) powder and formalin in a closed room for 5 minutes and successively cleaned by using a wet cloth, chlorine solution and wiped with alcohol by using a cotton swab. Eggs were wrapped in aluminum foil and pasteurized at 60 °C for 3.5 minutes (Froning et al. 2002) then separated from the shell and then put into a sample bottle. The sample bottles were first cleaned by using warm water and sterilized. 100 ml sample was homogenized and then sterilized by using ultraviolet by placing it in a PCR Hood for 15 minutes. The sterile sample was added with 10 ml of working culture (106 CFU/ml) and then homogenized with a tube shaker, the sample was then fermented according to the research treatment (Nahariah et al. 2015).

Tested Parameters

Water Content

Prepare a porcelain dish that had been cleaned in an oven at a temperature of 105 °C for 2 hours. Then it was cooled in a desiccator for hour and then weighed (a gram). Put the sample into a porcelain cup and weigh ± 1 gram of the sample (b gram). Next, to bake at 105 °C for 8 hours or leave overnight. Remove from oven and cool in desiccator for ½ hour then weight (c gram) with the following calculation:

\[
\% \text{Water} = \frac{100 \times (C - A)}{B}
\]

Crude Fat

Weigh ± 1 gram of the sample then put it into a 15 ml test tube and added chloroform to a 10 ml scale and after that shook it and let it cool overnight. Squeeze up to 10 ml with chloroform and shake again. Filtered with filter paper into a test tube. Pinch 5 ml into a cup of known weight (a gram) and oven at 100 °C for 4 hours. After that, took it out from the oven and cold it in a desiccator for ½ hour then weigh it (b gram). The calculation is as follows:
The proximate composition of fermented chicken eggs by using different incubation times can be seen in Table 1.

### RESULTS AND DISCUSSION

The proximate composition of fermented chicken eggs with different incubation times can be seen in Table 1.

### Water Content

Table 1 showed that the proximate composition of fermented chicken eggs with different incubation times had a significant (P<0.05) effect on water content. Moisture content decreased with increasing incubation time.

Table 1. The proximate composition of fermented chicken eggs with different incubation times

<table>
<thead>
<tr>
<th>Incubation Time (hours)</th>
<th>Water content</th>
<th>Crude Fat</th>
<th>Crude Fiber</th>
<th>BETN</th>
<th>Ash Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>81.61 ± 0.31c</td>
<td>4.33 ± 0.05a</td>
<td>0.50 ± 0.00c</td>
<td>4.17 ± 0.12b</td>
<td>0.72 ± 0.01a</td>
</tr>
<tr>
<td>48</td>
<td>80.94 ± 0.03b</td>
<td>5.51 ± 0.12b</td>
<td>0.33 ± 0.06b</td>
<td>4.03 ± 0.23b</td>
<td>0.73 ± 0.00b</td>
</tr>
<tr>
<td>96</td>
<td>80.32 ± 0.09a</td>
<td>5.93 ± 0.01c</td>
<td>0.20 ± 0.00a</td>
<td>2.37 ± 0.23a</td>
<td>0.75 ± 0.00c</td>
</tr>
</tbody>
</table>

Description: Different superscripts in the same column showed significant differences (P<0.05).
line with the opinion of Sitio (2019), that the fermentation process caused the microorganisms contained in probiotic supplements to be able to break down long-chain carbohydrates, proteins, and fats. The breakdown of long chains of carbohydrates, proteins and fats made complex molecule meals simple.

**BETN**

The results of the proximate analysis showed that the different incubation time of the Nitrogen-Free Extract (BETN) had a significant effect (P<0.05). The highest number of BETNs was found at 0 hours of incubation with a value of 4.17%, while the lowest number of BETN was found in 96 hours of treatment, which was 2.37%. The decrease at different incubation times was due to the longer incubation time, the lower the BETN value.

The decrease in BETN levels at 96% incubation time occurred because the crude fiber of fermented eggs also decreased. This was in accordance with the opinion of Tillman et al. (1991) that a decrease in the crude fiber content of a material would reduce the BETN content. Inversely proportional to the incubation time of 0 hours giving a high amount of BETN in line with the high amount of crude fiber in the treatment of 0 hours so it would give a high BETN value as well.

**Ash Content**

Table 1 showed the results of the proximate analysis of fermented chicken eggs with different incubation times that significantly affected (P<0.05) on the amount of ash content. Further test results showed that the higher the incubation time, the higher the amount of ash content. This was presumably because the metabolic activity of L. plantarum bacteria in eggs had not been maximized, resulting in an increase in ash content. This was in line with the decrease in water content in this study so that it would have a side effect of increasing the amount of ash content in fermented eggs. The work of L. plantarum bacteria decreased with the length of incubation time because the longer the incubation time, L. plantarum bacteria were not able to metabolize optimally. This was in accordance with the opinion of Sitio (2019), that the change in the amount of ash content was caused by bacterial activity during the fermentation process.

**CONCLUSION**

The eggs fermentation cause some changes in nutritional composition such as decreasing water content, crude fiber and BETN, and increasing crude fat and ash content during the increasing incubation time. The value of water content, crude fat, crude fiber, BETN and optimum ash content at an incubation temperature of 37 °C for 96 hours of incubation time.

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**REFERENCES**


