

Identification of Calcium and Phosphate Content in Chicken Bones and Duck Bones

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ABSTRACT

The production of poultry such as chickens and ducks, especially in East Java, is very large, so the bone waste produced is of course the same. Generally, minerals in bone are dominated by calcium, phosphorus and magnesium. Phosphate is a derivative of phosphorus. Phosphate is an anion consisting of phosphorus (P) and oxygen (O) atoms. Calcium and phosphate are as important as sodium and potassium in the regulation of basic body functions. The purpose of this study was to determine the identification of calcium and phosphate in chicken bone and duck bone waste. Beginning with cleaning and then proceeding with drying on each of the chicken bone and duck bone waste using an oven for 1 hour at a temperature of 110°C. Then the dried bone was ground until it reached 30 mesh and then weighed until it reached a weight of 50 grams. Furthermore, tests were carried out using AAS and gravimetry to determine the content of calcium and phosphate in chicken and duck bones. On chicken bones for the gravimetric test method obtained phosphate content of 6.7% and with the AAS test method obtained a calcium content of 24.9%. In duck bone with gravimetric test method for phosphate content obtained by 7.35% and with AAS test method obtained calcium content of 30.82%.

Keywords: Chicken bone, calcium, duck bone, phosphate

Introduction

We often encounter food menus with processed chicken or duck at roadside stall or restaurants. According to data from the Central Statistics Agency, chicken production in East Java in 2019 reached 459.570,078 heads/year and duck production in East Java was 7,487,391 heads/year. Because the production of these animals is very large, the bone waste produced is of course also directly proportional. The main supporting structure of the vertebrate body is the skeleton of bone tissue. Muscles, tendons, and ligaments are also attached to bones and cartilage. The organic matrix makes up 30 to 40% of the weight of bone. It consists of collagen protein fibers embedded in a mucopolysaccharide protein complex. The inorganic matrix of bone consists of calcium phosphate (85%), calcium carbonate (10%) and a small amount of calcium fluoride, magnesium chloride. Calcium and phosphate are as important as sodium and potassium in the regulation of basic body functions (Rauf, 2014).

Generally, minerals in bone are dominated by calcium, phosphorus and magnesium (Khirzin, 2020). According to Amalia et al. (2018) the calcium contained in bones is 7.07% CaCO_3 (calcium carbonate), 1.96% CaF_2 (calcium fluoride), and 58.30% $\text{Ca}_3(\text{PO}_4)_2$ (calcium phosphate). The phosphorus content in bone is 2.09% $\text{Mg}_3(\text{PO}_4)_2$. Phosphate is a derivative of phosphorus. Phosphate is an anion consisting of phosphorus (P) and oxygen (O) atoms. The chemical formula for phosphate is given as $(\text{PO}_4)^{3-}$. Phosphorus as phosphate plays an important role in the

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structure and function of living cells. Phosphorus in the body of livestock such as ducks is in the form of phospholipids as structural components of cell walls and also as organic phosphates that play a role in storing or releasing energy in the form of Adenine Triphosphate. Phosphorus is often juxtaposed with calcium in its role, because it plays a role in the process of forming bones, body skeleton, and egg shells. Phosphorus, calcium, and vitamin D play an important role in achieving the perfection of the duck's body metabolism (Sulistyoningsih et al., 2017).

Table 1. Animal bone material

Component	Content
Water	1,8 - 44,3
Fat	1,2 - 26,9
Collagen	15,8 - 32,8
Inorganic substances	28,0 - 56,3

Source: Anggraenie et al., 2017

The purpose of this study was to determine the identification of calcium and phosphate in chicken bone and duck bone waste. According to Pujiastuti et al., (2018) phosphate is an essential nutrient needed by plants for their growth and development. The need for phosphate is also quite large, especially as a raw material for the fertilizer industry. One of the popular types of fertilizer is phosphate fertilizer (Khirzin, 2020). The benefit of this research was conducted to reduce the waste of chicken bones and duck bones and to add economic value to the waste of chicken bones and duck bones. There are several studies that use animal bone waste as an additive in the manufacture of fertilizer. One of them is research from (Lestari & Azwin, 2014) which uses chicken bone waste as an alternative in the manufacture of fertilizer.

Material and Methods

The waste of chicken bones and duck bones are cleaned from the remains of meat that are still attached. After cleaning, each chicken bone and duck bone were dried using an oven for 1 hour at 110°C. After drying, the bone was ground to a size of 30 mesh, then weighed until it reached a weight of 50 grams. The test for calcium and phosphate levels was carried out at the Surabaya Research and Standardization Institute using AAS and gravimetric tests. Gravimetric analysis only provides analysis of one element, or a limited group of elements, at a time. Gravimetric analysis does not require expensive equipment. Due to its high degree of accuracy when done correctly it can also be used to calibrate other instruments in lieu of reference standards (Singh et al., 2013). The AAS or Atomic Absorption Spectrophotometry method is preferred because of its specificity, sensitivity, precision, simplicity, and relatively low cost per analysis. The purpose of analytical measurement is to obtain consistent, reliable and accurate data. Validated analytical methods play a major role in achieving goals (Ata et al., 2015).



Figure 1. Oven-dried chicken and duck bones



Figure 2. Cleaned chicken and duck bones



Figure 3. Bones that have been mashed up to 30 mesh



Figure 4. weighing the crushed bones

Results and Discussion

Table 2. Chicken bone calcium and phosphate content

No.	Parameter	Unit	Result	Method
1.	Phosphate	%	6.7	Gravimetry
2.	Calcium (Ca)	%	24.9	AAS

Table 3. Duck bone calcium and phosphate content

No.	Parameter	Unit	Result	Method
1.	Phosphate	%	7.35	Gravimetry
2.	Calcium (Ca)	%	30.82	AAS

According to Trilaksani et al. (2006) used waste tuna fish bones as a source of calcium content obtained of waste tuna bone calcium 23.72-39.24%, phosphorus 11.34-14.25. According to Utami and Mulyono (2004) for cow bone waste containing by weight there is 20% water, 45% ash, and 35% organic matter. Cow bone ash contains 37% Calcium and 18.5% Phosphorus by weight of beef bones. Based on the results of the calcium and phosphate content test, for comparison of several types of animals such as poultry, mammals and fish. It has been known that the calcium and phosphate content in mammals is higher, followed by poultry and the last group of fish.

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