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Effect of Chicken Bone Meal as Phosphorus Supplement on Blood Metabolites in Fattening Lambs

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Abstract

The aim of this study was to evaluate the effect of chicken bone meal (CBM) as phosphorus supplementon blood metabolites in fattening lambs. The experiment used 16 of 12 months old local male lambs with initial body weight 27.01 ± 1.51 kg. The experiment used a complete randomized design with 4 treatments and 4 replications. The treatments were T0 (basal ration = native grass + soybean curd waste), T1 (basal ration + 0.49% P Dicalcium phosphate), T2 (basal ration + 0.70% P CBM), T3 (basal ration + 1.39 % P CBM). The results indicated that CBM as phosphorus supplement was significantly different (P<0,05) on P intake, phosphorus and glucose serum and did not different significantly on dry matter intake and alkaline phosphatase activity. In conclusion, CBM is one of requirement organic phosphorus supplement which can be applied on ruminants.

1. Introduction

Forage is the main source of ruminant feed. Forage types that are mostly eaten by the ruminant animals are grass family *(Gramineae)* and legume *(Leguminoceae)*. The shortage of quality forage has become the limiting factor for development of ruminant farm resulting in the decreased ruminant production. Low productivity and nutritive value were the main problem in the ruminant farm. Native grass was one of forage that usually given in the ruminant farm. The only native grass consumption make a deficient on nutritive value especially minerals. Mineral requirement was needed in order to support optimal growth and production. Phosphorus was one of minerals suplement that needed by rumen and cattle microbes to maintain the integrity of membranes and cell walls, nucleic acid components and parts of high-energy molecules [18]. Sufficient phosphorus available in the rumen allows microbial rumen to ferment feed optimally.

Phosphorus is an important nutrient involved in most of the nutrient metabolism in the body. Phosphorus suplement source consist of anorganic an organic matter. An organic phosphorus usually used for example is Dicalsium phosphate [3]. The organic phosphorus usually used is ruminant bone meal. The problem is bone meal from ruminants is not recommended as a mineral supplement for ruminants as appropriate with the decision of the Minister of Agriculture (2002). Chicken bone meal was an alternative phosphorus source for mineral supplements.

Organic phosphorus derived from chicken bone flour has better utility. Its known from mineral solubility. The solubility of minerals from three bone meal such as chicken bone meal, goat bone meal and cow bone meal sequently are 19% chicken bone meal, 18.6% cow bone meal and 14.15% goat bone meal [16]. Based on the solubility, chicken bone meal can be used as an efficient mineral supplement.

Phosphorus is one of the minerals needed for ruminants especially lambs. P needed for bone growth and metabolism procces. Sufficienct P in diet was important to increase microorganism population and increase nutrient metabolism. Sufficient P in lambs can be described through the bloodmetabolites.

The aim of this study was to evaluate the effect of chicken bone meal (CBM) as phosphorus supplement on blood metabolites in fattening lambswith the purpose that chicken bone meal (CBM) is one of requirement organic phosphorus supplement which can be applied on ruminants.

2. Materials and Methods

2.1. Animals and Diet

The experiment used 16 of 12 months old local male lambs with initial live weight 27.01 ± 1.51 kg. The experimental basal diet (T0) was composedof native grass and soybean curd waste. The experimental treatments comprised three diets providing T1 (basal ration + 0.49% P Dicalcium phosphate), T2 (basal ration + 0.70% P CBM), T3 (basal ration + 1.39 % P CBM) (Table 1).
In allgroups, lambs were fed the corresponding diet in twoequal meals at 08.00 and 17.00 h and water were given ad libitum. The ration of native and soybean curd waste was 40:60. After 70-d of feeding treatment, blood serum was taken. The blood samples were withdrawn from jugular vein from each lambs by using a disposable sringe into 10 ml plain tubes.

2.2. Statistical Analysis

The experiment used a complete randomized design with 4 treatments and 4 replications.The data obtained were analyzed by variance analysis.

Table 1.Composition of basal diet

Item	T0	T1	T2	T3
Composition diet, % of dietary DM				
Native grass	40	40	40	40
Soybean curd waste	60	60	60	60
DCP		0.49		
Chicken bone meal			0.70	1.39
Nutrient composition				
Moisture (%)	12.77	12.77	12.77	12.77
Ash (%)	7.32	7.32	7.32	7.32
Crude Protein (%)	16.09	16.09	16.09	16.09
Extract Ether (%)	2.70	2.70	2.70	2.70
Crude Fiber (%)	35.48	35.48	35.48	35.48
Ca (%)	4.45	4.56	4.56	4.67
P (%)	0.56	0.65	0.61	0.65
TDN (%)	59.91	59.91	59.91	59.91

3. Results and discussion

The result of this study (Table 2), showed that dry matter (DM) intake not significantly different in each of treatment. The explanation of this phenomenon probably caused by the nutrient composition of diet such as energy and protein relatively was no different. Dry matter intake in each treatment was 2.46-2.54% of body weight (BW). DM requirement based on [12] was 3% of BW. This condition was assumed according to high moisture and crude fibre(CF) content (12.77 % dan 35.48%) of diet basal ration. High moisture and CF content will restrict the ability of consumption ration. This is due to limited rumen capacity and low rate of passage will reduce DM intake include other nutrients [10].

Feed intake was limited by energy requirements, which affects to DM intake. TDN on diet treatment was 59.91%. Energy requirement for lamb was 55-60% [14]. This condition causes lamb quit to consumtion of feed when energy requirement was fulfilled [13].

Based on Table 2, P intake between treatments showed significant differences. P intake of T1 and T3 (P <0.05) were higher than that in T2 and T0. The treatment on T1 and T3 was qualified the P requirement for lambs i.e. 2.39 g/d [12]. The results showed that adding CBM (1.39%) has been able to replace DCP (0.49%) as an organic phosphorus. The utilization of CBM has higher acceptability than DCP. It wasindicate from the higher P serum. P serum influenced by P intake [15]. Low P serum on T0 was assumed because of the low availability of organic P on the tissue [1].

This result was different from [17], where adding anorganic P (0.29%) dan organic P (0.35%) has unsignificant result in P intake (P>0.01). P intake anorganic dan organic was 1.34 (g/d) and 1.64 (g/d). The different was assumed because of the level of P addition and different source of organic P.

Fulfilled P in rumen was caused normal intake of P. Fulfilled of P in rumen supports rumen micro-organism fermented feed optimally. Organic feed material will be fermented by rumen micro-organism into microbial protein as a source of protein for livestock. Microbial rumen contributes 1/3-2/3 of the protein requirement of livestock.

3.1. P Serum

Phosphorus serum showed in every treatment was T0 (8.04 mg/dl), T1 (8.55 mg/dl), T2 (10.09 mg/dl) and T3 (11.21 mg/dl). P serum was higherin T3 treatment. This results was assumed from solubility factors as mention by [11]. One of the factors affecting P intake was solubility of P in the gastrointestinal tract. Increasing of solubility in gastrointestinal tract affect increasing of P absorption and it was associated with P intake.

Table 2. Phosphorus, Glucose and Alkaline phosphatase serum

Parameters	T0	T1	T2	T3
Dry matter intake (g/d)	664.24	670.09	684.54	677.84
P intake (g/d)	0.54^{c}	2.40^{a}	1.47^{b}	2.34^{a}
P Serum (mg/dl)	8.04^{c}	8.55^{bc}	10.09^{ab}	11.21^{a}
Glucose serum (mg/dl)	19.23^{b}	33.33^{ab}	30.03^{b}	46.38^{a}
Alkaline phosphatase (U/L)	63.87	79.39	81.00	83.87

Different superscripts on the same line show a significantly difference (P<0,05)

Phosphorus serum in all treatment was in a normal range. The normal range of P in lambs was 4-6 mg/dl [4]. Effect of CBM as an organic P supplement can increase P in serum (T2 and T3) higher than an anorganic P (DCP) in T1(P<0.05). This result was different from [17], where adding anorganic P (0.29%) dan organic P (0.35%) has unsignificant result in P serum (P>0,05). P serum anorganic dan organic was 6.16 (mg/dl) dan 7.20 (mg/dl). The different was assumed because of the level of P addition and different source of organic P. The normal P in the tissue shows supplement P to support metabolic activity on the tissues. This indicates that P was an essential metabolic in tissue [6].

3.2. Glucose Serum

The result of variance analysis showed that glucose serum was higherin T3 treatment (Table 2). Glucose serum of the study were below the normal range of 44-81.2 mg / dl [5], except T3 treatment.Phophorus supplementation in T3 treatment resulted normal glucose serum. Phosphorus intake was affected P concentration in the rumen. The sufficiency of P in the rumen helps fermentation carbohydrates. Glucose in ruminants derived from propionate (gluconeogenesis) was produced from the fermentation of fiber feed. Normal glucose serum especially in T3 treatment indicated energy from carbohydrate is fulfilled.

Phosphorus serum was affected glucose metabolism in blood. Glucose serum source was came from carbohydrates, glycogenic compounds that was produced from gluconeogenesis, and liver glycogen. Glucose serum was determined by the balance of glucose that enters the blood and which leaves the blood. Glucose serum was still to be secreted to supply the nutritional needs on various tissues. Glucose serum on normal limits, then most of the tissue will use glucose as an energy source.Increasing of glucose serum was followed by increase of carbohydrate absorption [7].

3.3. Alkaline Phosphatase Activity

Serum Alkaline phosphatase activityfrom the lowest was T0 (63.87 U/L), T1 (79.39 U/L), T2 (81.00 U/L) and T3 (83.87 U/L). P supplement on treatment did not influence to Alkaline phosphatase activity. The same compositionof energy and protein and P supplement were not significantly affected in alkaline phosphatase activity. The normal range of alkaline phosphatase activity is 63-387 U/L [8]. Indonesian local lambs have a range of alkaline phosphatase activity is 25.28-30.66 U/L [9].

Alkaline phosphatase activity is the total alkaline phosphatase released from tissue to blood. Alkaline phosphatase contains zinc used for enzyme activity. The physiological function of zinc in tissues or cells that are growing is to regulate protein synthesis [7].Increased alkaline phosphatase activity shows a high anabolic process in the tissues. This process can be either the synthesis of intra cellular materials or the growth of new cells in the tissue.

4. Conclusion

Effect of organic P supplements in diet was better than inorganic P and give the good effect on blood metabolites. Chicken bone meal (CBM) is one of requirement organic phosphorus supplement which can be applied on ruminants.

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