Nitrogen Retention and Productive Performance of Crossbred Native Chicken Due to Feeding Effect of Kayambang (*Salvinia molesta*)

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**Abstract** - The present research was aimed to clarify the effect of feeding *Salvinia molesta* in crossbred native chicken on productive performance based on the ability of protein utilization. The research was arranged in a completely randomized design with 4 treatments and 5 replications (5 birds each). The animals used in the present study were 100 birds of crossbred native chicken. The treatments given were as follows: T0 (diet without *Salvinia molesta*), T1 (diet with 6% *Salvinia molesta*), T2 (diet with 12% *Salvinia molesta*), T3 (diet with 18% *Salvinia molesta*). Parameter observed namely feed consumption, nitrogen retention, muscle protein mass, and body weight gain. The data were analysed using anova, when the effect of the treatments was significant, then duncan’s multiple range test was applied. The results showed that the treatment of feeding *Salvinia molesta* indicated a significant effect (p<0.05) on nitrogen retention and productive performance. Feed consumption, nitrogen retention, muscle protein mass, and the body weight gain of T1, T2, and T3 were significantly higher (p<0.05) than those of control (t0), while among treatments T1, T2, and T3 were not different. Feeding *Salvinia molesta* up to the level of 18% can improve nitrogen retention and productive performance of crossbred native chicken.

**key words** - kayambang (*Salvinia molesta*); crossbred native chicken; muscle protein mass; body weight gain; productive performance

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**I. INTRODUCTION**

Native chickens are local bird that don’t have specific characteristics, but it can be found easily in all over Indonesia because many farmers raised this type of chicken. Indonesian peoples prefer to consume products of native chicken rather than those of broiler because of its egg and meat’s taste are better. In addition to the better taste, egg and meat of a native chicken are believed to contain higher nutritional values which bringing about the selling price is relatively more expensive compared to that of broiler chicken products. However, productivity of native chicken is low due to the raising model applied is very simple, and also genetically low feed utilization efficiency. The low genetic ability of native chicken brought about many efforts have been conducted, one is that by cross-mating between native chicken and modern breed in order to get specific genetic trait that is not far different from the original ancestor (native chicken) but its productivity having higher economic value. Crossbred native chicken is the offspring of cross breeding between native chicken (male) and *Isa Brown* of egg-laying hen. Crossbred native chickens are able to produce meat with the characteristics, such as flavor and taste, similar to those of native chicken, but the growth rate is faster and slaughtering age is sorter for market. According to Muryanto (2005), crossbred native chicken can reach body weight for consumption (0.85kg) at the age of 60 days with intensive rearing management, while original native chicken can reach only 0.5 kg at the same age.

Nutritional supplies, especially protein, for poultry, including crossbred native chickens, should be adequate and meet requirement level. The adequacy of protein requirement is always connected with dietary metabolizable energy, so called the balance ratio between energy and protein. Generally, protein sources for poultry diet is fulfilled from fish meal. It is well known that fish meal is functioning as one ideal protein source with high amino acids content and balance. However, considering dietary inclusion of fish meal causes less efficiency of productive cost of crossbred native chicken.
farming, it is reliable to find an alternative local feedstuff with high enough protein content to partly substituted fish meal. One local feedstuff as an alternative ingredient can be included into the poultry diet with lower price but high protein content is known as kayambang or its scientific name called Salvinia molesta.

Salvinia molesta is a type of free floating aquatic fern that mostly grows in marshes, rivers, and also rice field area. Agronomically, Salvinia molesta grows fast, within 14 days its growth can reach as twice as the initial amount, therefore, within a year can produce as much as 45.6 up to 109.5 ton/hectare in fresh (McFarland et al., 2004). Salvinia molesta is possible to be used as poultry diet component because of its high protein content, reaching 30%. Salvinia molesta, an aquatic plant, is belong to the family of duckweed that is very potential for poultry diet (Bell, 1998). The content of protein in duckweed reaches 30-35%, duckweed is also rich of essential amino acids such as lysine and methionine, important minerals, and xanthophyll pigment which is very good for the poultry diet. According to Porath et al. (1979) cited by Akter et al. (2011), duckweed contains balanced amino acid especially for lysine (6.9 g/100g protein), methionine (1.59 g/100g protein), potential mineral and pigment source for poultry especially beta-carotene and xanthophyll content. The amount of beta-carotene in Salvinia molesta, as one of the duckweed family, is 10 times higher than that in other plants, while the amount of xanthophyll content is 1,000 ppm. Based on Halolo and Silalahi (1997) cited by Sumiati and Sumirat (2003), Salvinia molesta in the form of dried meal can be used in broiler chicken diet up to the level of 12%.

In relation to the growth acceleration, Salvinia molesta is greatly possible to be used as a component of crossbred native chicken diet due to its high protein content. Animal needs energy and substrate supplies for optimal growth of sel or tissue that is achieved by diet containing adequate protein. According to Widyaratne and Drew (2011), feed intake is influenced by the diet quality, where is a balanced of diet protein influenced by amino acid concentration especially lysine. High quality diet for poultry usually contains complete and balanced amino acid to support growth. In addition, Suthama et al. (1998) reported that there was a close relationship between improved growth of native chicken and feed intake which is influenced by the availability of nutrient, especially protein. When diet contains more protein with better balanced and adequate amount of amino acid, it can increase body weight and efficiency of dietary protein utilization.

According to the background described previously, Salvinia molesta was used as a dietary component and its protein contributing effect for crossbred native chickens was evaluated. The response of crossbred chickens against the feeding effect of Salvinia molesta, based on protein utilization and growth, was discussed in the present study.

II. MATERIAL AND METHOD

The present study entitled “Nitrogen Retention and Productive Performance of Crossbred Native Chicken Due to Feeding Effect of Kayambang (Salvinia molesta)” was conducted from August 2012 to December 2012 at the Laboratory of Poultry Production, Faculty of Animal Science and Agriculture, Diponegoro University, Semarang. Samples of diet ingredient, meat, and excreta were analyzed at the Laboratory of Nutrition and Feed Science, Faculty of Animal Science and Agriculture, Diponegoro University.

A hundred birds of crossbred native chicken (crossing between male native chicken and modern laying hen) of 3-week-old with an average initial body weight of 218.76 ± 0.54g was used as experimental animals. The birds were placed at the battery cages equipped with feeder box and watering bowl. Corn, soybean meal, coconut oil, rice bran, fish meal, CaCO$_3$, premix, methionine, lysine, and Salvinia molesta were the components for experimental diet formulation. Salvinia molesta was obtained from Banyubiru river irrigation area (Central Java). Salvinia molesta was given in the form of dried meal. Diet was formulated containing approximately isoprotein (20 and 19% for starter and finisher periods, respectively) and isocaloric (2,900 kcal/kg for both starter and finisher periods) as shown in Table 1 and Table 2.

| Feed Ingredients | T0 | T1 | T2 | T3 |
|------------------|----|----|----|----|
| Corn             | 52.10 | 52.30 | 51.00 | 51.80 |
| Soybean Meal     | 21.30 | 17.00 | 14.00 | 10.80 |
| Oil              | 1.20  | 1.20  | 1.30  | 1.30  |
| Bran             | 16.80 | 15.90 | 15.10 | 11.80 |
| Fish Meal        | 5.00  | 5.00  | 5.00  | 5.00  |
| CaCO$_3$         | 0.80  | 0.70  | 0.40  | 0.40  |
| Premix           | 0.80  | 0.70  | 0.40  | 0.40  |
| Methionine       | 1.00  | 0.60  | 0.40  | 0.30  |
| Lysine           | 1.00  | 0.60  | 0.40  | 0.30  |
| Salvinia molesta | 0.00  | 6.00  | 12.00 | 18.00 |
| Total            | 100.00 | 100.00 | 100.00 | 100.00 |

**Nutrient Composition (kcal/kg):**

- **EM (kcal/kg):** 2,900,71 2,900,84 2,900,31 2,900,80
- **PK (%):** 20.32 20.04 20.27 20.33
- **LK (%):** 5.04 4.94 4.91 4.68
- **SK (%):** 6.22 8.36 10.57 12.10
- **Methionine (%):** 1.26 0.88 0.68 0.58
- **Lysine (%):** 1.55 1.15 0.95 0.82
- **Calcium (%):** 6.22 8.36 10.57 12.10
- **Phosphor (%):** 0.72 0.71 0.71 0.67

* ME was calculated with Balton formula that sited by Sibbald (1989)

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*** Table of Feedstuff Composition by Amrullah (2004)

The study was conducted using completely random design with 4 treatments and 5 replications (5 birds each), thus there were 20 unit experiments. Dietary treatments were as follows; T0 (diet without Salvinia molesta), T1 (diet with 6% Salvinia molesta), T2 (diet with 12% Salvinia molesta), T3 (diet with 18% Salvinia molesta). Experimental diets started to be offered from 3-week-old and completed when the chickens were 10-week-old. Diet and drinking water were offered ad libitum. The parameters observed were feed consumption, nitrogen retention, muscle protein mass, and body weight gain. Data were subjected to analysis of variance, and it was continued to Duncan test at a probably level of 5% when the treatment indicated significant effect.
Feed consumption, nitrogen retention, muscle protein mass, and body weight gain of crossbred native chickens were significantly (P<0.05) affected by feeding *Salvinia* (Table 3). Birds given control diet without *Salvinia* (T0) showed the lowest feed consumption (P<0.05) compared to other treatments with *Salvinia* (T1,T2,T3), but feed consumption among the three treatments (T1,T2,T3) were not different (Figure 1). The higher feed consumption of treatments T1, T2, and T3 compared to control could be caused by the difference of diet components. Since the treatments of T1, T2, and T3 composed of *Salvinia* it is obvious that its protein or amino acid contents contributed to the better amino acid balance due to the complementary effect with animal protein source used in the diet. *Salvinia*, an aquatic plant, is belong to the family of duckweed that is very potential for poultry diet (Bell, 1998). According to Porath et al. (1979) cited by Akter et al. (2011), duckweed contains balanced amino acid especially for lysine (6.9 g/100g protein), methionine (1.59 g/100g protein), potential mineral and pigment source for poultry especially beta-carotene and *xanthophyll* content. The amount of beta-carotene in *Salvinia*, as one of the duckweed family, is 10 times higher than that in other plants, while the amount of *xanthophyll* content is 1,000 ppm.

### III. RESULTS AND DISCUSSION

According to Widyaratne and Drew (2011), feed consumption is influenced by the diet quality, where is a balanced of diet protein influenced by amino acid concentration especially lysine. High quality diet contains complete and balanced amino acid is important to be effectively used by poultry to support its growth. In addition, Suthama et al. (1998) reported that feed consumption is influenced by the availability of nutrient, especially protein attributed by complete essential amino acids. When diet contains more protein with better balanced of amino acid, it can increase feed consumption and efficiency of dietary protein utilization.

Table 3. Feed consumption, nitrogen retention, muscle protein mass, and body weight gain of crossbred native chicken given *Salvinia molesta*

| Parameters | Treatment | T0 | T1 | T2 | T3 |
|------------|-----------|----|----|----|----|
| 1. Feed Consumption (g/bird/day) | 38.08* | 47.95* | 51.63* | 54.30* |
| 2. Nitrogen Retention (g) | 1.11* | 1.92* | 1.90* | 1.90* |
| 3. Muscle Protein Mass (g) | 51.40* | 126.32* | 140.37* | 134.98* |
| 4. Body Weight Gain (g/bird) | 308.56* | 657.12* | 721.20* | 733.12* |

Value bearing different superscript in the same row indicated significantly different (P<0.05)

The increased feed consumption resulted in the present research was in lines with the increase in amino acid content in diet, especially lysine. Thi My Tu (2012) reported that feed consumption in duck increased from 92.1g to 104g by feeding effect of duckweed contained 30% protein. The present result was also similar with the finding of Donsbough (2008) that the increase in feed consumption of broiler from 37.49g to 40,66g was consistent with the increase in dietary amino acid, especially lysine.

The pattern of nitrogen retention was similar to that of feed consumption which dietary *Salvinia* treatments (T1,T2,T3) resulted significantly higher nitrogen retention (P<0.05) when compared to control (T0) as shown in Figure 2. Nitrogen retention should be have a close relationship with the efficiency of protein utilization. Dietary protein have a positive correlation with protein consumption, while nitrogen retention influenced by protein consumption. This phenomenon was supported by the data of protein consumption, namely, treatment T1, T2 and T3 was 11.21; 11.01 g/bird/day, respectively, and these values were higher than that of control (8.69 g/bird/day). Suthama et al. (2010) obtained that there is a close interrelationship between the increasing protein diet and protease enzyme activity, where the higher enzyme activity, the better nitrogen retention resulted due to the biochemical process of dietary protein hydrolysis. Nitrogen retention is also influenced by dietary...
energy supply. It was still supported by the finding of Suthama (2010), when dietary energy is not available enough, although protein as a substrate is available, it can inhibit the utilization of nitrogen or nitrogen retention process.

Based on Elvina (2008), there is factor that influenced energy in poultry, that is polysacaride (cellulosa and hemicellullosa) in crude fiber fraction. Polisacaride in crude fiber fraction that can be digested will increasing an energy supply for poultry. Based on Sumiati and Nurhaya (2003), hemicellulosa content of Salvinia is higher than cellullosa, hemicellullosa content of Salvinia is 11.35%, while cellulosa is 8,11%, and hemicellullosa have a higher digestibility (66,67%) than cellulosa (5,28%). Nitrogen retention that resulted in this treatment (T1,T2,T3) is better that reported by Iskandar et al. (2001). Iskandar et al. (2001) found that nitrogen retention in 12 weeks old of crossbred native chicken that feeding with 19% protein is 1,52g.

Muscle protein mass also indicated similar pattern as that of other parameters described previously. Feeding Salvinia (T1, T2, T3) resulted significantly higher (P<0.05) muscle protein mass when compared to control (T0), however, there was no difference among T1, T2, and T3 (Figure 3). It can be clearly described that muscle protein mass was getting better because of the feeding Salvinia. Considering Salvinia contains higher protein (32.25%) compared to other plant feedstuffs. It is very logic that the higher protein supply bring about the better metabolism for growth through the increase in body protein synthesis indicated by muscle protein mass.

The distinctive body weight gain between the Salvinia feeding treatment and control was caused by the higher feed consumption and level of muscle protein mass. Nutrient consumption, indicated by higher feed consumption, especially protein, functions as the substrate to built a better balance between substrate (nutrient) and hormone that takes part in growth (Suthama et al., 1998). The higher supply of dietary protein can ensure the better nutritional as well as hormonal balance and brought about lower protein degradation and higher rate of protein synthesis, producing higher muscle protein mass and finally leads to gain in body weight (Suthama et al., 2010).
categorized good because it was supported by the low value of feed conversion ratio (T1, T2, and T3 was 3.69, 3.56, and 3.44, respectively) as compared to control (6.43).

IV. CONCLUSION

Feeding Salvinia up to the level of 18% can increase nitrogen retention and leads to producing better muscle protein mass and higher body weight gain.

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