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EGG QUALITY OF SELECTED ACEH NATIVE CHICKENS FED ON THE DIETS COMPOSED OF *Indigofera* sp. MEAL BASED ON FEED FERMENTATION AS PARTLY SUBSTITUTION OF COMMERCIAL DIET

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ABSTRACT

The objective of this study was to determine the effect of inclusion of fermented feed consisted of 15% *Indigofera* sp. + 40% rice bran + 25% corn bran + 20% soybean meal as partial substitution of commercial diet on the egg quality of selected Aceh native (SAN) chickens. As many as 48 SAN pullets were used in this study. The study was performed in a completely randomized design, consisted of 4 treatments and 4 replications. Each replication was an experimental unit consisted of three chickens. The results of study indicated that inclusion of up to 15% fermented feed which was composed of 15% *Indigofera* sp. + 40% rice bran + 25% corn bran + 20% soybean meal as substitution of commercial layer diet significantly (P<0.01) improved yolk index without adverse effect on albumen and eggshell quality of SAN chickens. As conclution, substitution of fermented feed contained 15% indigofera may improve the egg quality of SAN chickens.

Key words: *Indigofera* sp., fermentation, native chicken, egg production

ABSTRAK

Tujuan dari penelitian ini adalah mengetahui pengaruh pemberian pakan fermentasi yang mengandung 15% Indigofera sp. + 40% dedak padi + 25% dedak jagung + 20% bungkil kedelai sebagai substitusi sebagian dari pakan komersial terhadap kualitas telur ayam lokal Aceh. Penelitian ini menggunakan rancangan acak lengkap, terdiri atas 48 ekor ayam lokal Aceh betina yang dibagi menjadi 4 perlakuan pakan dan 4 ulangan. Setiap ulangan sebagai unit percobaan yang terdiri atas 3 ekor ayam. Hasil penelitian menunjukkan bahwa subtitusi hingga 15% pakan fermentasi yang yang mengandung 15% indigofera + 40% dedak beras + 25% dedak jagung + 20% bungkil kedelai sebagai pengganti pakan komersial secara signifikan (P<0,01) meningkatkan kuning telur indeks tanpa memengaruhi kualitas albumen dan kulit telur ayam lokal Aceh. Dari penelitian ini dapat disimpulkan bahwa subtitusi pakan fermentasi yang mengandung 15% tepung indigofera dapat meningkatkan kualitas telur.

Kata kunci: Indigofera sp., fermentasi, ayam lokal, kualitas telur

INTRODUCTION

There are 31 clusters of identified Indonesia native chickens that had been living and breeding under different habitat (Nataamijaya, 2000). Besides more preferable egg and meat taste, native chickens had been thought more resistance to the disease and under extremely high temperature condition (Chen *et al*., 1993). Many efforts had been performed to upraise the potency of native chickens. Selected Aceh native (SAN) chicken is one of the outcomes of developing the genetic quality of native chickens. These chickens had been resulted through a long process of selection stages of their parents including *progeny test* at every phase of their chicks in order that achieving the criteria of better production than commonly native chickens (Nataamijaya, 2006).

The most important issue of genetic quality of native chicken is low production and egg quality that possibly caused by improperly nutrient intake (Yaman *et al*., 2000). Therefore, feeding the hens by commercial laying hen diets would be a better solution. However, the price of commercial diets would not be more economics as native chickens were fed those diets out of genetic respond. The way to solve this problem is by manipulating of their nutrition to maximize the properly nutrient intakes based on their genetic capability with furnishing a cheaper diet. It could be carried out by withdraw partially of commercial diet followed by substitute it with various alternative local feeds such as indigofera leaf.

Indigofera (*Indigofera zollingeriana)* is the legume belong to the family *rosales* and *subfamily leguminosainosae* (Hassen *et al.,* 2006). The plant leaf has rich protein (20.47-27.60%) and potentially served as poultry feedstuff (Abdullah and Suharlina, 2010). High tolerance to dry season and high salinity makes this legume appropriate planted in Indonesia (Hassen *et al*., 2006). It was well known that xanthophylls and β-carotene existing in the plant could improve yolk color.

As commonly plant feed sources, high crude fiber contained in indigofera should be the limited factor for include it in to the poultry diets. The content of crude fiber in indigofera was between of 10.97 and 21.40% (Abdullah and Suharlina, 2010). However, fermentation process can reduce the fiber content and enrich the nutritive value of the plant. The aim of present study was to determine egg quality laid by SAN hens fed the commercial diet substituted with up to 15% of indigofera meal based fermentation-feed.

MATERIALS AND METHODS

The research was conducted at the Field Laboratory of Animal Husbandry, Universitas Syiah Kuala for 3.5 months. As many as 48 SAN pullets developed at the

Field Laboratory of Animal Husbandry, Universitas Syiah Kuala, were used in this study.

The experiment used commercial laying hen diet with the code of N524 produced by PT Charoen Pokphand, Medan, Indonesia as base diet (control, diet A). The diet was partly substituted with the level of 5% (diet B), 10% (diet C), and 15% (diet D), respectively of fermentation feed based on mixing 15% indigofera + 40% rice bran + 25% corn bran + 20% soybean meal. The protein content of fermented feed was formulated to be isoprotein and closely meet that of commercial diet. The composition of experimental diets and calculated nutrient contents were given in Table 1.

The preparation of fermentation feed was run as follow: indigofera leaf was cropped at the Ie Suem Farm Syiah Kuala University, then dried and grinded to be a powder form. The indigofera meal then mixed with rice bran, corn bran, soybean meal, and followed by spraying sugar water solution. Probiotic EM4 was poured into the feed then mixed homogenously. Finally, the feed was filled into the plastic bag and tightly tied then preserved in room temperature for 48 hours. Afterward, the feed was removed from the plastic bag and kept exposed under room temperature for 5 days. The study was performed into completely randomized design (CRD) consisted of 4 diet treatments and 4 replications. Each replication was an experimental unit consisted of three SAN chickens. Forty eight SAN hens at 24 weeks of age were selected from the colony flock at the Field Laboratory of Animal Husbandry, Universitas Syiah Kuala, with body weight between 1000 and 1200 g. The birds were randomly placed into the battery of 2-tier cages for which each battery consisted of three birds. The birds were fed experimental diets *ad libitum* for 2.5 months. At 24 weeks of age, six eggs laid in each battery were collected to measure egg quality.

Parameters of this study were yolk index, albumen index, yolk color, haugh unit (HU), and egg shell thickness. The eggs were cracked on the breakout flat table. Yolk index was calculated by dividing the yolk height and the yolk diameter. Albumen index was calculated by dividing albumen height and its average diameter. Both the height of yolk and albumen were measured using tripod caliper, while yolk and albumen diameter were measured using digital micrometer. Yolk color and HU were determined using egg analyzer. Egg shell thickness was measured using precision egg shell thickness gauge.

The data were statistically analyzed by analysis of variance and continued by Duncan Multiple Range Test (DMRT) only if significant effects were detected among the treatments with the procedure following Ott (1993).

RESULTS AND DISCUSSION

The averages of egg qualities of (SAN) chickens recorded in this research were shown in Table 2.

Yolk Index

The main parameters of yolk quality evaluated in

Tabel 1. The compositions of experimental diets

Ingredients	Diet			
	A	B	C	D
			(%)	
Commercial diet (N524)[1]	100	95.00	90.00	85.00
Fermentation feed based on 15% of indigofera	0	5.00	10.00	15.00
Calculated nutrient contents				
Protein (%)	17.00-18.00	16.80-17.75	16.61-17.51	16.42-17.27
Crude fiber (%)	7.00	6.84	6.67	6.51
Ether extract (%)	7.00	7.35	7.70	8.05

[1]Chemical composition according to market label of product made up of PT Charoen Pokphand: Protein 17-18%, crude fiber 7.0%, crude fat 7.0%, Ca 3.25%, and P 0.60%. [2]Chemical composition according to the results of analyzing Laboratory Nutrition and Feed Technology Universitas Syiah Kuala (2017): Protein 13.17%, crude fiber 3.71%, and crude fat 14.03%

Tabel 2. The average of egg quality of SAN hens

Parameter	Experimental diets			
	A	B	C	D
Yolk Quality				
Yolk height (mm)	13.84±0.60	14.58±0.26	14.14±0.61	14.23±0.36
Yolk diameter means (mm)	38.83±1.58^{a}	36.66±0.76^{b}	36.47±1.35^{b}	36.84±0.32^{b}
Yolk index	0.36±0.02^{a}	0.40±0.01^{b}	0.39±0.02^{b}	0.39±0.01^{b}
Yolk color	4.81±0.24	4.56±0.31	4.69±0.43	4.50±0.20
Albumen quality				
Albumen height (mm)	3.11±0.67	2.83±0.42	2.64±0.17	3.18±0.68
Albumen diameter (mm)	71.14±3.95	68.20±3.42	69.29±4.91	70.07±6.23
Albumen index	0.044±0.012	0.042±0.008	0.038±0.003	0.045±0.008
HU	58.48±8.51	57.48±5.55	56.03±3.45	60.56±5.07
Eggshell				
Eggshell thickness (mm)	0.35±0.004	0.34±0.017	0.33±0.021	0.35±0.036

$^{a, b}$Means in the same rows with different superscripts indicated significantly difference (P<0.05). A= control diet, B= 95% commercial diet + 5% fermentation feed based on 15% *Indigofera* sp., C= 90% commercial diet + 10% fermentation feed based on 15% *Indigofera* sp., and B= 85% commercial diet + 15% fermentation feed based on 15% *Indigofera* sp.

this study were yolk index and yolk color. Yolk index describes the viscosity of yolk and it was an indicator to the yolk qualty. It was known that the higher yolk index, the quality of egg yolk will be better. Results showed that substitution of 15% indigofera meal as partly substitution of commercial diets significantly affected (P<0.05) yolk index of SAN hens. The eggs laid by the hens fed the diets containing the 15% indigofera meal based fermentation-feed (diet B, C, D) had higher yolk index (P<0.05) than those fed on control diet (diet A). The eggs from the treatment diets B, C, and D had significantly (P<0.05) shorter yolk diameter and higher yolk height causing the increasing of yolk index. It was assumed that using 15% indigofera meal based fermentation-feed as a partly substitute of commercial diet increased the quality of yolk.

Yolk indexes of all birds in this research ranged between 0.36 and 0.40 and considered matching to standard value. The eggs measured in this study were fresh eggs, hence they had good viscosity. Fresh eggs had low variation in yolk index (Mountney and Parkhurst, 1995) but not for stored eggs. It was clear that utritional factor (Tiller, 2001) and various farming systems was pointed to the fact that the particular system used influences the quality of eggs, where alternative systems often tend to produce eggs of lower quality (Ledvinka *et al.*, 2012). Indigofera has rich protein (Hassen *et al.* 2007) and protein content in the diet affected the yolk viscosity and further affecting the yolk index (Wilson, 1975). Yolk quality is also determined by the availability of types of vitamins and minerals feeding in the long term to the chicken. It was assumed that important role in influencing egg yolk pigmentation is the high content of beta carotene and xanthophyll in indigofera leaves available compared to other forages.

Yolk Color

Result showed that fed on the 15% indigofera meal based fermentation feed as partly substitution of commercial diets did not significantly affect (P>0.05) the yolk color of SAN hens. This result was contrary to the report of Akbarillah *et al*. (2008) which observed that inclusion of indigofera meal in the quail feed significantly increased yolk color of quail eggs. Supplementation of *Indigofera zollingeriana* top leaf meal with a dose of 3-6% in rations increased the color of the yolk in duck dan quail eggs (Yaman *et al.*, 2012).

Yolk color was affected by yellow pigment such as xanthophylls and ß-carotene (Damron *et al.*, 1984; Gross, 1991) existing in the feedstuffs. Physiologically, the pigment was absorbed in the small intestine of hens and then transported to the target organs. Fermentation feed caused a retardation of the absorption of pigment due to the increasing of mucosa production in the intestine released from goblet cells due to a high microbe activity in probiotic (Brummer *et al*., 2010) such as EM4. However, the diet was not the only factor affecting yolk color, but strain, individual variation, and the number of egg production were considered influence it as well (North and Bell, 1990).

Yolk index and yolk color of SAN hens of all treatment diets was shown in Figure 1. Yolk colors of all hens in this study were in the range of 4.50-4.81. Based on Stadellman and Cotteril (1995), good yolk color was in the range of 7-12. Low yolk color in this study was suspected the response of ANS to different diet wa low due to egg was recorded in the early month of egg production stage that enable the pigment has not been completely absorbed.

Albumen Index

Results of analysis of variance showed that inclusion of the 15% indigofera meal based fermentation-feed as partly substitution of commercial diets did not significantly affect (P>0.05) the albumen index of SAN chickens. No significant effects were detected on both albumen diameters and albumen height. Albumen indexs of eggs of all hens in this study were in the range of 0.038-0.045. This value was lower than that of commonly laying hens. The value of albumen index was recommended at the range of 0.09-0.12 (Buckle, 1987). It means the SAN hens fed the diets containing the 15% indigofera meal based fermentation-feed (diet B, C, D) produced the albumen quality relatively equal to those fed 100% commercial diets (diet A). According to Jacob *et al*. (2011), albumen quality of the egg was not greatly influenced by hen nutrition. A high level of positive correlation

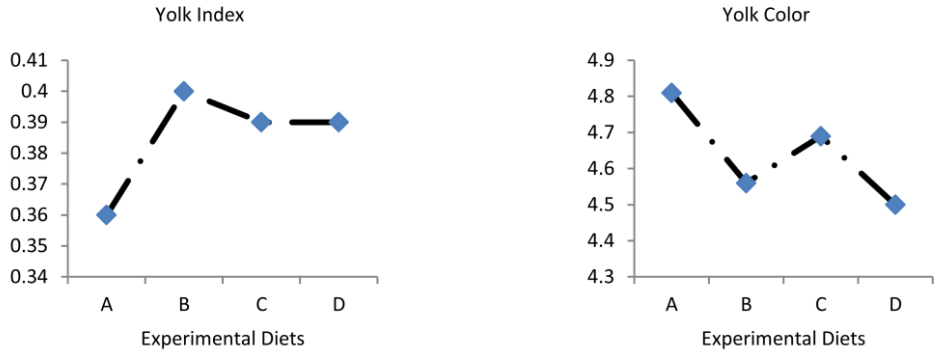

Figure 1. Yolk index dan yolk color of SAN hens

was found between the weight of the egg as a whole and the weights of its constituent parts, in particular the albumen and yolk. The masses of yolk and albumen were greater in heavier eggs compared to smaller ones (Silversides and Scott, 2001).

Haugh Unit

Haugh Unit (HU) describes the relationship between albumen height and egg weight (Stadellman and Cotterill, 1995). The similar result found in the albumen index, the HU of SAN hen was similar to that of commonly laying hens. The HU of all hens in this research were in the range of 56.03-60.56 and matching to B quality. The eggs with HU value in the range of 31-60 and 60-72 are classified into B and A quality, respectively (Nesheim *et al*., 1979). The subtitution of indigofera to 15% in feed did not change the HU of ASN. This proved that the subtitution of indigofera leaf reduced the use of commercial rations without affecting HU. According to USDA (2000), good quality of egg has HU more than 72. In this study, ASN response to substitution of indigofera associated with changes in HU was still influenced by the age factor of chickens where young chickens have a low response to feed changes.

Eggshell Thickness

SAN chicken fed on 15% indigofera meal-based fermentation-feed as a partly substitution of commercial diets did not significantly affect (P>0.05) the eggshell thickness. There were no obviously evidences that feeding SAN hens with the diet containing 15% indigofera meal based fermentation-feed deteriorated the eggshell.

The eggs of all chickens in this experiment had the thickness of eggshell in the range of 0.33-0.35 mm. These numbers were exactly the same as reported by Steward and Abott (1987) studying in laying hens. Since the level of calcium in the diet was responsible to the eggshell thickness, substitution of feed fermentation containing 15% indigofera meal up to 30% considerably ensured the sufficiency of calcium availability in the diet.

CONCLUSION

Based on this experiment, it had been concluded that the inclusion of up to 15% fermentation feed which was composed of 15% indigofera + 40% rice bran + 25% corn bran + 20% soybean meal as substitution of commercial layer diet improved yolk index. However, no adverse effect was observed on albumen and shell quality of SAN chickens.

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