NUTRIENT CONCENTRATE FERMENTATION BASED SHRIMP WASTE AND EFFECT ON PRODUCTION PERFORMANCE PHASE LAYER NATIVE CHICKEN

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Abstract

Efforts toward improving the quality of waste containing high chitin through bioprocess shrimp waste utilizing Bacillus licheniformis, Lactobacillus sp. and Saccharomyces cerevisiae, in order to obtain the product (Nutrient Concentrate) quality in order to meet the nutritional needs of local poultry (native chicken). Biological test products in the ration to determine its effectiveness towards achieving the optimal performance needs to be done. Native chicken has an important role as a provider of meat and eggs to be relied. The study was conducted using a laboratory experiment using a completely randomized design, consisting of 6 treatments rations and each repeated four times. Ration treatment: R0 = control diet (15% protein and ME 2,750 kcal/kg); R1 = rations containing 5% Nutrient Concentrate (Protein 15% and ME 2,750 kcal/kg); R2 = ration containing 10% Nutrient Concentrate (Protein 15% and ME 2,750 kcal/kg); R3 = rations containing 15% Nutrient Concentrate (Protein 15% and ME 2,750 kcal/kg); R4 = rations containing 20% Nutrient Concentrate (Protein 15% and ME 2,750 kcal/kg); and RS = standard ration (Protein 18% and ME 2,750 kcal/kg). Variables observed that the performance of native chicken layer phase (egg weight, number of eggs, daily egg production and feed efficiency) and hematological values chicken blood (erythrocytes, leukocytes, and blood hematocrit). Data were analyzed by analysis of variance and differences between treatments were tested by Duncan's multiple range test. The results obtained by the performance of native chicken layer phase with the use Nutrient Concentrate at the rate of 20% in the ration equivalent to the standard ration, the weight of the eggs ranged from 40.51 to 43.46 g/grain, the number of eggs from 32.37 to 33.16 grains/2 months, han-day 53.95% - 55.26% and feed efficiency of 54.02% - 58.95% . Values range chicken blood hematological phase in the normal range, the number of erythrocytes ranged from 2.06 to 2.16 ×10⁶/mm³; leukocytes from 36.42 to 37.27 ×10³/mm³; and hematocrit 33.25% - 34.25%. Nutrient Concentrate can be used as a source of animal protein in the ration formulation native chicken layer phase and use up to the level of 20%.

Key words: nutrient concentrate, shrimp waste, bioprocess, layer phase, native chicken.

INTRODUCTION

Industrial waste material processing frozen shrimp is the potential to serve an alternative feed ingredients for poultry. It is based on nutritional content, ie: 43.41% crude protein, 18.25% crude fiber, 7.27% fat, 5.54% calcium, 1.31% phosphorus, 3.11% lysine, 1.26% methionine and 0.51% cystine, and gross energy 3,892 kcal/kg (Abun, 2008). Factors limiting the use of waste materials such as poultry feed is the presence of chitin in the amount of about 15-20%. Chitin bind strongly to protein, fat and mineral covalent bond β-(1-4) so difficult to be digested by the digestive enzymes of poultry (Leeson and Summers, 2001). Poultry do not have enzymes that can break the glycosidic bond β-(1-4), so that before used as feed material, the waste must be processed first. One of the efforts to transform organic material into useful new products and nutritional value better is to exploit microbes through bioprocess.

Bioprocess shrimp waste can be done in two phases, namely deproteination using Bacillus licheniformis, and demineralization with Lactobacillus sp. and Saccharomyces cerevisiae. Bacillus licheniformis is a bacteria that can produce protease and chitinase in relatively large quantities (Williams and Shih, 1989; Rahayu et al., 2004). Lactobacillus sp. a microbial decomposers glucose, sucruse,
licheniformis digestibility fermented with kcal/kg to 2,103 kcal/kg (Simanjuntak, 1998). Metabolizable energy by 14% from 1,844 chickens, and the result is an increase in it needs to be considered, as feed additives can improve the quality and value of benefits in native chicken rations. Thus, it is necessary to find alternative feed additives are inexpensive, easy to obtain, the quality is good, as well as non-food. One of them is the use of shrimp waste processed with fermentation technology and hereinafter referred Nutrient Concentrate. Indonesia is the country's third largest shrimp producer in the world, annually produced about 0.08 million tons from an area of 380,000 hectares of shrimp ponds. Approximately 80-90% of the shrimp is exported in frozen form without heads and skins. Skin, head, and tail shrimp is industrial waste from factories freezing of shrimp, this waste can reach 30 - 40% of the weight of the whole (Krissetiana, 2005). The use of shrimp waste processed product is a source of alternative feed ingredients that can be used in the preparation of chicken rations.

Experts have conducted research to test the product bioprocess. Measurement of metabolizable energy product of fermentation residue oil palm by Aspergillus niger in broiler chickens, and the result is an increase in metabolizable energy by 14% from 1,844 kcal/kg to 2,103 kcal/kg (Simanjuntak, 1998). Increasing the value of shrimp waste protein digestibility fermented with Bacillus licheniformis and Aspergillus niger amounted to 13.27% (from 63.44% to 71.86%) in broiler chickens (Abun, 2008). Improving the quality of nutrition bioprocess resulted in complex molecules or organic compounds such as proteins, carbohydrates and fats into molecules that are simpler and easier to digest (Darana, 1995).

Native chicken has long been known by the people of Indonesia as the local chicken, chicken vegetable, or chicken, in Latin is known Gallus domesticus. Range chicken accounts for 20 to 40% of eggs and 25% of meat consumed in the country (Directorate General of Livestock, 2014). Native chicken is more likely to be developed as farm people, given the domestic poultry does not require substantial capital investment, easy maintenance, high adaptability, as well as meat and eggs are more favored by the public.

In general, native chicken reared traditionally-extensive (production is low and the mortality rate is high enough), causing the population to fluctuate from time to time. According to Rasyaf (1990), the potential and prospects of native chicken is very good but to date information and research on the development of native chicken is still small. The low level of productivity of native chicken is influenced by genetic and environmental factors. Genetic factors are poorly coupled with means and feeding the still traditional is the cause of low production of native chicken, both growth and egg production. Egg production reached only 30-60 eggs per year with an average egg weight of 37.5 grams per egg (Kingston, 1982).

Rations containing Nutrient Concentrate bioprocess products sought a positive influence on the performance of native chicken layer phase. It is understood by paying attention to the health of livestock is to know the condition of hematologic. Hematologic circumstances and in accordance with animal health standards causing the transport of oxygen and nutrients into the body to be smooth so the metabolic processes in the body, the better and, in turn, can increase the productivity of native chicken.

MATERIALS AND METHODS

(a) Preparation of "Nutrient Concentrate"

Deproteination. Starter inoculum B. licheniformis cultivated in 50 ml broth and incubated for 2 days at a temperature of 50°C, then inoculated on shrimp waste substrate with a dose of 2% (v/w). Liquid substrate fermentation is done using auto-shakerbath for 2 days at a temperature of 45°C with a rotation of 120 rpm (Abun et al., 2012).

Demineralization. Starter inoculum Lactobacillus sp. cultivated, mixed standard
solution (0.5% (w/v) yeast extract, 0.5% NH₄NO₃; 0.05% KCl; 0.05% MgSO₄; 0.01% FeSO₄; and 0.001% CuSO₄), inoculum of Lactobacillus sp. added to the product deproteinization a dose of 2% (v/w) for 2 days at a temperature of 45°C with a rotation of 120 rpm (Abun et al., 2012).

Fermentation with Saccharomyces cerevisiae. Saccharomyces cerevisiae pure cultures were incubated for 3 days, then made inoculum to prepare a standard solution (NH₄NO₃ 0.5%; 0.05% KCl; MgSO₄.7H₂O 0.05%; FeSO₄.7H₂O 0.01%; and CuSO₄.5H₂O 0.001 %) and then fermented in auto-shakerbath. Product demineralization, then added inoculum of Saccharomyces cerevisiae sp. cultivated, mixed standard solution (0.5% (w/v) yeast extract, 0.5% maltose and lactose into lactic acid, causing (Wagstaff, 1995).

Native chicken has long been known by the public, meat is easy to obtain, the quality is good, as well as find alternative feed additives are inexpensive, improve the quality and value of benefits in the digestive organs (Wagstaff, 1995).

It needs to be considered, as feed additives can be added to the diet can be done by adding the feed additives. Fulfillment of nutrients in the diet meets the requirements in sufficient quantities and balanced. The production of feed additives can be obtained from shellfish waste or shrimp waste from factories without heads and skins. Skin, head, and tail of the shrimp is industrial waste from factories 90% of the weight of the whole (Krissetiana, 2005). The use of shrimp waste processed 40% of the weight of the whole (Krissetiana, 2005).

The experiments were performed using the experimental method in the laboratory. The experimental design used was a completely randomized design, consisting of 6 treatments ration (R0 = ration low in protein / 15%; R1 = rations containing 5% Nutrient Concentrate / protein 15%; R2 = rations containing 10% Nutrient Concentrate / protein 15%; R3 = rations containing 15% Nutrient Concentrate / protein 15%; R4 = rations containing 20% Nutrient Concentrate / protein 15%; and RS = high ration protein18%) and each repeated four times. Data were analyzed with Fingerprint Car (Test F) and the differences among the treatments tested using Duncan's Multiple Range Test.
RESULTS AND DISCUSSIONS

The average egg weight, number of eggs, the daily production and feed efficiency of native chicken layer phase for 8 weeks (2 months) experiment is shown in Table 1.

Table 1. Egg weight, number of eggs, eggs daily production and efficiency phase native chicken layer rations for 8 weeks (2 months) trial

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatments</th>
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<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Egg Weight (g/item)</td>
<td>44.21A</td>
</tr>
<tr>
<td>Number of Eggs (grains)</td>
<td>32.37A</td>
</tr>
<tr>
<td>Eggs Daily Production (%)</td>
<td>53.95A</td>
</tr>
<tr>
<td>Efficiency Ration (%)</td>
<td>59.53A</td>
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The average weight range chicken eggs experimental results ranged from 40.51 to 44.65 grams/grain. The analysis showed that the treatment ration showed no significant differences (P>0.05) to the weight range chicken eggs. Use of Nutrient Concentrate up to the level of 20% in native chicken ration phase layer does not affect the egg weight.

The average number eggs of native chicken layer phase for 8 weeks of the experiment results ranged from 32.37 to 33.16 grains. The analysis showed that the treatment ration showed no significant differences (P>0.05) to the number eggs of native chicken layer phase. Use of Nutrient Concentrate up to the level of 20% in native chicken ration phase layer does not affect the number of eggs.

The mean hand day production range native chicken eggs for 8 weeks of the experiment results ranged from 53.95 to 55.26%. The analysis showed that the treatment ration showed no significant differences (P>0.05) on hand day production range native chicken eggs. Use of Nutrient Concentrate up to the level of 20% in native chicken ration phase layer does not affect the hand day egg production.

The average efficiency feed of native chicken trial results for 8 weeks ranged from 54.02 to 59.53%. The analysis showed that the treatment ration showed no significant differences (P>0.05) on the efficiency of feed utilization of native chicken. Use of Nutrient Concentrate up to the level of 20% in native chicken ration phase layer does not affect the efficiency of feed utilization.

Use of Nutrient Concentrate up to the level of 20% in the diet did not negatively impact performance in native chicken egg production, and the results were equivalent to a standard diet (18% protein ration). Chicken body weight during the study are relatively homogeneous with a coefficient of variation of body weight ranged between 3.80% - 4.07%, with each chicken feed consumption of 75 g/day.

The mean value of erythrocytes, leukocytes, and blood hematocrit range native chicken layer phase containing rations Nutrient Concentrate for two months trial are presented in Table 2.

Table 2. Values of erythrocytes, leukocytes, and blood hematocrit native chicken phase layer rations containing nutrient concentrate for two month trial

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatments</th>
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<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Erythrocytes (×10⁶/mm³)</td>
<td>2.18AB</td>
</tr>
<tr>
<td>Leukocytes (×10³/mm³)</td>
<td>36.07AB</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>33.00B</td>
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The average value range chicken blood erythrocyte experiment results for 8 weeks ranged from 2.065 to 2.221×10⁶/mm³.

The analysis showed that the treatment ration significant effect (P<0.05) to native chicken blood erythrocytes.

Use of Nutrient Concentrate in the ration at the rate of 20% (R4 /15% protein) did not show
significant differences (P>0.05) with standard ration (RS / 18% protein) against the value of the phase range chicken blood erythrocyte layer. Normal red cell count in chickens according to Smith (1987) ranged from 2.0 to 3.2 × 10⁶ grains/mm³, mean blood erythrocyte value of native chicken are still in the normal range. The number of erythrocytes per mm³ of blood varies according to species and also between individuals within a species. According to Swenson (1977), the number of erythrocytes is influenced by several factors, including age, sex, diet quality, disease and environmental temperature.

The mean value of native chicken blood leukocyte 8-week experiment results ranged from 36.07 to 37.27 ×10³ / mm³. The analysis showed that the treatment ration significant effect (P <0.05) on blood leukocytes range chicken. Use of Nutrient Concentrate in the ration at the rate of 20% (R4 / 15% protein) did not show significant differences (P>0.05) with standard ration (RS / 18% protein) against the value of the phase range chicken blood erythrocyte layer. The content of leukocytes from the research results within the normal range according to Smith (1987) that is between 16-40 ×10³ grains/mm³. Chicken means not impaired in their blood because of physiological systems across flats are within the normal range. According to Brown, et al (1989), the number of erythrocytes and leukocytes far below varies depending on the type of animal. Fluctuations in the number of leukocytes in each individual is quite large on certain conditions such as: stress, physiological activity, nutrition, age, and others. Frandson (1993), stated that increasing the number of leukocytes is generally a sign of infection or injury.

The mean blood hematocrit values range chicken for 8-week results of the experiment ranged from 33.00 to 34.25%. The analysis showed that the treatment ration significant effect (P <0.05) on blood hematocrit values range chicken. Use of Nutrient Concentrate in the ration at the rate of 20% (R4 / 15% protein) significantly (P <0.05) higher than the standard ration (RS / 18% protein) against native chicken blood hematocrit values phase layer. Normal hematocrit values in chickens according Sturkie (1986) ranged from 29-40%, meaning chicken not impaired in their blood because of physiological systems across flats are within the normal range. The high hematocrit value caused by the tendency of the red cell count is high. According to Swenson (1977), hematocrit value has a positive relationship with the number of erythrocytes. Frandson (1993), adding that the hematocrit value is the percentage of blood that consists of red blood cells (erythrocytes). Hematocrit value of all treatments on the results of this study are in the normal range.

Native chicken by layer phase containing rations Nutrient Concentrate 20% during the study had hematologic value good (healthy) and decent as test animals. The fact that the value of the erythrocytes obtained ranged from 2.06 to 2.2 ×10⁶ grains/mm³ in the normal range (poultry ranged between 2.0 to 3.2 ×10⁶ grains/mm³). Leukocyte values ranged from 36.07 to 37.27 ×10³ grains/mm³ in the normal range (poultry ranged between 16-40 ×10³ grains/mm³). Hematocrit values ranged from 33.00 to 34.25% in the normal range (poultry ranges between 29-40%).

CONCLUSIONS

Production of the optimal range native chicken eggs for 60 days of maintenance is the treatment of rations containing 20% Nutrient Concentrate with the average egg weight 40.51 g/grain; the number of eggs 32.37 grains; and the production of hand-day 53, 95%; the feed efficiency of 54.02%.

Nutrient Concentrates can be used up to a level of 20% in native chicken ration phase layer without affecting the health of chickens (erythrocytes = 2.06 to 2.22 × 10⁶/mm³; leukocytes = 36.07 to 37.27 × 10³/mm³; and hematocrit = 33.00 to 34.25%).

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