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The evaluation of changes in organoleptic flavor of fermented egg whites at different levels and types of fruit ²

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Abstract. The addition of fruits with different levels in eggs is expected to improve the quality of fermented egg whites products. The egg whites fermentation process causes changes in the organoleptic flavor of the egg. The study aimed to evaluate changes in the organoleptic taste of fermented egg whites by the addition of different levels and types of fruit. This study was arranged according to a completely randomized design with a 4x5 factorial pattern. Factor A was the level of fruit (10, 20, 30 and 40%, respectively). Factor B was fruit type (melons, apples, mangoes, oranges and dragon fruit, respectively). The parameters measured were organoleptic flavors which included fruit flavors, egg flavors and acid flavors. The results showed that the addition of different levels of fruit had a significant effect ($P < 0.01$) on fruit flavor changes, but the types of fruit showed no significant effect. The addition of different types of fruit had a significant effect ($P < 0.05$) on changes in egg flavor. However, the level of fruit addition did not show any significant effect on changes in egg flavor. The addition of fruit types and levels did not show a significant effect on changes in acid flavor in fermented eggs. The addition of a level of 30% indicates a higher fruit flavor than other levels. The addition of fruit did not change the fruit and acid flavors. But it can reduce the flavors of eggs in fermented egg whites.

1. Introduction

Eggs naturally have functional properties that are good for health. Egg whites are rich in nutrients and bioactive compounds that have biological activities. Biological activities include anticancer, anti-hypertension, immunomodulator, antioxidant and protease inhibitors [1-3]. Eggs contain antioxidants naturally [4,5]. In addition, other egg functional properties are antimicrobial and can be used in the preservation and pharmaceutical industry [6,7]. Similarly, eggs also have functional properties for processing purposes [8,9].

In general, the use of eggs has been carried out, among others, as food, and as a basis for cake preparations. But its use is still limited because there are some people who cannot consume eggs properly. The content of ovomucin in egg white results in some people experiencing allergies, thereby avoiding egg consumption. In addition, high-fat content is also one of the considerations of limited egg consumption [9]. High-fat content in eggs causes fat oxidation which produces a rancid odor or better known as the peculiar odor of eggs [10]. The development of processed eggs is done aims to reduce the effects of allergies.



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Diversification of processed eggs for a wider range of uses. So that eggs can be generally accepted by the public.

The processing of egg whites with fermentation technology has been carried out [3,11]. However, the fermentation process in egg white results in a low level of product acceptance, especially in the quality of its organoleptic flavor. The addition of fruits including melons, apples, mangoes, oranges and dragon fruit with different levels is expected to improve the quality of good organoleptic flavor. The aim of the study was to evaluate changes in organoleptic taste in fermented eggs by adding different levels and types of fruit.

2. Study methods

This study was using equipment for sample preparation including sterilizers, analytical scales, incubators, autoclaves. Other equipment was a blender, mixer, measuring cup, sample bottle a 100 mL, spoilers a 10 mL and a 1 mL, gloves, and masks. The equipment to test the required sample was a 3 mL sample bottle, a test sheet and a panelist of 20 people. As for the research materials used were distilled water, alcohol, aluminum foil, egg whites, culture starter, full cream milk, types of fruits including melons, apples, mangoes, oranges, and dragon fruit.

This study was arranged a completely randomized design with a factorial pattern of 4 x 5. Factor A was fruit levels at 10, 20, 30 and 40%, respectively. Factor B was a type of fruit including melons, apples, mangoes, oranges and dragon fruit. Melons, apples, mangoes, oranges and dragon fruit. The parameters measured were organoleptic flavors which included fruit flavors, typical flavors of eggs and acid flavors.

2.1. Procedures of the study

2.1.1. Space preparation, equipment, and materials. Room sterilization was carried out using a mixture of formalin and KMnO₄ for 5 minutes. Sterilization using an autoclave on equipment made of stainless and glass. Equipment made of plastic or which cannot withstand heat was sterilized using PCR HOOD. Egg sterilization was done by the pasteurization method [12]. Eggs were washed using hot water at 70°C [13]. Then rinsed using 70% chlorine and alcohol solution [12]. Chicken eggs were broken, then the egg whites and yolk were separated in different places. Then 100 mL of egg whites were placed in a measuring cup and homogenized using a blender [14]. Homogeneous egg whites were added to milk powder and glucose by 2% [15-14]. The next step was the addition of fruit types and their levels according to the treatment of the study. Furthermore, the addition of a starter culture of 10 mL to the sample and fermented at 37°C for 12 hours [16].

2.1.2. Organoleptic testing procedure. The number of panelists in this study was 20 men and women. The panelist category was semi-trained. The criteria for panelists were 20-23 years old, physically and mentally healthy. Panelists consumed eggs without causing allergic effects. Panelists conducted an assessment by filling out the test sheet that has been prepared by the authors. Samples are placed in front of each panelist to be assessed according to predetermined criteria. The criteria being tested were the typical flavors of eggs, acid flavors and fruit flavors. Test instructions were using the sense of taste. The determination of value was done by using a structured line-scale [17].

3. Results and discussion

The addition of fruits to the egg white fermentation process resulted in changes in the organoleptic taste of egg products. These changes included fruit flavor, egg flavor and acid flavor.

2.1. Changes in fruit flavor in fermented egg whites that get additional levels and types of fruit

The results of the analysis of variance showed that the addition of different levels of fruit had a significant effect ($P < 0.01$) on changes in fruit flavor in fermented egg whites. However, the addition of fruits did not show any significant effect. Likewise, an interaction between the two factors to the changes in fruit flavor produced during the fermentation process was not found.

Table 1. Changes in fruit flavor in fermented egg whites

Level of fruit (%)	Type of fruit					Average
	Melons	Apples	Mangoes	Oranges	Dragon fruit	
10	2.67±0.58	3.00±0.00	3.00±0.00	3.00±0.00	2.67±0.50	2.87±0.35 ^a
20	2.67±0.57	3.00±0.00	3.00±0.00	3.00±0.00	3.00±0.00	2.93 ±0.26 ^a
30	3.00±0.00	3.67±0.58	3.00±0.00	3.67±0.58	3.00±0.00	3.27 ± 0.45 ^b
40	3.00±0.00	3.00±0.00	3.00±0.00	3.00±0.00	3.33±0.58	3.07± 0.26 ^{ab}
Average	2.83±0.39	3.17±0.39	3.00±0.00	3.17±0.39	3.00±0.43	3.03± 0.37

^{ab}Different superscripts in the same column show significant differences ($P < 0.01$)

Duncan's test results showed that the addition of significantly different fruit levels had increased changes in fruit flavor in fermented egg whites. The addition of fruit by 10% did not show any significant difference with the addition of fruit by 20% to changes in fruit flavor. The fruit flavor is more prominent at the addition of 30% fruit. This is likely due to the flavor of fruit in all types of fruit used in the fermentation process that works effectively at the addition of 30%. Each type of fruit has an active compound that characterizes fruit. The addition of 10% and 20% of fruit during the fermentation process has not shown changes in fruit flavor in fermented egg whites. But an increase of 30% can change from fruitlessness to fruitfulness. The addition of fruit at the 40% level did not show a difference of 30% on changes in fruit flavor.

Table 1 shows that the types of fruit added did not show changes in fruit flavor. The addition of melons (*Cucumis melo L.*), apples (*Malus sylvestris*), mangoes (*Mangifera indica*), oranges (*Citrus sinensis*), and dragon fruit (*Hylicereus polyrhizus*) did not contribute to changes in fruit flavor in fermented egg whites. But there is a tendency for the addition of melons to make changes in fruit flavor lower than other types of fruits.

Apples contain a lot of carotenes which can function as a source of vitamin A and antioxidants. Melons contain a lot of carbohydrates, protein, vitamin C and antioxidants. Melon fruit that had ripped has a lower vitamin C content so that the taste is sweeter. This is because there is a change in the structure of fructose sugar to sucrose. Sucrose gives a prominent sweet flavor. Dragon fruit is a fruit that contains a lot of betacyanin-type flavonoids, this can provide a special flavor of dragon fruit [18]. Besides dragon fruit also contains anthocyanin 8.8/100 g of fruit weight [19]. Mangoes contain vitamin C and beta-carotene and high potassium minerals. Mangoes that have a certain level of maturity give a sweeter flavor. Oranges contain carbohydrates, limonoids and carotenoids so the flavor tends to be sour - sweet. This shows that the active ingredient content of each fruit gives a characteristic to the flavor of the fruit.

3.2. Changes in the typical flavor of eggs in fermented egg whites that get the addition of different levels and types of fruit ² ⁶

The results of the analysis of variance showed that the addition of different types of fruit had a significant ² effect ($P < 0.05$) on changes in the flavor of the eggs produced in the egg white fermentation products. But the addition of fruit levels did not show any significant effect. Likewise, the interaction between the two factors to the change in the flavor of eggs was not found.

Table 2. Changes in typical egg flavors in fermented egg whites

Level of fruit (%)	Type of fruit					Average
	Melons	Apple	Mangoes	Oranges	Dragon fruit	
10	4.00±0.00 ^s	3.33±0.58	3.00±0.00	3.00±0.00	3.33±0.58	3.33±0.49
20	3.00±0.00	3.67±0.58	3.00±0.00	3.00±1.00	3.67±0.58	3.27±0.59
30	3.67±0.58	3.00±1.00	3.00±0.00	3.00±0.00	3.67±0.58	3.27±0.59
40	3.33±0.58	3.33±0.58	3.33±0.58	3.00±0.00	4.00±0.00	3.40±0.51
Average	3.50±0.52 ^{ac}	3.33±0.65 ^{abc}	3.08±0.29 ^{ab}	3.00±0.43 ^b	3.67±0.49 ^c	3.32± 0.54

^{ab}Different superscripts a, and b in the same lines show significant different ($P < 0.05$)

³ Duncan's test results showed that the addition of different types of fruit markedly increased changes in egg flavor. Fermented egg whites undergo a change from egg flavor to egg flavorless. Changes in the flavor of eggs according to differences in the types of fruits that are added to the egg whites fermentation process.

The addition of melons did not show any significant difference with the addition of apples, mangoes and dragon fruit. But it is significantly different from the addition of oranges fruits to changes in the flavor of eggs. The addition of dragon fruit is significantly different from the addition of mangoes and oranges in increasing the change in the flavor of a typical egg. Dragon fruit is a type of fruit that has high antioxidant content which includes beta-carotene and anthocyanin. In addition, other antioxidant contents are phenol, betacyanin and vitamin C of 8-9 mg/100 gr of material [20]. These antioxidant compounds can inhibit oxidation by binding to free radicals or reactive compounds so as to minimize damage due to the oxidation process [20].

The change from egg flavor to egg flavorless is probably caused by oxidative inhibition activity. The specific flavor or distinctive flavor of the egg may be caused by high protein content in the egg whites, or a high-fat content in the egg yolk. It is consistent with Nahariah and Hikmah [21] that, high protein content in egg whites is suspected as a cause of the fishy odor. Many fishy odors are avoided by consumers [21].

The special taste of these eggs can experience changes due to oxidation activity. Fat oxidation or protein oxidation can be inhibited by the presence of antioxidant compounds [22]. Food oxidation is the process of releasing the structure of a negatively charged O atom and will become stable when obtaining a pair of positively charged atoms [22-23]. The types of fruit used in this study are rich in positively charged compounds so that they are good as antioxidants. The addition of antioxidant-rich fruits to the egg whites fermentation process showed a decrease in the typical flavor of the egg in the egg whites. Adding the amount or level of melons, apples, mangoes, oranges and dragon fruit to the fermented egg whites does not contribute to changes in the flavor of the eggs. However, there is a tendency for the egg's flavor to change according to the increasing level of fruit used in the process. The addition of fruit results in the reduced flavor of eggs.

3.3. Changes in acid flavor in egg fermentation products that obtain ¹⁰the addition of different levels and ²types of fruit

The results of the analysis of variance showed that the addition of different levels and types of fruits did not significantly affected the change in acid taste in fermented egg whites. Likewise, neither of them showed a significant interaction with the changes of acid taste during the fermentation process.

Table 3. Changes in acid taste in fermented egg whites

Level of fruit (%)	Type of fruit					Average
	Melons	Apple	Mangoes	Oranges	Dragon fruit	
10	2.67±0.58	2.67±0.58	3.00±0.00	3.00±0.00	2.67±0.58	2.80±0.41
20	2.67±0.58	2.33±0.58	3.00±0.00	3.00±0.00	2.67±0.58	2.27±0.46
30	2.00±0.00	2.67±0.58	3.00±0.00	2.67±0.58	2.67±0.58	2.60 ± 0.51
40	3.00±0.00	2.33±0.58	3.00±0.00	2.33±0.58	3.00±0.00	2.73± 0.44
Average	2.58±0.52	2.50±0.52	3.00±0.00	2.75±0.45	2.75±0.45	2.72± 0.45

In general, products derived from fermentation will taste acidic. Acid products are metabolic products of microbial activity during the fermentation process [3, 24]. The success of the fermentation process is largely determined by the ability to grow bacteria in the growth media [25]. Bacteria especially the types of lactic acid bacteria (LAB) need carbohydrates, especially glucose as a source of energy in carrying out metabolic activities. Eggs, especially the whites, are foods that contain a low carbohydrate component [2]. The addition of fruits is expected to be a source of carbohydrates for lactic acid bacteria, but this study did not show a significant effect.

The need for lactic acid bacteria for energy is generally obtained from sugar, including lactose. The addition of fruit types including apples, melons, mangoes, oranges, and dragon fruit contains fructose sugar so that the acid production from the fermentation process is not significant. This is probably ¹because the LAB bacteria used have not been able to break down fructose type carbohydrates at 12 hours fermentation time. The ability of LAB bacteria to break down types of fructose sugar requires a longer fermentation time. Sugar is a source of energy for growth bacteria and their metabolism. Apples, mangoes, oranges and dragon fruit contain fructose carbohydrates. Older melons contain lots of carbohydrates so they are sweeter.

4. Conclusion

The addition of fruit did not change the flavor of fruit and acid flavor. However, it can reduce the distinctive flavor of the fermented egg whites produced. An additional rate of 30% indicated a higher fruit rate than other levels.

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