The fat content and the preferences of salted duck egg enriched with black and white pepper

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Abstract. This study was aimed to determine the fat content and the preferences of salted duck egg enriched with black and white pepper. The experimental was designed as completely randomized design with 2 factors. First factor was concentration of black and white pepper (10%, 15% and 20%), while the second factor was length of salting period which are 7 and 10 days. Fat content was determined by Soxhlet extraction method, and the product preferences was determined by using hedonic scale test. The preference test was done at white egg and yolk color, taste of saltiness, aroma and gritty texture. Results showed that, fat content of salted duck egg with pepper addition tend to decrease along with the duration of immersion. According to the preferences test, salted duck egg at 20% black and white pepper were mostly preferred at 10 and 7 days salting period, respectively.

1. Introduction

Fresh egg is known as protein source, it has delightful flavor and easy to digest. It is containing 13.1% protein, 12% fat, vitamin and minerals. Further processing and preservation are necessary to maintain its quality and extend shelf life of the egg. Commonly, fresh egg is preserved conventionally through salting process. The main ingredient of salted egg making is salt or sodium chloride. The sodium chloride plays important role of preservation by reducing the growth of microorganism thereby extending shelf life [1].

Salted egg are widely made by duck eggs due to its distinctive characteristics than other egg. The average of duck egg dimension is bigger than chicken egg, it reaches 70-80 gram per egg. The duck egg has a larger pore than other eggs that accelerate salt penetration into eggshell [2]. It generally takes 2-4 weeks of salting duration depending on the method used. There are two common methods of salted egg process namely brining and coating method [3].

The salted egg preservation technology is developed by the enrichment of various spices and fruit addition extracts for specific purpose. The previous study [1] enriched salted duck egg with clove extract in the aim to determine lipid oxidation and antioxidant activity of salted duck eggs. Another study [4] used natural acid from Averrhoa bilimbi, lime and tamarind to eliminate fishy aroma of the salted duck eggs. The addition of garlic oil and cinnamon on salted egg making process aimed to determine the antibacterial activity, antioxidant activity and sensory characteristic of salted duck egg [1,5].

In regards with spices production, Lampung province of Sumatra is the major black pepper producing region, while Bangka province produces white pepper. Black pepper is known to have benefit on health. Piperine compound in the black pepper could help control fat in the blood. Black pepper extract has been reported significantly increases anticancer activity, relieves digestive problems and inhibits free
radicals that are harmful to the skin [6]. Therefore, the objectives of this study were to determine the fat content and sensory perception towards salted duck egg enriched with black and white pepper.

2. Materials and methods

2.1. Sample preparation

Materials used in this study were duck eggs, black and white pepper powder, vinegar, water and salt. The duck eggs and pepper powder were obtained from farmers in Airnaningan, Tanggamus. The vinegar and salt were obtained from local store in Bandar Lampung. The duck eggs were washed manually and soaked in 5% vinegar for 30 minutes. The preliminary treatment was conducted based on the previous protocol [7] with slight modification. Following preliminary treatment, eggs were treated with 100, 150 and 200 gr of pepper powder (black or white) solution. Subsequently, eggs were immersed in 30% salt solution and kept in the closed jars. Meanwhile, eggs without pepper also produced for control purpose. Data collection was conducted at 7 and 10 days of salting. The eggs then prepared by steaming process for 20 minutes, followed with cooling in running water. The samples were then subjected to analysis.

2.2. Fat analysis

The fat content was determined by Soxhlet extraction method [8]. Data of fat content was analysis descriptively.

2.3. Preferences test

Samples were served in codified plate with a glass of water and a slice of cucumber to 20 untrained volunteer panelists from different ethnic group namely Java, Lampung, Palembang, Batak, Minang and Sunda. The samples were evaluated using preference test based on a five-points hedonic scale (5 = like extremely; 3 = neither like nor dislike; 1 = dislike extremely). Sensory parameters including appearance of white egg and yolk, aroma, taste of saltiness and texture of grittiness were measured based on earlier study [9] with slight modification. Data were analyzed using ANOVA, followed with Least Significance Difference (LSD) analysis at $\alpha = 5\%$ [10].

3. Results and discussion

3.1. Fat content

Addition of pepper powder in the current study was expected to improve quality of salted duck egg in terms of nutritional value, including flavor enrichment and visual performance. The result of fat analysis of salted eggs in both black and white pepper enrichment were presented in Table 1. At 7 days of salting, the fat of egg added with black pepper was found at range between 8.63-9.09%.

| Table 1. Fat Content of salted duck egg enriched with black and white pepper in various concentration at 7 and 10 days salting |
|----------------|----------------|----------------|
| Treatments       | Fat content (% wet weight basis) | Moisture content (%) |
|                  | 7 days | 10 days | 7 days | 10 days |
| L0/P0 (Pepper 0%) | 8.84   | 9.08    | 67.53  | 58.01   |
| L1 (Black pepper 10%) | 9.09   | 8.23    | 68.43  | 68.78   |
| L2 (Black pepper 15%) | 8.63   | 8.77    | 68.31  | 68.75   |
| L3 (Black pepper 20%) | 8.99   | 8.46    | 68.50  | 62.85   |
| P1 (White pepper 10%) | 9.18   | 9.11    | 61.33  | 64.17   |
| P2 (White pepper 15%) | 8.88   | 8.54    | 64.39  | 67.96   |
| P3 (White pepper 20%) | 8.75   | 8.61    | 67.84  | 58.54   |

The highest of fat content in black pepper treatment was in 10% of addition. Compared to white pepper treatment, the addition of 10% white pepper found to have highest fat. A pattern of the decrease
of fat was observed at 7 to 10 days, but it’s not applied to all treatment. In term of moisture content, we didn’t find any linear pattern of decrease on increase, but there was a moisture decrease as the pepper (black and white group) concentration increased.

Fat content in eggs was concentrated in the yolk with levels reaching 35%. Generally, fresh duck eggs have 14.3% fat content then salting process will reduce fat content to 13.18-13.26% [11, 12]. Previous study has reported that salting process significantly increase fat content on boiled salted egg [13]. Salting process causes a reaction between Low Density Lipoprotein (LDL) which is the main fat content in the yolk with the salt solution. The fat content is released from LDL micelles to structural changes induced by dehydration and the high salt environment. Other study reported that the proportion of lipid in the yolk rose from 8.5 to 16.5% during salting up to 14 days [14].

Once the salting process take place, the proportions of moisture of egg white and yolk decrease gradually as a result of the loss of water from both components to the environment, mainly mediated by osmosis. As the salt in egg white accumulates, it encourages further migration from the yolk. Water move from egg yolk to egg white and finally to the outside through the eggshell, as influenced by pore sizes and structure of the shell [3]. Black pepper and white pepper contain of chemical piperine as a major bioactive component that has numerous reported physiological and therapeutics value. Previous study reported that black pepper may have health benefits on enhancing digestive tract function, inhibiting free radicals, affecting bacterial activity and enhancing immune response as anti-inflammatory action [15, 16].

3.2. Sensory assessment
Sensory assessment aims to determine participant perceptions toward salted duck egg with black pepper and white pepper attributes. However, the preference ranking test does not explain why a certain formulation is preferred over the others. In this regard, a rating test can be performed with the same subjects to verify which attribute is higher or lower in each formulation, and therefore a sensory optimization can be made [17].

3.2.1. Preferences of black pepper salted duck egg. The average of preferences level towards black pepper salted duck egg 7 days salting is presented in Figure 1. Parameters evaluation including level of liking for white egg color, yolk color, aroma, taste of saltiness, texture of grittiness and overall acceptance. The analysis of variance showed that in 7 days of curing, the overall perception of parameters was not significantly different. However, the average of aroma showed the significant differences among the samples, except control sample (L0) and 15% black pepper addition. The 15% black pepper showed the highest rank in terms of aroma, taste of saltiness and texture of grittiness. As
a result, the 15% black pepper of salted duck egg had the highest average for overall acceptance during salting for up to 7 days. Moreover, preference attributes acceptability of the salted duck egg added with 15% of black pepper had a score of 3.52 which indicates that the preference degree is in between neither like nor dislike and like.

Mean scores of preference attributes of black pepper salted duck egg which is cured for 10 days is presented in Figure 2. During the 10 days of salting, the overall liking of the sample’s attributes were not significantly different, ranged from 3.38 to 3.55. This value is in between neither like nor dislike and like indicates that the salted egg with addition of black pepper which are cured for 10 days are acceptable. However, the most preferred of those parameters occupied by 20% black pepper salted duck egg.

3.2.2. Preferences of white pepper salted duck egg. The level of preferences towards white pepper salted duck egg which is soaked for 7 days is presented in Figure 3. During 7 days of salting, the result of variance analysis showed a significant difference among the samples in terms of degree of liking of yolk color which ranged from 2.95 to 4.30. On the other hand, the mean of preference towards white egg color, aroma, saltiness and grittiness showed there was no significance different between control samples (P0) and treatment samples (P1, P2, and P3). The overall acceptability of all samples is in between 3.46-4.00 indicating participants accept those attributes in the category of neither like nor dislike and like. However, the highest score (4.00) of overall acceptance taken by the 20% white pepper salted duck egg for 7 days soaking time.

Based on the variance analysis, there was no significant differences among the samples of 10 days salting of salted duck egg in terms of yolk color, aroma, saltiness and grittiness. While, the mean of preference towards white egg color showed significant differences. The score of white egg color preference is in between 3.55 and 4.30. The salted duck egg with addition of 20% white pepper is the most preferred in terms of white egg color, taste of saltiness and texture of grittiness. The overall liking of samples ranged from 3.53 (P0) to 3.86 (P2). The highest mean of general acceptance of samples for 10 days salting was the salted duck egg added by 20% of white pepper (3.86) which is categorized in between neither like nor dislike and like.

Dehydration during salting process increases oil discharge, while the amount of oil coming out along with the formation of gritty texture on egg yolk. The egg yolk containing beads of salt bind to the lipoprotein thus it is damaged and the fat drive out. Other than amount of oil, the grittiness of the egg yolk is also affected by the strength of the gel from egg yolk and egg yolk granule diameter. The higher value of those three criteria, the higher the grittiness resulted [18].

![Figure 2](image-url)
Generally, the colour of fresh egg yolk is yellow, after the salting process turns to brownish yellow, dark brown, orange or bright yellow [13]. The formation of those colors is due to the egg yolk losing water content during soaking process in a salt solution. Salt concentration causes water content decrease and the color changing occurred [19]. Moreover, egg yolk color is influenced by carotenoid which reflects the color of yellow, orange or red. Carotenoid is a pigment with bioactivity as pro-vitamin A which can decrease the risk of cell degeneration, inhibit cancer cell growth and increase immune [20].
easily into the egg. Acid treatment of the duck egg resulted in the decrease of shell thickness with a subsequent increase in salt penetration and shorten the salting process time [3].

4. Conclusion
Black and white pepper addition might cause decreasing of fat content of salted duck egg along with the length of salting period. The addition of pepper did not cause a significant difference between control sample and treatment samples in case of sensory determination. For the black pepper salted duck, the most preferred was the 20% black pepper salted egg cured for 10 days. While the most preferred of white pepper salted duck, egg was the 20% white pepper salted egg soaked in 7 days.

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