Physical characteristics of quail (Coturnix coturnix) meat given hydrolyzed feather meal from broiler at different levels

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Abstract. The quail (Coturnix-coturnix) is a type of bird that has recently been widely cultivated. One factor that can affect the physical quality of quail meat is feeding. The need for food ingredients for protein sources is necessary to meet the protein needs in the quail. Hydrolyzed feather of broiler chicken meals is a feed material that has a high protein content, but low potency digestibility. It is expected that the hydrolysis process improves the digestibility in feather meal. The level of digestibility of the ingredients will affect the rate of metabolism of nutrients (proteins) in the body of the quail. The metabolic process of the protein compounds also has the potential to influence the characteristics of quail meat. The purpose of this study was to evaluate the characteristics of quail meat by eating broiler feathers resulting from the hydrolysis process of feed at different levels. This study used 100 heads quail one week old, body weight range 140-180g, (unsex). The study was designed using a completely randomized design (CRD) unidirectional a 4 x 5 pattern. A total of four types of feeding treatment has been applied in this study, namely: (T0 = 0%, T 1 = 1%, T 2 =1.5 and T 3 = 2%). Each treatment was repeated five times. The number of treatment units was a 4 x 5 = 20 treatment units. Each treatment unit used five head quails as samples. The observation process was carried out for 30 days. On the 30th, the slaughtering process was carried out and then the meat quality test was continued. The test samples of the quality of the meat were obtained from the chest muscular (Pectoralis superficialis). Observations of parameters include: (1) the water holding capacity (WHC), (2) cooking loss (CL) and (3) meat shear force (MSF). The data obtained were analyzed statistically using ANOVA. The results of the research data show significant effect and then Duncan's test. The results showed that the treatment of the feather meal hydrolyzed at different levels significantly (p<0.05) in the WHC, CL, and MSF. The WHC value of breast meat (Pectoralis superficialis) in the range of 32.42± 6.24-49.48±11.63%, CL (3.05±2.00-22.30±14.26%) and MSF (0.56±0.26-0.99±0.10 kg/cm²). The use of feeds from the broiler meal at 1.5% (T 2) level shows the characteristics of quail meat better than other treatments.

1. Introduction
Quail (Coturnix coturnix) is one type of poultry that is very popular in Indonesia. Quail is a type of bird that cannot fly, has a relatively small body size and is also short-legged. Quail is included in the various types of domesticated cattle which were originally wild and subsequently adapted into animals that can be farmed. Quail is one type of poultry that can produce meat and eggs. Based on statistical data, the number of quail populations in Indonesia currently reaches 14,427,000 head [1]. Quail
development is not only in developing countries like in Indonesia but also in other large countries. Countries in Europe and Latin America today have given great attention to this livestock because of the increased need for consumption of meat and processed products (eggs and meatballs) [2, 3, 4].

As much as 60% of the total cost requirement in a quail farming industry comes from the feed. The type of feed ingredients was used affect the performance of livestock, especially protein source feed ingredients. Quail has a better ability to utilize nutrient feed which is under 70% [5]. Protein digestibility has differences between ingredients used in a composition of feed. This depends on the process of gastric and pancreatic secretions to degrade proteins in the digestive tract of the poultry [6]. Improved growth performance occurs due to the addition of exogenous proteases. However, this does not affect the feed intake much. This is likely to be influenced by energy digestibility and amino acids [7].

Protein feed ingredients can be obtained from plants and processed by-products of livestock. One type of by-product of livestock that is processed as a source of protein is feather. The problem is that feathers have high protein content but their digestibility is very low. The quality and digestibility level of the feed consumed affects the quality of the meat. This is related to the level of absorption of food substances in the body of livestock. Information related to the effect of giving hydrolyzed feather meal on the quality of meat in quail has not been widely reported. Protein content in quail blood has the same concentration and is not affected by partial changes in protein in feed [8]. The purpose of this study was to evaluate the physical properties of quail (Coturnix coturnix) meat given hydrolyzed feather meal from broilers at different levels.

2. Materials and Methods

2.1. Materials

The main material in this study was used local quail (Coturnix coturnix), obtained from the quail livestock, Gowa regency, South Sulawesi Province. This study was used 100 heads of quails, one week old, weights of 30-36g. Quail feed was prepared according to an isoprotein formula consisting of ingredients such as feather meal concentrate, corn, rice bran, coconut grout, fish meal, soybean meal, and mineral mix. Feather meal concentrate was produced by the Animal By-products Processing Technology Laboratory, Faculty of Animal Science, Hasanuddin University using hydrolysis technology. Hydrolysis technology was carried out using a combination of chemical and physical processes, namely 1 M-HCl 20% (v/v) + autoclaved (21 Psi). Quail cages were made from the bamboo with dimensions of 30 cm x 20 cm x 30 cm.

2.2. Methods

2.2.1. Design of study. The study was designed using a completely randomized design (CRD) pattern in a 4x5 unidirectional, consisting of four treatments with five replications. Based on the design, 20 treatment cages were obtained. Each plot of treatment cage consisted of five quail samples. The types of ingredients were used in the formulation and composition of the quail feed was presented in table 1.

In this study, four levels of percentage use of feather meal concentrate in the main diet were applied, namely: (T0 = 0%, T1 = 1%, T2 = 1.5% and T3 = 2%) for 30 days. The quality of the quail meat was carried out on the last day of the study.

2.2.2. Implementation of study and data analysis. First of all, quails were placed in a cage. Each cage consists of five quails. Furthermore, quail was weighed before being placed in the cage to know the body weight. The quails were weighed every week to find out weekly weight gain. Feeding was controlled, while drinking water was given ad libitum. The results of the data were analyzed by statistically using ANOVA. The results of the study which showed a real influence then carried out further tests using Duncan’s test [10].

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### Table 1. The composition materials and nutritional of quail (*Coturnix coturnix*) feeding used in the study

| Formula         | Level of Feather Meal |
|-----------------|-----------------------|
|                 | T₀=0% | T₁=1% | T₂=1.5% | T₃=2% |
| Corn (%)        | 38.4  | 35.1  | 39.8    | 40.3  |
| Rice bran (%)   | 28.4  | 32.6  | 27.7    | 27.7  |
| Coconut grout (%)| 6.1   | 5.2   | 4.9     | 4.9   |
| Feather meal (%)| 0     | 1     | 1.5     | 2     |
| Fish meal (%)   | 4     | 5     | 6       | 6     |
| Soybean meal (%)| 23    | 21    | 20      | 19    |
| Mineral mix (%) | 0.1   | 0.1   | 0.1     | 0.1   |
| Total           | 100   | 100   | 100     | 100   |

Feed Nutrient Components
- Protein (%)*: 20, 20, 20, 20
- Metabolism energy (Me) (kкал/kg)**: 2489.34, 2441.83, 2535.68, 2541.68
- Water (%)*: 11.30, 11.02, 11.21, 11.16
- Ash (%)*: 5.82, 6.41, 6.33, 6.34
- Fat (%)*: 5.82, 6.10, 5.86, 5.90
- Fiber (%)*: 4.76, 5.16, 4.79, 4.83

Source: * Animal Feed Chemistry Laboratory, Faculty of Animal Science, Hasanuddin University ; ** Result of the Study [9].

### 3. Results and Discussion

#### 3.1. Water holding capacity (WHC)

Water holding capacity (WHC) is the ability of meat protein to hold the water. WHC is the amount of water added during strength effects, such as cutting meat, heating, grinding, and pressure. In general, meat has the ability to absorb water spontaneously from an environment that contains liquid. A description of the difference in the value of DIA for quail meat in the provision of feather flour with different concentrations was presented in figure 1.

![Figure 1. Comparison of water holding capacity (WHC) (%) value of quail (*Coturnix coturnix*) meat given feather meal at different levels after production process (30 days)](image)

Based on the results of statistical analysis of the data in figure 1 shows that the difference in the level of giving feather meal in the feed had a significant effect (P<0.05) on the value of WHC of the

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**Figure 1.** Comparison of water holding capacity (WHC) (%) value of quail (*Coturnix coturnix*) meat given feather meal at different levels after production process (30 days)
quail meat. The result of WHC values in the quail meat test was in the range of 32.42-49.48%. Increased levels of feather meal treatment significantly increase the value of WHC. The WHC is influenced by differences in species, age and muscle function, feed, transportation, temperature, humidity, storage and preservation, sex, health, pre-cutting treatment and intramuscular fat [11]. Increased feed consumption can result in increased absorption of protein relative to energy. This occurs because of the increase in the rate of movement of feed particles or the degradation in the digestive tract of cattle. Increased DIA is also associated with the presence of phenol groups. This can reduce protein oxidation [12]. The quail has lower protein and energy use efficiency than other species [13].

3.2. Meat shear force (MSF)

Meat shear force (MSF) is one of the objective parameters to assess tenderness (subjective) in meat using a Warner-Blatzler (WB) modification tool. The value obtained from these measurements is an expression of meat tenderness assessed subjectively. The meat that has a high MSF value indicates that the meat has a low tenderness level. On the contrary, the meat has a low MSF value indicates that the meat has a high tenderness [14]. A description of the difference in MSF value of quail meat given feather meal at a different level presented in figure 2.

![Figure 2. Comparison of meat shear force (MSF) (kg/cm²) value of quail (Coturnix coturnix) meat given feather meal at different levels after production process (30 days)](image)

The statistical analysis in figure 2 gives an indication, that the difference in the level of feeding feather meal gives a significant effect (P<0.05) on the MSF value of quail meat. The MSF test results on quail meat showed a value in the range of 0.56-0.98 kg/cm². The tenderness properties are the most important factors to influence consumer satisfaction related to the level of palatability in meat [15, 16, 17]. The ability of consumers to distinguish different levels of tenderness is very important to give value to meat. If consumers do not have the ability to differentiate tenderness, then efforts to increase tenderness in a beef product become difficult. Giving value from consumers related to tenderness will provide economic value to producers [18].

3.3. Cooking loss (CL)

The value of cooking loss (CL) in quail meat treated with feather meal in the composition of its feed generally was presented in figure 3.
The difference in the level of giving feather meal in quail feed showed a significant effect (\( P < 0.05 \)) on the CL value of Quail meat (fig. 3). The range of the CL test value on quail meat given introduction of feather meal in feed is 14.26-22.30%. Increased use of protein levels of feather meal in feed can be decreases CL significantly. This is likely due to changes in the chemical and physical composition of meat. Increasing the application of protein levels of feather meal will increase the binding capacity of water in the meat proteins, which can reduce cooking shrinkage values (Soeparno, 1994). The decline in CL is also related to the presence of phenol in feed can reduce the occurrence of protein oxidation [19].

![Figure 3. Comparison of cooking loss (CL) (%) value of quail (Coturnix coturnix) meat given feather meal at different levels after production process (30 days)](image)

3.4. Carcass weight (CW)

The carcass is the parts of livestock that have been slaughtered after the head and feet are separated. Then, skinned and the contents of the stomach and chest are removed so that meat is produced, without head, feet, skin, and innards. Comparison of carcass weight in quail that have introduced feather meal in feed presented in figure 4.

The level of giving different feather meal during the quail growth process to the limit of 2% did not show a significant effect (\( P > 0.05 \)) on the quail carcass weight maintained for 30 days (fig. 4). The results of the measurement of carcass weight (CW) on quails, which were introduced with feather meal, showed a value range of 64.16-64.98 g. The role of protein in increasing body weight is influenced by protease activity in the body of poultry. Protein supplementation in feed will stimulate the release of protease enzymes in the digestive system. According to [20], protease supplementation promotes weight gain. Similarly, [21] reported that supplementation with alkaline protease (versazyme) increased feed cost ratio (FCR) in poultry (broiler) during the starter phase.

If the volume of feed in the digestive tract increases, the utilization of nutrients decreases. This is due to a decrease in the efficiency of digestive enzymes. As a result, nutrient absorption is relatively lower. In limited dietary intake, quail is able to promote the use of energy for a better diet [22]. Maintenance energy metabolism in broiler quails is lower than in broilers and laying muscles [23]. Body weight and weight gain, in general, have been used as one of the criteria in the selection process in the quails [24, 25].
64.48±1.68 64.16±5.05 64.98±8.15 64.36±2.15

Figure 4. Comparison of carcass weight (CW) (g) value of quail (Coturnix coturnix) meat given feather meal at different levels after production process (30 days)

4. Conclusion
The feather meal treatment for quail (Coturnix coturnix) to a level of 2% during 30 days of maintenance at different levels increase of WHC, decrease of MSF and CL, but stabilize of CW. The level of 2% feather meal in feed shows better meat quality than other levels and control.

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