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The evaluation of physicochemical characteristics of royal icing sugar made from three different white eggs

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ABSTRACT

Royal icing sugar is usually used not only to decorate cakes or cupcakes, but also to add sweet taste. We use pasteurized chicken egg whites as foam maker to give texture to the royal icing sugar. Besides chicken egg, Indonesian people also consume duck and quail eggs. They are potentially substitute the use of chicken egg. This research was conducted to find out the physicochemical characteristics of duck, chicken and quail eggs and their influence to the final result of the royal icing sugar during storage. In this research, fresh chicken, duck and quail eggs were used in three times trials. The data were then processed by using Windows' SPSS. The result showed that water content and Aw of the products made from duck and quail eggs were lower than the one made from chicken egg. While crude protein and fat contents as well as TBA value of products made from duck and quail eggs were higher than the one made from chicken egg. The royal icing sugar made from duck egg showed the highest lightness degree while the one made from quail egg showed the lowest lightness degree. The royal icing sugar made from duck egg showed the best result because it had the highest lightness degree and lower TBA value than the one made from quail egg.

Keywords : royal icing sugar, white eggs

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INTRODUCTION

Royal icing sugar is a sweet emultion made from whisked white egg, icing sugar and lemon juice which sets solid (BBC, 2015). It is usually used for decorating cakes or cupcakes and adding sweet taste. To make royal icing sugar, pasteurized white chicken egg is usually used as foam maker to give the texture of royal icing sugar. Besides chicken egg, Indonesian people also consume duck and quail eggs. They are potentially substitute the use of chicken egg. The quantity of nutrition contents of duck and quail eggs are higher than that of chicken egg (USDA, 2007). In Indonesia, the production quantity of duck and quail eggs are high. At 2015, the production of duck egg reached 277,827.5 ton, while the production of quail egg reached 20,651.105 ton (Directorate General of Animal Husbandry, 2015). Although duck and quail eggs have lower foam stability, the other characteristics are pretty much the same with chicken egg. Until now, white chicken egg is always used for making royal icing sugar. That is why the ability of duck and quail eggs to substitute chicken egg needs to be learned.

MATERIALS AND METHOD

The making of royal icing sugar

The egg whites were whisked in large bowl until they become frothy. After that, icing sugar, lemon juice and vanilla essence were added. The mixture was then beated until it was very stiff. Royal icing sugar was then stored in refrigerator.

Water content of royal icing sugar

Water content of royal icing sugar was determined using thermogravimetric analysis. First, empty porcelain cup was dried in the oven at 100-105°C for 18 hours and then the weight was measured. 5 grams of sample were put into the empty porcelain cup and dried in oven at 100-105°C for 18 hours. The porcelain cup of dry sample was then put into desiccator for 15 minutes before the weight measurement. The water content was then calculated.

Crude protein content analysis

The analysis of crude protein content was using Kjeldahl method. Digestion tube was cleaned using HCl and aquades. 0,5 grams of sample, 7 grams of K_2SO_4, 0,35 grams of HgO, and 15 ml of H_2SO_4 were put into digestion tube to be digested for 3 hours. After that, 70 ml of NaOH and $Na_2S_2O_3$ mixture was then added. The mixture was then destilated for 3 minutes (Erlenmeyer with 25 ml of 4% boric acid was used to collect destilate). 3 drops of methyl red blue were then added to the destilate for titration using HCl 0,1 N until the color changed to light purple. The protein content was then calculated.

Crude fat content analysis

The analysis of crude fat content was using Soxhlet method. 2 grams of sample were dried and put into filter paper. The filter paper containing sample was then put into extractor. Meanwhile, hexane was put into distillation flask. The fat extraction was done for 4 hours. The hexane containing fat from the extraction was put into empty porcelain cup and dried in the oven at 80°C for 12 hours. The porcelain cup was then put into desiccator for 15 minutes before the weight measurement. The crude fat content was then calculated.

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Thiobarbituric acid analysis

0,5 grams sample was dissolved into 50 ml of aquades. The solution was put into destillation tube which contained 48,5 ml of aquades. 1,5 ml of HCl and 3 drops of antifoam were added into the solution. The destillation process was done until 25 ml of destilate was obtained. 5 ml of destilate was put into closed test tube and added with 2,5 ml of TBA reagent. The solution was then heated for 30 minutes. Absorbance was read at 528 nm.

Color intensity analysis

The color intensity of royal icing sugar was measured using Chromameter Minolta CR-400 at 3 different spots.

Foam stability of white eggs analysis

Foam stability was measured by whisking 50 ml of white eggs until stable foam was obtained in scale plastic cup. Then the volume and overrun were calculated. After 10 minutes, the volume and overrun were calculated again. Foam stability was then calculated.

Water activity analysis

The analysis was done by putting 35 grams of sample in transparent tube inside the Aw meter. After 10 minutes, the result was read at the Aw meter

Statistical analysis

The results of water content, crude protein, crued fat, TBA, water activity and color intensity analysis were analyzed using SPSS for Windows. This analysis was using One Way ANOVA. Significant differences between means were analyzed by Duncan's multiple range tests.

RESULTS AND DISCUSSION

Water content of royal icing sugar

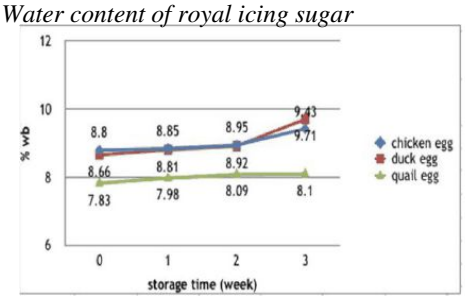

Figure 1. The water content of royal icing sugar during 4 weeks storage

The highest water content was obtained by royal icing sugar made from chicken egg whites while the lowest water content was obtained by royal icing sugar made from quail egg whites. The increase of water content during storage was caused by melting of foam as the result of the decrease of foam stability (Stadelman & Cotterill, 1995).

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Crude protein content of royal icing sugar

Product	Protein content (%)
Chicken Egg Whites' Royal Icing Sugar	1,74 ± 0,36[1]
Duck Egg Whites' Royal Icing Sugar	1,79 ± 0,14[1]
Quail Egg Whites' Royal Icing Sugar	2,05 ± 0,16[1]

Figure 2. The crude protein content of royal icing sugar

The highest protein content was obtained by royal icing sugar made from quail egg whites while the lowest protein content was obtained by royal icing sugar made from chicken egg whites. The percentage of crude protein content of egg whites was higher than that of royal icing sugar because there are some addition of icing sugar and lemon juice in the royal icing sugar.

Crude fat content of royal icing sugar

Product	Fat Content (%)
Chicken Egg Whites' Royal Icing Sugar	0,52 ± 0,01[1]
Duck Egg Whites' Royal Icing Sugar	0,73 ± 0,01[2]
Quail Egg Whites' Royal Icing Sugar	0,99 ± 0,02[3]

Figure 3. The crude fat content of royal icing sugar

The highest fat content was obtained by royal icing sugar made from quail egg whites while the lowest fat content was obtained by royal icing sugar made from chicken egg whites. The percentage of crude fat content of egg whites was lower than that of royal icing sugar because there are some addition of lemon juice which also contained fat.

Thiobarbituric acid value of royal icing sugar

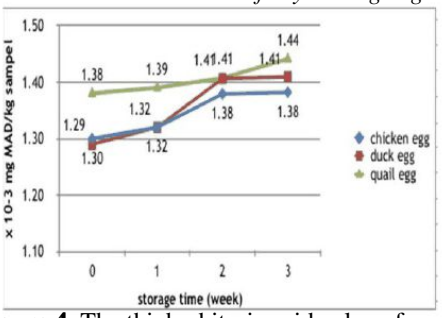

Figure 4. The thiobarbituric acid value of royal icing sugar during 4 weeks storage

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The highest thiobarbituric acid value was obtained by royal icing sugar made from quail egg whites while the lowest thiobarbituric acid value was obtained by royal icing sugar made from chicken egg whites. The increase of thiobarbituric acid value was caused by product contact with oxygen and light which resulting in fat oxidation. The results are directly proportional with the crude fat content results.

Lightness degree of royal icing sugar

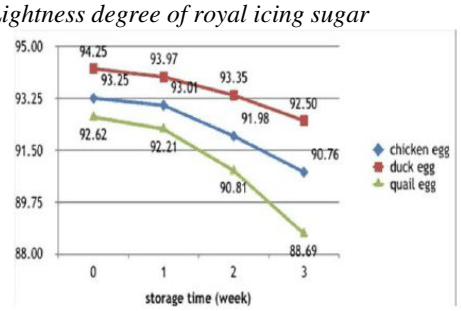

Figure 5. The lightness degree of royal icing sugar during 4 weeks storage

The highest lightness degree was obtained by royal icing sugar made from duck egg whites while the lowest lightness degree was obtained by royal icing sugar made from quail egg whites. The decrease of lightness degree during storage was in accordance to the theory of Cauvain & Young (2001) which said that royal icing sugar would undergo color changing during storage. Eskin (1990) added that the color changing was caused by browning of the amino content.

Foam stability of royal icing sugar

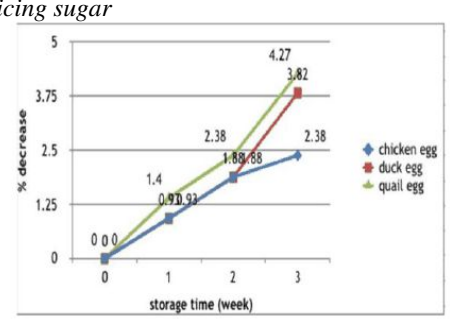

Figure 6. The foam stability of royal icing sugar during 4 weeks storage

Globulin content of duck and quail egg whites are lower than that of chicken egg whites. That is why the best foam stability was obtained by royal icing sugar made from chicken egg whites. Besides, the fat is also foam inhibitor. Product with higher fat content had lower foam stability. The foam stability had tight connection with the color intensity of product. Product with lower foam stability had lower product lightness.

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Water activity of royal icing sugar

Product	Aw
Chicken Egg Whites' Royal Icing Sugar	0,86 ± 0,002
Duck Egg Whites' Royal Icing Sugar	0,85 ± 0,001
Quail Egg Whites' Royal Icing Sugar	0,85 ± 0,002

Figure 7. The water activity of royal icing sugar

The result showed that water activity inversely proportional to product's water content. This was caused by icing sugar addition which has solid form and has the ability to create hydrogen bond which resulting in water content decrease (Kusnandar, 2010).

CONCLUSIONS

The highest lightness was obtained by royal icing sugar made from duck egg whites while the lowest L value was obtained by royal icing sugar made from quail egg whites.

Royal icing sugar made from duck and quail eggs had lower water content and foam stability than royal icing sugar made from chicken egg whites.

Royal icing sugar made from duck and quail eggs had higher crude protein content, crude fat content and TBA value than royal icing sugar made from chicken egg whites.

The royal icing sugar made from duck egg showed the best result because it had the highest lightness degree and lower TBA value than the one made from quail egg.

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