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Effect of Floor Density and Feeding System on The Weights of Bursa of Fabricius and Spleen as Well as the Plasma Triiodothyronine Level of *Bayang* Duck

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Abstract: An experiment was conducted to evaluate the effect of floor density and feeding system on the weight of bursa of Fabricius and spleen as well as the plasma Triiodothyronine level of *Bayang* Duck. Objective of the experiment was to know the effect of floor density and feeding system on the weights of bursa of Fabricius and spleen as well as the plasma triiodothyronine level in the Ducks. As animal materials in the experiment were used Bayang Ducks, a localized kind of domestic water poultry. Bayang Ducks have been being reared traditionally by small farmers in District Pesisir Selatan of The Province of West Sumatera-Indonesia. In amount of 80 ducks treated since they were 2 weeks age and average body weight 135±0.39g until finishing of six weeks experimental period. The experiment was arranged into Split Plot Design in CRD with factors Floor density D1 0.48 sq m/duck, D2 0.08 sq m/duck and feeding systems F1 ration and F2 free choice. Every treatment had five replications and every experimental unit consisted of four ducks. The measured variables were relative weight of bursa of Fabricius and spleen as well as level of triiodothyronine in blood plasma. Data were analyzed statistically with Split Plot Design in CRD. The experiment resulted in that the relative weight of bursa of Fabricius as well as spleen and the level of plasma triiodothyronine (T3) as D1 and F1 effects significantly higher than that of S2 and F2 respectively.

Key words: Floor density, feeding system, plasma triiodothyronine, Bayang duck

INTRODUCTION

Bayang Duck is one of the originated water poultry from The Province of West Sumatera in Indonesia that would be potentially developed for meet and egg production. Now days Bayang Ducks are still reared in very traditionally management system, in that they are free in the environment to find out almost all their feeding need. Therefore, the ducks could be high potentially deficient in nutrients, which result in their low productivity. An alternative development in duck management through intensive management like rearing and feeding them in the stable could develop duck productivity. Additionally, changing the upper narrated traditional management to the intensive one would much reduce the land area need for rearing the ducks.

Onbasilar *et al*. (2008) summarized results of their research in broiler chicken that higher stable density decreased feed consumption, body weight gain, carcass percentage and feed efficiency. Lower feed consumption as well as body weight gain of broiler chicken because of the higher stable density were also reported by Mtileni *et al*. (2007) and Margawati (1985). The experimental result of Iskandar (2000) showed that the chicken growth was higher with ration feeding in comparison to choice feeding. It could be understood that it was due the completely and synchronously consumption of nutrients with the ration feeding. Conversely finding was reported by Bakrie *et al*. (2005) that compare to the commercially ration, the free choice feeding increased body weight gain of the Local Ducks as well as the Alabio Ducks.

Management with low floor density could bring the ducks into heat stress condition. Heat stress as well as imbalance nutrients negatively affect animal immune system and productivity. Hecker *et al*. (2002) summarized their experimental research that lower floor density significantly reduced the weight of bursa of Fabricius and spleen of broiler chicken.

The ration with low arginine content in broiler chicken reduced feed consumption and body weight gain as well as the weights of thymus, bursa of Fabricius and spleen broiler (Kwak *et al*. , 1999). Bursa of Fabricius, spleen and thymus belong to lymphoid organs those have function to produce lymphocyte. Meanwhile, lymphocyte belongs to leucocyte which has function in producing immunoglobulin (Ig) like Ig A, Ig y , Ig G and Ig M (Swenson, 1993).

Sugito *et al*. (2007) and Kusnadi *et al*. (2009) approved from their experiment that heat stress could reduce growth rate as well as level of the hormone triiodothyronine (T3) in blood plasma of broiler chicken. As calorigenic factor T3 has function to increase oxygen consumption for metabolism through what the increment of growth rate could be gained.

Therefore, research with the objective to find out the effect of floor density and feeding system on the weights of bursa of Fabricius and spleen as well as the level of hormone triiodothyronine in Bayang Ducks had been carried out.

MATERIALS AND METHODS

An experiment used 80 Bayang Ducks since 2 weeks old with mean initial body weight 132 ± 0.39 g, until finishing of 6 weeks experimental period. Treatments were two floor density i.e. D_1 0.48 m^2/duck and D2 0.08 m^2/duck as well as feeding system i.e. F1 ration feeding and F2 free choice feeding.

Feedstuffs consisted of green maize, rice bran, fish meal, soy-bean cake, coconut cake, bone meal and coconut oil. The ration (F1) was formulated from all upper feedstuffs with its energy and crude protein contents of 3000 kcal/kg and 22 % respectively for starter ducks (≤ 4 weeks old) as well as 2800 kcal/kg and 18 % for the grower ones (4-8 weeks old) (NRC, 1994). The treatment of free choice feeding (F2) was served from the all feedstuffs and each of them in the same amount with the feedstuff was used in formulating the ration (F1).

The measured variables consisted of:

1. Relative weight of bursa of Fabricius was calculated by dividing its absolute weight with body weight at the experimental termination.
2. Reactive weight of spleen was calculated by dividing its absolute weight with body weight at the experimental termination.
3. Level of hormone triiodothyronine (T3) in blood plasma at the experimental termination was measured through radioimmunoassay method (RIA).

All the collected data were analyzed with Split Plot Design in Completely Randomized Design (Steel and Torrie, 1993)

RESULTS AND DISCUSSION

As showed in Table 1, 2 and 3, analysis of variance resulted in significantly difference in the effect of floor density as well as feeding system ($P < 0.05$) on bursa of Fabricius weight, spleen weight and triiodothyronine (T3) in blood plasma.

Treatment effect on relative weight of bursa of fabricius and spleen

Table 1 showed that average weight of bursa of Fabricius of Bayang Duck rearing in floor density D1 was 1.211 g/kg bw. It was significantly higher than that rearing in floor density D2 (1.094 g/kg bw). The duck consumed ration feeding (F1) also had significantly higher average weight of bursa of Fabricius (1.176 g/kg bw) that of free-choice feeding (1.128 g/kg bw).

Table 2 showed the same trend on spleen relative weight. Table 2 showed that average weight of spleen of the duck rearing in floor D1 was 1.079 g/kg bw. It was significantly higher than that rearing in floor D2 (0.922 g/kg bw). The duck consumed ration feeding (F1) also had significantly higher average weight of bursa of Fabricius (1.029 g/kg bw) that of free-choice feeding (0.973 g/kg bw).

Reduction of relative weight of bursa of Fabricius and spleen because of low floor density indicated that there had accured disturbances of disposal of the in body accumulated heat to the environment. That condition logically caused heat stress in the duck. Yunianto *et al.* (1999) reported that heat stress in animal stimulated the increment of plasma corticosterone hormone and Siegel (1995) found that corticosterone eliminated growth of lymphoid organs (bursa of Fabricius and spleen). It could lead into disturbances of immune system production in the body and reduction in growth rate of the animal. Reduction of growth rate and low amount of lymphocyte which were due to the corticosterone increment in blood plasma approved through several experiments by Kusnadi (2004 and 2006), Kusnadi *et al.* (2005), Onbasiler *et al.* (2008) and Zulkifli *et al.* (2000). Hecker *et al.* (2002) and Puvadolpirod and Thaxton (2000) also summarized their experimental results that reduction of relative weight of bursa of Fabricius and spleen occurred in the low floor density as well as in the treatment of exogenous corticosterone hormone in broiler chicken.

In Tables 1 and 2 were also displayed that average relative weights of bursa of Fabricius and spleen with ration feeding were 1.176 and 1.029 g/kg bw, respectively. They were significantly higher in comparison to those of free choice feeding (1.128 and 0.973 g/kg bw). It could be understood that free choice feeding had potentiality of nutrient deficiency which reduced growth rate and include lymphoid organs (Sunder *et al.*, 2008). An experiment from Kwak *et al* . (1999) also resulted in reduction weight of bursa of Fabricius, spleen and thymus because arginine deficiency.

Treatment effect on plasma triiodothyronine (T_3): Table 3 showed that average hormone T3 level of the duck raising in the floor D1 (1.262 nmol/L) was significantly higher than that of the duck in the floor D2 (1.129 nmol/L). As effect of feeding system, T3 level of the duck with ration feeding (1.259 nmol/L) was significantly higher than that of free choice feeding (1.132 nmol/L).

Triiodothyronine (T3) has function in metabolic process through increment of oxygen consumption (Shibata *et al.*, 2007) and its effect much more optimal at condition of the comfortable temperature zone, which resulted in higher growth rate (Decuypere dan Buyse, 2005). However, reduction of plasm T3 level in stress condition negatively affected the growth rate (Gerart *et al.*, 1996, Kusnadi *et al.*, 2009 and Sugito *et al.*, 2007). It was approved that crowed ducks in floor caused difficulty in loosing body heat into the environment. Finally, the duck could decrease both growth rate as well as weight of lymphoid organs. The way to subtract accumulated body heat, the duck drank much and decreased feed consumption. Meanwhile, synthesis and secretion of the

Table 1: Treatment effect on average relative weight of bursa Fabriciusi (g/kg bw)

	Feeding system		
Floor density	Ration (F_1)	Free choice (F_2)	Means
D1 (0.48 m^2/duck)	1.241±0.060	1.181±0.052	1.211±0.062[a]
D2 (0.08 m^2/duck)	1.111±0.056	1.076±0.068	1.094±0.062[b]
Means	1.176±0.087[a]	1.128±0.079[b]	

[a,b]Mean with different superscript in same row/column differ significantly (p<0.05)

Table 2: Treatment effect on average relative weight of lymph (g/kg bw)

Floor density	Feeding System		
	Ration (F_1)	Free choice (F_2)	Means
D1 (0.48 m2/duck)	1.109±0.065	1.051±0.063	1.079±0.067[a]
D2 (0.08 m2/duck)	0.949±0.057	0.896±0.062	0.922±0.063[b]
Means	1.029±0.102[a]	0.973±0.101[b]	

[a,b]Mean with different superscript in same row/column differ significantly (p<0.05)

Table 3: Treatment effect on average of plasma triiodothyronine level(nmol/L)

Floor Density (D)	Feeding system (F)		
	Ration (F_1)	Free choice (F_2)	Means
D1 (0.48 m2/duck	1.348±0.103	1.176±0.123	1.262±0.139[a]
D2 (0.08 m2/duck	1.170±0.079	1.088±0.078	1.129±0.086[b]
Means	1.259±0.127[a]	1.132±0.108 [b]	

[a,b]Mean with different superscript in same row/column differ significantly (p<0.05)

active calorigenic hormone T3 were also decrease (Decuypere and Buyse, 2005). The low level of hormone T3 with free choice feeding might be due to deficient nutritional consumption. Its effects on reduction of growth rate and T3 synthesis were approved by lower feed consumption and lower body weight of the F2-ducks in comparison to those of F1 (Kusnadi and Rahim, 2009). Decuypere and Kuhn (1984) reported that blood plasma T3 of poultry was under effect of environmental temperature, age, healthy status and feeding.

Conclusion: It could be summarized that relative weights of bursa of Fabricius as well as spleen and T3 level in blood plasma were higher with floor density 0.48 m^2/duck or with ration feeding than those with floor density 0.08 m2/duck or with free-choice feeding.

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