

Physical and Sensory Quality of Nuggets from Spent Laying Hens Using Durian Seed Flour (*Durio Zibethinus* Murr)

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ABSTRACT

This study aims to determine the effect of adding durian seed flour on the physical and sensory quality of spent laying hen nuggets. The design used in this study was a completely randomized design with 5 treatments and 4 replicates. The treatments given were the addition of durian seed flour with the following formulations: P0 = nugget mixture + 0% durian seed flour, P1 = nugget mixture + 5% durian seed flour, P2 = nugget mixture + 10% durian seed flour, P3 = nugget mixture + 15% durian seed flour, P4 = nugget mixture + 20% durian seed flour. The parameters measured were physical quality (water binding capacity and cooking shrinkage) and sensory quality (color, aroma, and taste). The tabulated data were then analyzed using analysis of variance, and if there were differences between treatments, Duncan's test was used. The results of the analysis of variance showed that the addition of durian seed flour had a significant effect ($P < 0.05$) on the physical quality of water binding capacity, cooking loss, and sensory color, aroma, and taste of spent laying hen meat nuggets. Conclusion: Adding up to 20% durian seed flour can improve the physical and sensory quality of spent laying hen meat nuggets, making them more palatable.

INTRODUCTION

Chicken nuggets are a popular fast food product due to their convenience, especially among urban communities who have limited time. They are easily available and have a taste that appeals to a wide range of people. The high demand for this product presents challenges in terms of production costs and raw material sustainability, making the use of spent laying hens a potential innovative solution in nugget production. Nutritious, tasty nuggets with excellent texture will not be accepted by consumers if their color deviates from what it should be (Ratulangi et al, 2017).

Durian seeds, which are generally considered waste, contain starch that can be used as a filler to improve the texture and elasticity of products. According to Rofaida (2008), converting durian seeds into flour will facilitate the use of durian seeds as a flexible semi-finished material, because in addition to having a long shelf life, it can also be used to diversify food processing.

Durian seed flour has significant potential as an additive in improving the nutritional quality and sensory characteristics of nuggets. Durian seed flour is known to contain dietary fiber and starch compounds that have the ability to bind water and fat, as well as help improve dough structure. Durian seed flour is flour derived from durian seeds through a process of sorting, washing, peeling, soaking, slicing, drying, roasting, milling, and storage. Durian seed flour can improve the physical characteristics of processed meat products and enrich their fiber and mineral content (Mayna *et al*, 2021).

The use of spent laying hens and the addition of durian seed flour to the physical quality of chicken nuggets can be understood by looking at the basic characteristics of both ingredients. Spent laying hens generally have a tougher meat texture and coarser fibers than broiler chickens because they are older and have higher physical activity during the egg production period.

The addition of durian seed flour can improve the texture of nuggets, making them denser and chewier, as well as improving their physical appearance. Durian seed flour also affects sensory aspects such as taste, aroma, and texture. Although it has a neutral taste that tends to be slightly bitter, at certain concentrations, this flour does not interfere with the basic flavor of the nuggets and can even give them a unique flavor that is different from conventional nuggets. The addition of flour also makes the surface of the nuggets look smoother and the color more even after frying, which can enhance the visual appeal of the product. The aroma of nuggets made from spent laying hens is sometimes stronger and less desirable if not combined with the right additives. Durian seed flour can also help balance the aroma, as the fiber and starch in durian seed flour absorb some of the distinctive smell of old meat. In terms of taste, although the meat of spent laying hens has a strong flavor, if it is not balanced with the right ingredients, it can leave an unpleasant aftertaste. This can be mitigated with durian seed flour, which gives a cleaner and lighter flavor.

Overall, the relationship between the use of spent laying hens and the addition of durian seed flour shows potential synergy in producing chicken nuggets that are not only physically acceptable but also sensorially acceptable to consumers. The use of these two ingredients also reflects a sustainable approach

in the food industry, by maximizing the potential of local ingredients that have been underutilized. The innovative use of durian seed flour in chicken nuggets not only improves production cost efficiency, but also supports the concept of zero waste in the food industry. Diversification with this plant-based ingredient offers dual advantages: optimized nutritional value and increased consumer preference for processed meat products.

THEORETICAL REVIEW

The utilization of spent laying hens as raw material for processed meat products has gained increasing attention due to their lower commercial value and tougher meat texture, which requires appropriate modification to improve product acceptability. Previous studies show that incorporating plant-based binders or extenders can enhance the physical characteristics of meat products by improving water-holding capacity, texture, and yield. Durian seed flour, derived from *Durio zibethinus* Murr., has been reported to contain significant amounts of starch, dietary fiber, and polysaccharides that function effectively as natural binders. Its application in processed foods has been shown to enhance gel formation, reduce cooking loss, and improve structural stability. In nugget formulations, the use of such flour may contribute to better cohesiveness, juiciness, and texture while potentially influencing sensory attributes such as flavor, color, and overall acceptability. Studies on alternative flours similarly demonstrate that partial substitution of conventional binders can improve product quality while reducing production costs. Therefore, incorporating durian seed flour into nuggets made from spent laying hens offers a promising strategy to optimize both physical and sensory properties, supporting sustainable utilization of poultry by-products.

METHODOLOGY

Materials and Tools

The ingredients used are 2,500 g of chicken breast and thigh meat, 500 g of durian seed flour, 300 g of tapioca flour, 20 g of coconut oil, ice cubes 185 g, powdered milk 130 g, egg yolks 200 g, breadcrumbs 500 g, garlic 110 g, seasoning 10 g.

The tools used in this study were a blender, frying pan, cutting board, stove, knife, plastic container, handskun, aluminum oil tray, water bath, spoon, meat grinder, cooper, oven, toothpick, paper plate, 41.2 flat glass, and 35 kg weight.

Research Design

The experimental design used in this study was a completely randomized design (CRD) with 5 treatments and 4 replicates (Steel and Torrie, 1995), and for sensory testing, 30 panelists were used as replicates (Masyitah and Asyura, 2025). The treatments used were as follows: P_0 = Nugget dough + 0% durian seed flour; P_1 = Nugget dough + 5% durian seed flour; P_2 = Nugget dough + 10% durian seed flour; P_3 = Nugget dough + 15% durian seed flour; P_4 = Nugget dough + 20% durian seed flour.

The Process of Making Durian Seed Flour

The production of durian seed flour begins with cleaning the durian seeds of any remaining fruit flesh, then boiling them for 30–60 minutes to remove the sap and reduce the odor. After boiling, the seeds are peeled and cut into small pieces so that they are easy to dry. The drying process is carried out by sun drying or using an oven until the water content is significantly reduced. Once dry, the seeds are ground into a fine powder, then sifted to obtain a smoother flour. The resulting durian seed flour can be stored in an airtight container to maintain its quality. The process of making durian seed flour can be seen in Figure 1.

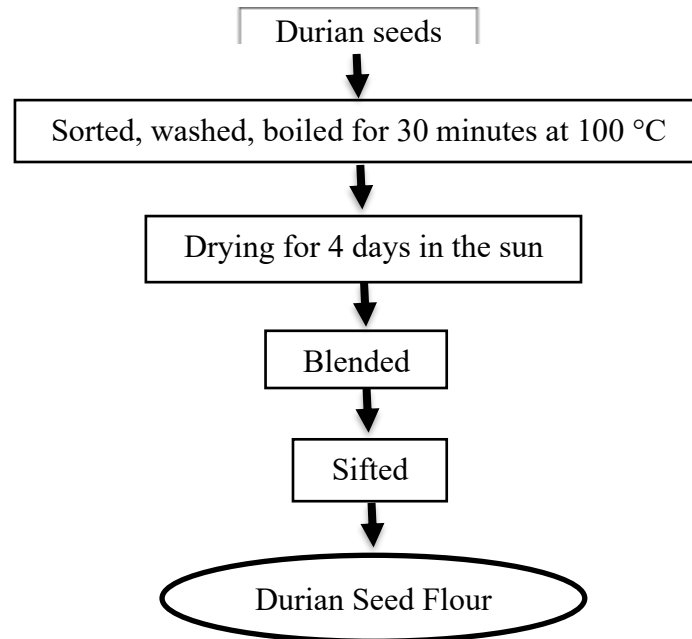


Figure 1. Flow chart Making Durian Seed Flour

The Process of Making Chicken Nuggets

The process of making chicken nuggets begins with cleaning the chicken meat to ensure the cleanliness and safety of the raw materials. The cleaned meat is then ground and mixed with durian seed flour at concentrations of 5%, 10%, 15%, and 20%. This mixture is added to other ingredients such as wheat flour, eggs, and seasonings (salt, pepper, and garlic), then stirred until evenly mixed into a dough. The dough is molded and cut into 1x4 cm pieces, then steamed at 80 °C for 30 minutes. After steaming, the nuggets are cooled, coated with egg and breadcrumbs, then fried at 170 °C for 5 minutes until cooked and golden brown. The chicken nugget production process can be seen in Figure 2.

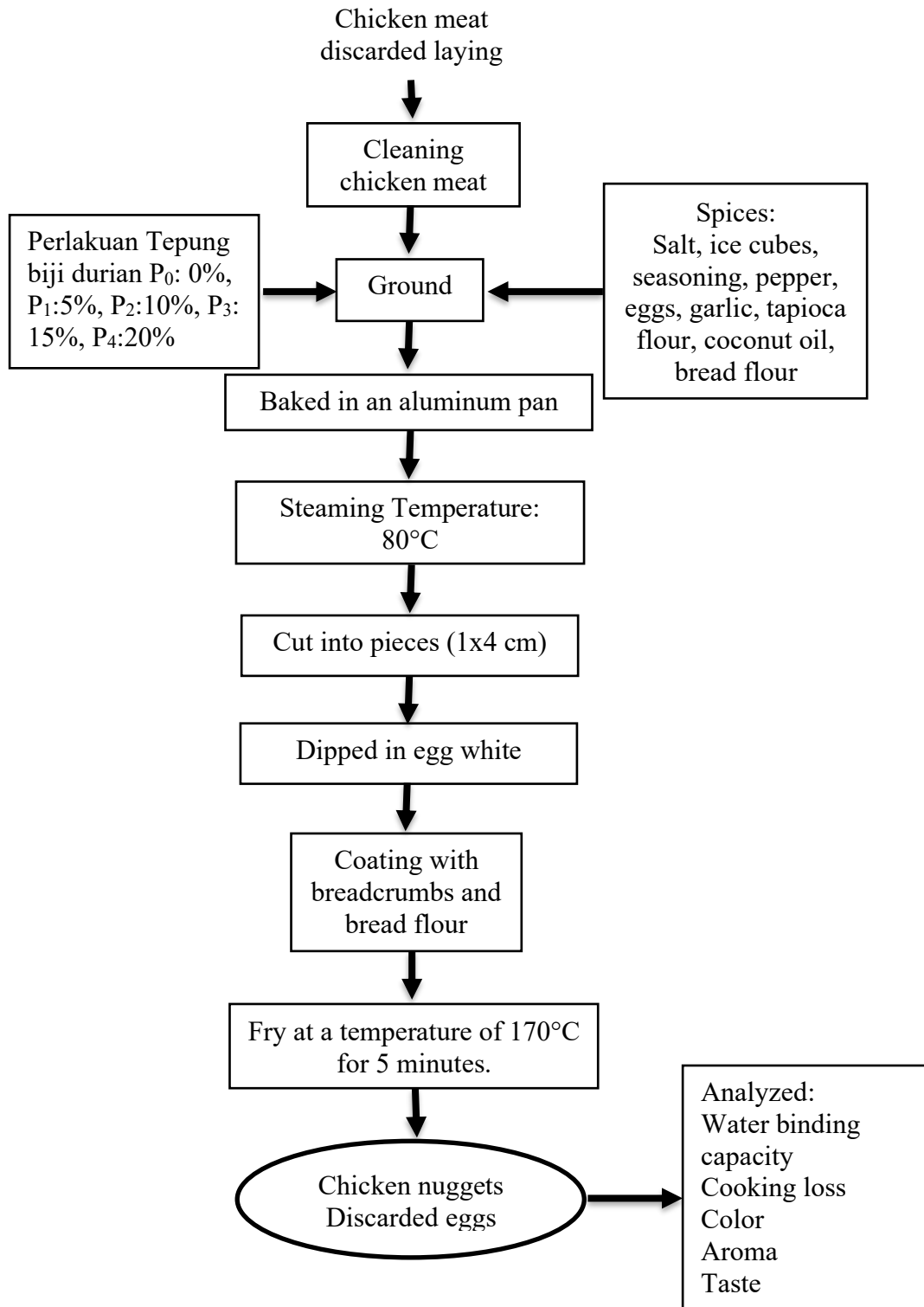


Figure 2. Flow chart of nugget production

Research Variables

The variables observed in this study were physical quality, consisting of water binding capacity and cooking shrinkage, and sensory quality, consisting of color, aroma, and taste.

Data Analysis Model

The data obtained from the study was analyzed using Analysis of Variance (ANOVA), and the results of the analysis showed differences, which were then followed up with Duncan's test.

RESULTS AND DISCUSSION

The data on the effects of adding durian seed flour on the water binding capacity and cooking shrinkage of spent laying hen nuggets can be seen in Table 1.

Table 1. Average effect of adding durian seed flour on water binding capacity, cooking shrinkage, color, aroma, and taste of chicken nuggets made from spent laying hens

Variabels	Treatments				
	P ₀	P ₁	P ₂	P ₃	P ₄
Water binding capacity	20,55 ^a	21,28 ^a	27,20 ^b	37,80 ^c	44,30 ^d
Cooking loss	13,46 ^a	13,25 ^a	7,02 ^b	6,97 ^b	1,83 ^c
Color	3,97 ^{ab}	3,73 ^{bc}	3,63 ^{ab}	3,53 ^a	3,40 ^c
Aroma	3,96 ^{bc}	3,70 ^{abc}	3,63 ^a	3,60 ^{ab}	3,43 ^c
Taste	3,36 ^{ab}	3,53 ^{bc}	3,60 ^{ab}	3,73 ^a	4,00 ^c

Note: Different superscripts on the same line indicate significant differences ($P < 0.05$).

Water Binding Capacity of Laying Hen Nuggets

The data in Table 1 shows that the water-binding capacity of spent laying hen nuggets with the addition of durian seed flour had the highest average in treatment P₄ at 44.30%. In terms of water binding capacity, there was an increase in value along with the increase in the concentration of durian seed flour used. Starting from treatment (P₀) with a WBC value of 20.55%, there was an increase in each addition of durian seed flour concentration until it reached the highest value in treatment (P₄) of 44.30% at a concentration of 20%.

The results of the analysis of variance of discarded laying hen nuggets with the addition of durian seed flour showed a significant difference ($P < 0.05$). The results of Duncan's multiple range test showed that treatment P₀ had no significant effect on P₁, while P₁ had a significant effect on P₂, P₃, and P₄, and P₂ had a significant effect on P₃ and P₄, while P₃ had a significant effect on P₄. This indicates that durian seed flour has a good ability to increase water binding capacity in spent laying hen nugget products due to the starch content in durian seed flour. According to Mawati *et al*, 2017, fillers function as emulsion stabilizers, increase water binding capacity, reduce shrinkage, and lower costs. Nurjaya *et al*, (2023) in Kholidah *et al*, (2023) state that if water binding capacity is high, the viscosity of the gel formed can increase the elasticity of the product, thereby affecting the softness of the product.

Cooking Loss of Spent Laying Hens

The data in Table 1 shows that the cooking loss parameter is inversely proportional to water binding capacity. The higher the concentration of durian seed flour added, the lower the cooking shrinkage value. The value in treatment

(P₀) was 13.46% at a concentration of 5%, gradually decreasing to a minimum value (P₄) of 1.83% at a concentration of 20%.

The results of the analysis of variance of the addition of durian seed flour to spent laying hen nuggets showed a significant difference ($P < 0.05$). Furthermore, based on the results of Duncan's multiple range test, the addition of durian seed flour in treatment P₄ had a significant effect on P₃, P₂, P₁, and P₀, while P₃ had no significant effect on P₂, and P₂ had a significant effect on P₁ and P₀, and P₀ was not significantly different from P₁. The results of the study indicate a decrease in the cooking shrinkage value of spent laying hen nuggets influenced by variations in the concentration of durian seed flour added, with treatment ranges from P₀ (5%) to P₄ (20%). This phenomenon of reduced cooking shrinkage indicates that durian seed flour has a significant capacity to retain the moisture content of the product during the cooking process. This can be attributed to the ability of durian seed flour to act as an effective binding agent in the nugget product matrix. The characteristics of durian seed flour, which is rich in starch and fiber, enable it to form a strong gel matrix, thereby minimizing water loss during the cooking process. This is in line with Soeparno (2007) opinion that meat with lower cooking shrinkage has relatively better quality than meat with higher cooking shrinkage, because there is less loss of nutrients during cooking. The higher the amylose content, the lower the starch's ability to expand and the lower the gel strength (Mayna *et al*, 2021). Low cooking shrinkage has better quality than high cooking shrinkage. This is because there is less nutrient loss during the cooking process (Komariah, 2009 in Meitta *et al*, 2013)).

Color of Spent Laying Hen Nuggets

The data in Table 1 shows that the highest average score for the color of spent laying hen nuggets was found in treatment P₀ at 3.97 (like) and the lowest average score was found in treatment P₄ at 3.40 (kind of like). These observations indicate that the higher the addition of durian seed flour, the more the panelists liked the color of the spent laying hen nuggets.

The results of the analysis of variance of chicken nuggets with the addition of durian seed flour showed a significant difference ($P < 0.05$) in the color test of spent laying hen chicken nuggets. Furthermore, the results of Duncan's multiple range test showed that treatments P₀, P₁, P₂, and P₃ had no effect, while P₁ had a significant effect on P₃, and P₄ had no significant effect on P₁ but had a significant effect on P₀, P₂, and P₃. The results of research on sensory quality with color indicators show that chicken nuggets have a significant effect. This is thought to be due to differences in the durian seed flour added to the chicken nuggets. Higher concentrations or increases in the amount of durian seed flour added cause the chicken nuggets to turn brown. Myoglobin can oxidize at temperatures of 80-85 °C, forming metmyoglobin, which causes the brown color (Soeparno, 2007 in Mursali and Yusuf, 2021). Color is one of the factors that determines quality. Visually, color is the first thing we see and is sometimes very decisive, so color is an important attribute in food products (Winarno, 2002; Lawless and Heymann, 2010).

Aroma of Spent Laying Hen Nuggets

The data in Table 1 shows that the highest average value for the aroma parameter occurred in treatment P₄, with a decrease in value from 3.43 (kind of like) to 3.96 (like) in treatment P₀. This shows that the more durian seed flour is added, the less the panelists like the aroma. The results of the analysis of variance of chicken nuggets with the addition of durian seed flour showed a significant difference ($P < 0.05$) in the aroma of the nuggets. The results of Duncan's multiple range test showed that P₀ had no significant effect on P₁, and P₁ had no significant effect on P₂ and P₃, while P₂, P₃, and P₄ showed significant differences. There was a significant difference between P₄ and P₁, P₂, and P₃. This suggests that the higher the concentration of durian seed flour added, the lower the aroma value of the chicken nuggets produced. According to Lawless and Heymann, (2010), the average value tends to decrease as the amount of durian seed flour added increases. However, the aroma of durian seed flour is not too dominant, so the characteristic smell of chicken nuggets is maintained. The aroma detected in chicken nuggets comes from volatile compounds contained in chicken meat and the combination of spices used. Sinta *et al.* (2019) state that aroma is an important quality attribute to consider in the organoleptic evaluation of food ingredients, as aroma is a factor that greatly influences consumer acceptance of a product. Aroma is a quality attribute that quickly makes an impression on consumers.

The Taste of Spent Laying Hen Nuggets

The data in Table 1 shows that the average taste score for chicken nuggets ranges from 3.36 (kind of like) to 4.00 (like). Based on the analysis of variance of chicken nuggets with the addition of different durian seed flours, there is a significant difference ($P < 0.05$) in the taste of chicken nuggets made from spent laying hens. The results of the Duncan's multiple range test show that the taste of P₀ spent laying hen chicken nuggets has no significant effect on P₁, P₂, and P₃, while P₃ has a significant effect on P₁ and P₄ has no significant effect on P₁ but has a significant effect on P₀, P₂, and P₃.

The results of the study on the flavor indicators of spent laying hen nuggets showed a significant effect due to the difference in durian seed flour added to the spent laying hen nuggets. The higher the concentration or increase in durian seed flour added, the more preferred it was by the panelists. This is in line with Rofaida (2008) research, which states that the flavor of food ingredients can come from the food ingredients themselves, but when treated, the flavor can be influenced by the added ingredients. Ageng *et al.*, (2017) stated that the savory flavor in nuggets is determined by the presence of glutamic acid, an amino acid in protein that has the ability to enhance flavor.

CONCLUSIONS AND RECOMMENDATIONS

Adding up to 20% durian seed flour can maintain the physical and sensory quality of chicken nuggets made from spent laying hens.

FURTHER STUDY

Further research is recommended to explore the broader functional potential of durian seed flour in processed meat products. Future studies may

investigate the nutritional enhancement, shelf-life stability, and microbial safety of chicken nuggets formulated with higher or varied concentrations of durian seed flour.

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