Chemical analysis of duck bone meal (Anatidae) from traditional food processing waste typical of Sidrap

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Abstract. Sidrap Regency in South Sulawesi Province has special food, namely Palekko', which has duck as raw material. The number of palekko' stalls in Sidrap will raise concerns about the waste generated because there is no treatment at all. This waste will increasingly pollute the environment, if not managed properly. Therefore, the processing is carried out, namely the manufacture of duck bone meal. This duck bone meal was analyzed by chemical analysis to compare it with the SNI for the bone meal and other bone meal that had been tested. This research was conducted to know the potential use of duck bone meal to be maximized through chemical analysis. The chemical analysis carried out was the test of moisture, protein, fat, crude fiber, ash content, calcium, and phosphorus (P₂O₅). The results of the chemical analysis obtained were moisture, protein, fat, crude fiber, ash, calcium, and phosphorus content (P₂O₅) respectively, namely 2.01%, 33.33%, 12.38%, 2.78%, 41.66%, 2.53% and 6.24%. Then it compared with SNI a duck bone meal and others. The results obtained bone powder duck has the potential to be applied optimally produce products made from the bone meal of duck with doing some treatment to improve their quality.

1. Introduction

The waste problem in Indonesia has not been fully resolved optimally. Whether it's organic waste or inorganic waste. Every day the organic waste increases. If the population of Indonesia is 220 million people, while the production of organic waste/day is 110,000 tons or 40,150,000 tons/year, it will cause many environmental problems, especially resulting in environmental pollution if it is not treated properly [1].

One of the ways to deal with waste is by processing waste into useful products. For example, in Sidrap district, which produces duck bone waste as traditional food waste, it is typical of ducks palekko'. So far in sidrap, duck bone waste has only been disposed of and not utilized at all. Bone waste is organic waste which, if handled ineffectively, will damage the environment. For certain concentration and quantity limits, solid waste will harm the environment, especially for human health, so it needs treatment [2].

Animal meal is rich in phosphorus, calcium, and alkaline oxides [3]. Calcium derived from animals includes duck bone waste, which until now has not been utilized. Even though this duck bone meal has a high selling value for producers of animal feed, food innovation products, etc.
Bone meal can be used as an animal feed for its mineral content, especially calcium and phosphorus. The bone meal contains a lot of mineral salts such as 58.3% calcium phosphate, 1.0% calcium carbonate, 2.1% magnesium phosphate, and 1.9% calcium chloride [4]. Calcium and phosphorus are required in bone formation and the body's metabolic activities [5].

2. Research method
This research was conducted at the Islamic University of Makassar, Tamalanrea, Makassar, since June 2020. A calculation of the yield of duck bone meal products was then analyzed, namely water content, protein, fat, crude fiber, ash content, calcium, and phosphorus (P\textsubscript{2}O\textsubscript{5}). Water content was analyzed using methods thermogravimetry by reference [6]. Analysis of protein content using the Kjeldahl semimicro method based on [6] with the principle of calculating the total nitrogen content of the material which is then converted into protein content. Fat content analysis refers to [6]. The ash content was calculated from the remaining organic combustion products at 550°C [6]. Fiber content analysis is the crude fiber content in tempeh which is analyzed by the method of determining crude fiber content (Gravimetric method) in percent (%) units. Calculation of calcium was carried out using the permanganometric titration method based on [7]. After the analysis results were obtained, a comparison was made with the SNI bone meal with other bone meal to obtain the potential utilization of duck bone meal.

3. Results and discussion
The yield is one of the important parameters in the manufacture of a product to determine its economic value and effectiveness. The higher the yield, the higher the economic value and effectiveness of a product. The results of observations of the yield produced in the manufacture of duck bone meal can be seen in table 1. The average yield obtained was 43.98%, where the yield value was higher when compared to the fishbone meal from research [8] which was 32.47%. The low yield can be affected by many components nonmineral (water, protein, and fat) in a material that as an insoluble with the longer time spent [9].

| Deuteronomy | Initial Weight (g) | Final Weight (g) | Yield (%) |
|-------------|--------------------|-----------------|-----------|
| I           | 271.11             | 120.05          | 44.28     |
| II          | 280.02             | 122.08          | 43.60     |
| III         | 275.66             | 121.45          | 44.05     |
| Average     | 275.60             | 121.19          | 43.98     |

The results of chemical analysis of duck bone meal can be seen in table 2. The results obtained can be described as follows.

3.1. Water content
The moisture content contained in foodstuffs or food products greatly affects the quality and durability. The lower the water content produced, the more durable the food ingredients or food products produced. Analysis results in water content of duck bone meal were 2.01%, the low water content obtained was determined by the method of making meal and the proper drying technique. The water content of duck bone meal is still in the standard range set by SNI. Based on stipulation [10] that bone meal has a maximum moisture content of 8%.

3.2. Protein content
Protein is a nutritional component that is needed by the body. Proteins function as builders and regulators [11]. The results of the analysis carried out obtained a protein of 33.33%. The resulting protein is quite high, approaching the protein content value of tuna fish meal as a result of the study [12] which is
Besides, based on research [13] that in general, the protein content contained in bone meal is 12%. It can be seen that the protein content contained in a duck bone meal is quite high. The high protein content is obtained due to the absence of protein hydrolysis.

3.3. Fat content
Fat content determines the quality of bone meal so that it is not easily damaged and relatively more stable. The high-fat content will affect aroma and taste and will cause easy oxidation of fat. The results of the observation of the fat content of duck bone meal were 12.38%. The resulting fat content is quite high when compared with [10] a maximum of 6%. This is due to the absence of treatment to remove fat levels in the bones. As it is known that fat is not easily released because it has complex bonds, and it is difficult to be removed even if it is crushed in an alkaline solution [14].

3.4. Crude fiber content
Crude fiber is related to the rate of digestion and absorption of nutrients. The higher the crude fiber content in food products, the slower the rate of digestion and absorption of nutrients [15]. Crude fiber produced from the manufacture of duck bone meal is 2.78%. When compared with the results of research [13] that the content of crude fiber in general in bone meal is 2%. This indicates that the crude fiber content is still low.

3.5. Ash content
Ash content analysis was carried out to determine the mineral content contained in duck bone meal. The ash content in the duck bone meal was 41.66%. The ash content was higher than the ash content of the fishbone meal produced [16], only 33.0%, and the ash content of the catfish bone meal results [12] of 33.5%. The results of the ash content of duck bone meal were not optimal because the alkaline solution was not immersed to release organic matter, especially protein.

3.6. Calcium levels
The calcium levels produced in this study were 2.53%. When compared with calcium levels of [10] a maximum of 20% and 30%, it is very different. The resulting calcium levels are very small, this is because the boiling is not done for a long time. According to Kusumaningrum et al., (2016), the increase in calcium levels is determined by the increasing frequency of boiling that is done [17].

3.7. Phosphorus content ($P_2O_5$)
The phosphorus content produced in this study was 6.24%. When compared with calcium levels of [10] a maximum of 20% and 20%, it is very different. The phosphorus content produced was very small, however, the phosphorus content of duck bone meal compared to the Belida fish bone meal results from the study [17] was 3.98%–4.06% still higher. According to Kaya et al., (2008) that the level of phosphorus produced in bone meal depends on the use of temperature, time, and method used [18].

**Table 2. Chemical analysis results of duck bone meal.**

| Parameter          | Duck bone meal (%) | SNI bone meal 01-3158-1992 (%) |
|--------------------|--------------------|--------------------------------|
|                    |                    | I      | II     |
| Water content      | 2.01               | 8      | 8      |
| Protein            | 33.33              | -      | -      |
| Fat                | 12.38              | 3      | 6      |
| Crude Fiber        | 2.78               | -      | -      |
| Ash content        | 41.66              | -      | -      |
| Calcium            | 2.53               | 20     | 30     |
| Phosphorus ($P_2O_5$) | 6.24              | 20     | 20     |
4. Conclusion
This study concludes that the results of chemical analysis obtained are moisture, protein, fat, crude fiber, ash, calcium, and phosphorus content ($P_2O_5$) respectively, namely 2.01%, 33.33%, 12.38%, 2.78%, 41.66%, 2.53%, and 6.24% than compared to SNI for duck bone meal and other bone meal, it was found that duck bone meal has the potential to be applied maximally to produce products made from duck bone meal by carrying out several treatments to improve its quality.

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