Characteristics of Physical, Chemicals and Organoleptic of Local Rabbit Meat Nuggets (Lepus nigricollis) Using Filler of Tofu Dregs Flour

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Abstract. Diversification of rabbit meat products into nuggets is one way to increase consumption of rabbit meat by the public. The filler used generally is wheat flour. However, these fillers can be substituted by tofu dregs which have better nutritional content. So it is expected that using filler of tofu dregs flour can improve the quality of rabbit nuggets. The study was conducted to investigate the doses of the use of tofu dregs filler to physical, chemical, and organoleptic properties of local rabbit meat nuggets in laboratory of Animal Husbandry Study Program, Faculty of Agriculture, Majalengka University. The best formulation of flour filler was applied to make rabbit nuggets. The experiment was arranged as a completely randomized design (CRD), consisted of 4 tofu dregs doses (0%, 35%, 70% and 100% of tofu gregs) which was repeated 5 times. Namwhile for chemical properties was done by descriptive analysis. The observed respond are include physical properties (pH and cooking loss of the nuggets), chemical properties (water content, ash content, protein content, and fat content), and organoleptic properties (colour, aroma, texture, and taste). The results showed that the addition of tofu dregs in rabbit nuggets has a significant effect on cooking losses, colour, and texture but does not affect the pH, aroma, and taste of rabbit meat nuggets. The use of tofu dregs in rabbit nugget has a significant effect on the physical quality of cooking losses but does not affect the pH value. The increasing of doses of tofu dregs tended to decrease the water and ash content and increase the fat and protein content. Moreover, the addition of tofu dregs affects the colour and texture but does not affect the aroma and taste of rabbit nuggets. The best dosage of tofu dregs filler for rabbit meat nugget was 70% and 30% of wheat flour. This finding concludes that tofu waste can be applied to making rabbit nuggets as much as 70% replacing wheat flour.
1. Introduction
Meat is one of the popular livestock commodities known as food to fulfill the needs of animal protein in human body. Meat can be processed into various types of interesting products with various shapes and flavours aiming at extending their shelf life and increasing economic value. One of the processed meat products is nugget. Processed meat products of rabbit meat are still rarely found in the market compared to chicken or beef. The lack of information about the benefits of rabbit meat is one of the reasons people do not consume rabbit meat. Therefore, rabbit meat which made into processed products, such as nuggets, can increase public interest in consuming them. In making nuggets, generally the binder used is flour, but some research results state that tofu dregs can be used as an alternative material to flour.

Tofu dregs is a by-product in the process of tofu-making which is obtained from filtering the soy milk. Tofu dregs still contains relatively high protein [1]. Besides protein, it also has other advantages such as containing fiber and can be bought at a low price. However, this food with a high nutritional value has not yet been widely used by the community. At present, tofu dregs is only used for making gembus (tempeh of tofu dregs) and animal feed, whereas it can be processed into flour and replace wheat flour as an ingredient for making various types of cakes [2].

Rabbit meat nugget with tofu dregs as filler is one of the efforts to increase the diversification of processed food products, especially processed meat products. In making nuggets, fillers are usually added in the form of flour. There are several types of flour often used in making nuggets, namely, wheat flour, rice flour, and cornstarch. Wheat flour is filler that works to improve texture, increases the water holding capacity, minimizes the shrinkage, increases product weight, and since the price is relatively low, it can reduce production costs [3]. The way to find out the quality of nuggets is to test their physical properties, chemical content, and organoleptic test.

This study aims to analyze the effect of the use of tofu dregs filler to the chemical characteristics of rabbit nuggets and create the best formulation of tofu dregs filler to make rabbit meat nuggets.

2. Material And Research Method
The research was carried out in the laboratory of the Faculty of Agriculture, Majalengka University and proximate analysis was carried out at the Nutrition and Animal Feed Laboratory of the Faculty of Animal Husbandry, Padjadjaran University, Bandung, from the 1st to the 12th April 2019. The rabbit meat used was 5 kg. The research was used a Completely Randomized Design (CRD), consisted of 4 treatments (P0 = 0% of tofu dregs) P1 = 35% of tofu dregs, P2 = 70% of tofu dregs, P3 = 100% of tofu dregs per 100 g rabbit meat) and provide with 5 replications.

The method of producing the rabbit nuggets include: tofu flour made by squeezing first, then dried and sifted, rabbit meat prepared in the form of fillets, then cut into pieces around 2-3 cm, and grind it. Rabbit meat plus flour, eggs, and water seasoning, then stirring using a food processor for 5 minutes. The dough was steamed for 15 minutes. Once cooked, the nuggets are allowed to stand until they cool. The dough was then cut about 2-3 cm then smeared with egg whites and bread flour, then fry for 2-3 minutes, until the color was light yellow. Rabbit nuggets are ready for physical, chemical and organoleptic properties.

The observed variables were physical properties (pH and cooking loss of the nuggets), chemical properties (water content, ash content, protein content, and fat content), and organoleptic properties (color, aroma, texture, and taste).

Data obtained from the test results of chemical and physical characteristics were then analyzed using various analysis (ANOVA), with a significance level of 5%. If there was any significant effect of treatment then it was followed by Duncan’s Multiple Range Test to determine the differences among the treatments to determine differences between treatments [4]. Sensory test data were analyzed by non-parametric analysis through hedonic Kruskal-Wallis test [5].

3. Result And Discussion
3.1. Physical Properties of Rabbit Meat Nuggets
The studied results of physical properties of rabbit nuggets (pH and cooking losses) based on the level of addition of tofu dregs is presented in Table 1.

Data in Table 1 showed that the substitution of tofu dregs to the use of wheat flour was not significantly different from the pH of rabbit meat nuggets. The lowest value was 7.08 at P2 treatment and the highest is at P0 and P3 with a value of 7.16.

| Treatment | The Average pH | The Average Cooking Losses (%) |
|-----------|----------------|-------------------------------|
| P0        | 7.16<sup>a</sup> | 8.8<sup>a</sup>              |
| P1        | 7.14<sup>a</sup> | 8.7<sup>ab</sup>             |
| P2        | 7.08<sup>a</sup> | 8.5<sup>bc</sup>             |
| P3        | 7.16<sup>a</sup> | 8.4<sup>c</sup>              |

Description: The value followed by the same letter within the column not different significantly (P>0.05).

The pH value of rabbit meat nuggets using tofu dregs still shows a normal value of 7.08 - 7.16. This is in accordance with the opinion that the range of pH values during the gelatinization process reaches the optimum pH for gel formation of 6.5 - 7.5 [6]. While the results of cooking losses test for rabbit nuggets based on Table 1 are significantly different by the substitution of tofu dregs. The lowest value is at P3 treatment with a value of 8.4 and the highest value is at P0 with a value of 8.8.

Rabbit nuggets substituted with tofu dregs had the better cooking losses value along with the addition of tofu dregs flour dosage. This is in line with the opinion that meat with lower cooking losses has relatively better quality than meat with greater cooking losses since there will be less of nutrients lost during the cooking [7]. This is because tofu dregs flour has binding properties of nugget dough. The high cooking losses will decrease the nutrient content in the nuggets so that the higher cooking losses will produce low-quality nuggets [8].

3.2. Chemical Content of Rabbit Meat Nuggets

The study results of chemical content of rabbit meat nuggets (water, ash, protein, and fat) based on the level of addition of tofu dregs are presented in Table 2.

| Treatment | Water Content (%) | Ash Content (%) | Protein Content (%) | Fat Content (%) |
|-----------|-------------------|-----------------|---------------------|----------------|
| P0        | 70.38             | 2.94            | 10.91               | 6.24           |
| P1        | 69.55             | 2.77            | 12.07               | 7.00           |
| P2        | 69.11             | 3.12            | 13.67               | 7.47           |
| P3        | 64.14             | 3.09            | 16.15               | 7.82           |

The water content of rabbit nuggets tends to decrease with the addition of tofu dregs. The highest water content was in the P0 treatment, while the lowest was in the P3 by 70.38% and 64.14% respectively. The decrease in water content is influenced by the high protein content of rabbit meat and tofu dregs. This is in accordance with the opinion that decreasing water content correlates with nugget protein levels [8]. Meat protein plays a role in binding water in meat. High levels of meat
protein cause the increased-ability to hold meat water thereby reducing free water content and vice versa.

The water content of nugget in this research was higher than that in chicken nugget of standard of SNI (Indonesian National Standard). According to BSN (National Standardization Agency of Indonesia), the maximum water content in chicken nugget is 60% (% BB/wet basis moisture content) [9]. Increased water content was influenced by the binder serves to bind water in the dough, in which one of the binders in making this nugget is tofu dregs. The high water content will be directly proportional to the quality of water-binding capacity of the nuggets. This is in accordance with the opinion that high water content can be used as an indication of good water binding capacity [7]. The main reason for high water content in rabbit nuggets is that the water content in raw rabbit meat is 70% [10].

Ash levels in rabbit nuggets tend to decrease with the addition of tofu dregs. This was influenced by several things, one of which is flour. In addition, decreased ash content has a negative correlation to the fat content. The increase in fat content will be followed by a decrease in ash content [11]. Ash content is influenced by chemical composition such as water content, fat, protein, crude fibre, carbohydrates, and other ingredients [3]. Rabbit meat nuggets in this study had ash content ranging from 2.77% to 3.12%. This ash content was lower than the level of rabbit nugget ash produced by [3], which is 6.39% to 5.38%. The low ash content of this rabbit nugget was caused by the low ash content of tofu dregs and rabbit meat.

Protein levels in rabbit nuggets tend to increase along with the addition of tofu dregs. The highest protein content was in the P3 treatment, while the lowest ash content was in the P0 treatment respectively by 16.15% and 10.91%. The protein content of rabbit nuggets in study was higher than the SNI standard for chicken nuggets. The minimum protein content based on chicken nugget is 12% (% BB) [9]. Increased protein levels are influenced by tofu dregs in nugget-making. Tofu dregs have high protein content. Mixing tofu dregs flour has an effect in increasing levels of protein, fat, ash, carbohydrates, and crude fibre [12].

In addition, the use of rabbit meat as the main ingredient in nugget-making also influences the increased protein content. Rabbit meat has protein content of 20.8% [13]. The fat level of rabbit nuggets tends to increase with the addition of tofu dregs. The highest fat content is in the P3 treatment, while the lowest is in the P0 treatment with content of 7.82% and 6.24%, respectively. The increased fat content was influenced by the addition of tofu dregs in the ingredients of rabbit nugget production. Mixing tofu dregs flour has an effect in increasing levels of protein, fat, ash, carbohydrates, and crude fibre [12]. The fibre has the property of absorbing fat and binding to positively charged amino groups so that it can absorb fats and cholesterol that are in general negatively charged [14]. In addition, the decreasing water content in nuggets also correlates with fat content. Ketaren (1986) states the decrease in water content occurs because the heat is channelled through steaming which results in evaporating the water contained in the material [15]. This shows that water content is negatively correlated with fat content in accordance with the opinion of [16]. Moreover, the fat content of rabbit nuggets in this study was lower than the SNI standard for chicken nuggets. The maximum fat content based on chicken nuggets is 20% (% BB) [9].

3.3. Organoleptic Properties of Rabbit Nuggets

The results of organoleptic study of rabbit nuggets (color, aroma, texture, and taste) based on the level of addition of tofu dregs are presented in Table 3.

The hedonic test of organoleptic properties of rabbit nugget colors using tofu dregs showed a significant difference (Table 3). The average value of panellist hedonic test on the color of nugget is between 3.37 to 3.80 (somewhat likes). The color of nuggets in the treatment without tofu dregs was significantly different along with the addition of tofu dregs flour percentage of 35% and 70% and significantly different from the treatment of 100% percentage of tofu dregs. It means that panelists prefer the nugget to be golden yellow to the pale one because the increasing percentage of tofu dregs will put more of yellow color to the nugget. Tofu dregs that contain high protein content cause a
browning reaction (Maillard reaction) during frying. The Maillard reaction is a complex reaction involving reducing sugars and amino group of proteins during frying, producing a new brown compound of melanoidins [17].

### Table 3. The Average Hedonic Value of Color, Aroma, Texture and Taste of Rabbit Nuggets

| Treatment | Color  | Aroma  | Texture | Taste  |
|-----------|--------|--------|---------|--------|
| P0        | 3.36\(^a\) | 3.4\(^a\) | 3.4\(^a\) | 3.4\(^a\) |
| P1        | 3.63\(^ab\) | 3.5\(^a\) | 3.7\(^ab\) | 3.5\(^a\) |
| P2        | 3.63\(^ab\) | 3.8\(^a\) | 3.8\(^b\) | 3.6\(^a\) |
| P3        | 3.80\(^b\) | 3.7\(^a\) | 3.6\(^ab\) | 3.5\(^a\) |

Description: The value followed by the same letter a column not different significantly (P>0.05)

The analysis of variance results based on Table 3 showed that the use of tofu dregs in rabbit nuggets had no significant effect on the nuggets aroma. The panelist hedonic average value to nugget aroma ranged from 3.4 to 3.8 (rather like). Panelists mostly liked the aroma of nuggets that were given 70% of tofu dregs. In accordance with the opinion that the fresh tofu dregs used in the nugget-making is squeezed and steamed first so that the nugget flavour given tofu dregs flour up to 70% can still be accepted by panellists [18]. There was a tendency for panelists' preference level to decrease with the increasing percentage of tofu dregs. It occurs because the distinctive aroma of rabbit meat nuggets decreases with the increasing percentage of tofu dregs.

The use of tofu dregs in rabbit nuggets has a real influence on the texture of nuggets. The panelist hedonic value of nugget texture ranges from 3.4 to 3.7 (rather like). Panelists liked the texture of nugget of P2 treatment, that is, the one treated with 70% of tofu dregs. This indicates that the percentage of different levels of tofu dregs affect the texture of resulting nuggets. The higher the percentage of tofu dregs, the panelists' rating tends to decrease because the texture of the nuggets is getting denser. In addition, the use of tofu dregs flour composite influences the texture of Langues de Chat/cat's tongue cookies [19]. This is because tofu dregs contain high fibre of 3.23%, while wheat flour only contains 0.4 to 0.5% fibre. The nature of fibre that is easy to absorb the liquid is inversely proportional to the nature of the flour which is very low in absorbing water which causes the cake to be denser.

The use of tofu dregs in rabbit nuggets has no significant effect on the taste of nuggets. The lowest value was at P0 treatment with a value of 3.4 and the highest value is at P2 treatment with a value of 3.6. The taste of rabbit nuggets of tofu dregs flour is still preferred by panelists but they more likely prefer the taste of P2 treatment nuggets, that is the one with the addition of 70% tofu dregs flour. This is in accordance with the opinion that the addition of tofu dregs flour substitution by 50% in nugget-making still can be accepted by panelists (with a level of like)[18].

### 4. Conclusion

Based on the results of this study, it can be concluded that the use of tofu dregs in rabbit meat nuggets had a significant effect on the physical quality of cooking losses but did not affect the pH value. The more additional doses of tofu dregs flour, the water and ash content tends to decrease, while the fat and protein content tends to increase. Furthermore, the addition of tofu dregs affects the color and texture but does not affect the aroma and taste of rabbit nuggets. The best dosage of tofu dregs to be applied as filler for rabbit nugget is 70% and 30% of wheat flour. This finding concludes that tofu waste can be applied to making rabbit nuggets as much as 70% replacing wheat flour.

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