AN INVESTIGATION ON REPRODUCTIVE PERFORMANCE OF AC CHICKEN FROM 28 – 39 WEEKS OF AGE

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ABSTRACT

The study aimed to identify the reproductive performance of Vietnamese local chickens, named Ac chickens, from 28 – 39 weeks of age. This study was implemented in Tra Vinh Province, Vietnam. The study was a descriptive study using a total of 150 native layers, which were split into 4 periods to record the data (1^{st} – 4^{th} observation). The results showed that egg production rate and egg weights slightly decreased from the first to the final observation and showed the highest performance at the1^{st} and 2^{nd} observation (28-33 weeks of age), while feed intake per 10 eggs, eggshell thickness, yolk index, albumen index, shape index, Haugh unit, and yolk color increased. For feed intake per hen, it is not truly different when compared to other periods. From 28-39 weeks of age, theegg production rate was 54.55, feed intake was 60.84 g/hen, 1.118 kg feed produced 10 eggs, the average egg weight was 41.63 g, yolk color was 10.61, and the Haught unit was 86.16.It can be concluded that Ac layers from 28-39 weeks of age reached peak production at 28-33 weeks of age; however, egg quality was the best at 34-39 weeks of age.

Keywords*: native chickens, reproduction, descriptive study, laying phases.*

INTRODUCTION

Recently, poultry production has not only grown in quantity but also made many strides in raising methods, especially applying science and technology to animal husbandry. As mentioned in the study of Charoensin et al. (2021), native chickens have been developing in Asian countries, including Vietnam. The development of native chickens has significantly contributed to human consumption and has been an interesting topic for scientists. It contains a considerable amount of bioactive substances when compared to commercial species (Sangsawad et al., 2017). The income from poultry production accounts for 32.5% of the total household income. In addition to their economic role, indigenous chicken breeds play an important role in the cultural and social relations of the Vietnamese people (Duy et al., 2020)

To increase community income in a sustainable way by developing and promoting functional food and products for an aging society, the results of current research are expected to open opportunities for enhancing the competitiveness of the healthy food market. Among indigenous chickens in Vietnam, black-boned chicken, named "Ac" chicken, is a famous breed. Ac chicken brings many benefits for Vietnamese because of its therapeutic potential from meat and is used as a medical food for improving human health. Compared to other native breeds, the information of H'mong and Dong Tao chickens was clearer (Duy et al., 2020). However, Ac chicken performance was not clear at all in the international database. Traditionally, Vietnamese local chicken breeds were named after their original village or their typical appearance. The diversity of local chickens has been studied previously (Cuc et al.,

2010; Pham et al., 2013) with 17 populations of Vietnamese local chickens, and approximately 21 local chicken breeds were investigated up to 2016 (MARD, 2016). Similar to other indigenous chickens in Vietnam, Ac chickens are well adapted to the environment. However, the production performance was not significantly good (Pham et al., 2013). This is because the production of local chickens still depends on small-scale farming and less investigation in farm equipment as well as its genetic traits. In addition, the production performance of chickens is affected by many internal and external factors, such as age, bird strain, eggshell integrity, nutrition, water quality, housing system and environmental factors (Ahmadi and Rahimi, 2011).

Given the importance of local production, the study of local chicken reproduction performance, especially Ac chickens, should be investigated. This study aimed to investigate the reproductive performance traits of local chickens, named "Ac" chickens, in a descriptive way. Thus, this study provides informative data for further research.

MATERIALS AND METHOD

Location and time

This study was implemented in Tra Vinh province from October, 2021 to January, 2022. Tra Vinh Province is located in the Mekong Delta, southern Vietnam. All procedures of this experiment were approved bythe Department of Animal Science and Veterinary Medicine, Tra Vinh University.

Animals and Experimental Design

Ac chicken is one of the native chickens in Vietnam. Ac chicken has a black color for the whole body, except plumage (plumage is white without any black points).At the time of the experiment, the average weight of the layers was 900 g - 1 kg.

The experiment included a total of 150 native layers at four different weeks of age to identify the different egg production performance during laying time. The first observation (1^{st} obs.) from weeks 28-30 of age, the second observation (2^{nd} obs.) was from week 31-33 of age, the third observation (3^{rd} obs.) was from 34-36 weeks of age, and the final one (4^{th} obs.) was from 37-39 weeks of age. Chickens were allotted at the same place with the same conditions for the entire experimental period. All hens were raised in the same building and put in individual cages (cage dimensions: 40 cm × 65 cm × 38 cm). This system made it possible to obtain individual egg production and feed consumption. The birds had *ad libitum* access to feed and water throughout the experiment.

All birds were vaccinated with Newcastle disease, avian influenza, and Gumboro disease.

Feed formulation

Chickens were fed *ad libitum* with formulated feed. Basic ingredients (Table 1) were analysed following the methods of AOAC (1990).

Table 1. Chemical composition of the feed ingredients in the experimental diets

Item,%	Maize	Broken rice	Rice bran	Fish meal	Soybean meal
DM	87.4	86.1	88.5	91.8	87.5
OM	99.4	99.7	92.6	85.8	94.2
CP	7.25	8.10	12.8	62.7	44.5
EE	2.30	0.91	12.7	10.0	1.73
CF	1.24	0.10	7.60	0.40	3.70
NDF	18.6	3.23	23.2	6.40	16.7
Ash	0.61	0.28	7.44	14.2	5.76
ME (Kcal/kg)	3760	3475	2818	3230	2645

Dry matter (DM), Organic matter (OM), crude protein (CP), crude fiber (CF), Neutral detergnent fiber (NDF), ether extract (EE), Metabolizable energy (from Janssen et al., 1994)

Table 2. The composition of feed ingredients (% air-dry)

Items	% in diet
Ingredients	
Maize	5.1
Broken rice	14.0
Rice bran	56.0
Soybean meal	11.8
Fish meal	5.0
Rock meal	3.7
Grind rock meal	3.7
Lysine	1.0
Dicalcium phosphate	0.3
Minerals – vitamins #	0.3
Feed composition	
Crude Protein, %	17.0
ME, kcal/g	2699
Canxi, %	3.52
Lysine, %	0.89

#: Vitamin A: 2,500,000 UI; Vitamin D3: 600,000 UI; Vitamin E: 4,000 mg; Vitamin K3: 400 mg; Folic acid: 80 mg; Choline: 100,^{000} mg; Mangan: 14 g; Zn: 40 g; Fe: 32 g; Cu: 48 g; Iodine: 0.5 g; Co: 0.28 g; Se: 0.04 g

Data collection

The data included total collected eggs. Eggs were collected from each of the households daily on a group basis. The criteria wereas follows: feed intake, feed intake per ten eggs, egg production rate, average egg weight, eggshell thickness, yolk index, albumen index, shape index, Haugh unit, and yolk color. All data were calculated following the methods of Moula et al. (2010) and Duy et al. (2020).

Data analysis

The study used descriptive data in Excel and Minitab 16.0. Descriptive statistics were applied to calculate the mean and standard error (SE) of each criterion using ANOVA.

RESULTS AND DISCUSSION

Egg production

Table 3. Reproductive performance of Ac chickens from 28-39 weeks of age

Criteria	Reproductive performance				
	1st obs	***2nd obs***	***3rd obs***	***4th obs***	***Obs***
Egg production rate, %	55.07±0.739	55.66±0.456	54.26±0.761	53.23±0.506	54.55±0,325
Feed intake, g	60.83±0.119	61.05±0.133	60.88±0.159	60.62±0.0737	60.84±0,063
Feed intake (kg)/10 eggs	1.11±0.012	1.10±0.009	1.15±0.009	1.11±0.01	1.118±0,005
Egg weight (g)	42.68±0.306	41.43±0.287	41.94±0.289	40.50±0.247	41.63±0,147

Note: Obs.: observation for the whole experiment (28-39 of age); 1st obs.: the first observation (28-30 of age); 2nd obs.: the second observation (31-33 of age); 3rd obs.: observation (34-36 of age); 4th obs.: observation (37-39 of age).

Table 3 shows that the egg production rate and egg weight decreased from the first observation to the final period, with the highest performance at 28-33 weeks. The data showed the highest egg production rate at 28-30 weeks of age (1st obs.) and feed intake was highest at 31-33 weeks of age (2nd obs.). An average feed intake per hen was not different, and feed intake per 10 eggs steadily increased throughout the periods.

Egg quality

Table 4 shows the egg quality of Ac layers from 28-39 weeks of age. In contrast to egg production, egg quality showed an increase in eggshell thickness, yolk color, egg shape index, albumen and yolk index, especially the Haught unit. The highest egg quality was from weeks 34-36 and sometimes 37-39 weeks of age. More clearly, the Haught unit showed the highest performance at 37-39 weeks of age.

Table 4. The egg quality of Ac chickens from 28-39 weeks of age

Criteria	Reproductive performance				
	1st obs	***2nd obs***	***3rd obs***	***4th obs***	***Obs***
Eggshell thickness *	0.39±0.003	0.41±0.003	0.42±0.004	0.42±0.004	0.408±0,002
Yolk color	10.42±0.054	10.45±0.059	10.72±0.086	10.87±0.086	10.61±0,037
Egg shape index	1.21±0.006	1.25 ±0.006	1.25±0.051	1.24±0.005	1.239±0,003
Albumen index	0.090 ±0.001	0.097±0.001	0.098±0.001	0.097±0.001	0.098±0,001
Yolk index	0.220±0.002	0.219±0.002	0.21±0.002	0.222±0.002	0.218±0,001
Haught unit	85.56±0.426	86.15±0.330	86.09±0.413	86.87±0.344	86.16±0,191

Note: Obs.: observation for the whole experiment (28-39 of age); 1st obs.: the first observation (28-30 of age); 2nd obs.: the second observation (31-33 of age); 3rd obs.: observation (34-36 of age); 4th obs.: observation (37-39 of age).

DISCUSSION

In most developing and undeveloped countries, indigenous/local/native chicken breeds play an essential role in rural economics. They provide a significant source of income for rural households and marginalized sections of the population, as well as nutritious chicken eggs and meat for their consumption. Changes in husbandry, food, and health coverage can all help local birds perform better (Padhi et al., 2016). However, genetic improvement can be achieved through either selection or crossbreeding or by combining the two methods. From that side, the most important is the records of chicken breeds consisting of growth and reproductive performance. The severe directional selection acting on commercial hybrid laying hens accounts for the substantial disparity with indigenous (and weakly chosen) lines (Moula et al., 2009). After demonstrating that the weight and egg composition contain genetic components, this suggests that better systematic selection could improve the performance of indigenous breeds (Dottavio et al., 2005).

The reproductive performance of Ac chickens in this study showed that Ac chickens have a low reproductive performance compared to commercial layers. More clearly, the reproductive performance of laying recorded in the study of Arifin (2016) can reach an average of 80% or more than at peak production. Padhi (2016) recorded that indigenous chickens in India have more than 57.58% egg production at week 52. The Institute of Food and Agricultural Sciences (2018) also showed that laying Flock production increases rapidly and peaks at approximately 90% from 6–8 weeks after the first egg. After a year of rest, production gradually drops to approximately 65%. In this study, the production performance of Ac chickenscould not reach that high ratio, which is normal for domestic chickens because of their genetics and raising conditions. Duy et al. (2020) showed the same statement that differences in raising, feed, and genetics are possible explanations for these differences, pointing to avenues for improvements. In addition, for other native chickens, reproductive performance is also low,

and their eggs are not used as a commercial food, such as the Ho and Dong Tao breeds (Duy et al., 2020). The feed intake per 10 eggs showed that Ac chickens need more than 1 kg offeed to produce 10 eggs. For this criterion, Ac chickens are more efficient than other native chickens in Vietnam, for example, black-boned chickens, named H'mong chickens, for which 6580 g of feed was needed to produce ten eggs with an average weight of 38.10 g (Phuong et al., 2017). For egg production, egg weight is one of the important criteria. Theegg weight results from this study are much smaller than those of other native chickens inVietnam, such as H'mong chickens. H'mong chicken eggs are approximately 51.43 g (Duy et al., 2020). It is very small when compared to commercial layer lines, withweights ranging from 68.3 to 69 grams for the popular breed (Safaa et al., 2008).

In this study, the yolk index was higher than the albumen index for all weeks. That is a good point that Ac native chickens can show to consumers. The yolk index and albumen index of Ac chickens are lower thanthe yolk and albumen index of H'mong chickens (Phuong et al., 2017). A high yolk/albumen ratio is a crucial requirement in the egg market since it can improve egg quality for both consumers and the food processing industry (Moula et al., 2009). The egg weight of hybrid laying chickens is frequently higher than that of native breeds (Moula et al., 2013). Another important criterion is yolk color, which can be seen from consumers directly. In this study, the yolk color of Ac chickens was more colored than that of other native chickens in Vietnam. For example, it is 10.57 for yolk color at 40 weeks for Ri chickens (Moula et al., 2011). The yolk color of Ac chickens is also higher than that of black-bone H'mong chickens, with 8.08 points (Phuong et al., 2017). In addition, eggshell thickness is a significant aspect in the egg manufacturing sector (Moula et al., 2013; Roberts 2004). Eggshell fragility is responsible for approximately 6-8% of industry losses (Washburn, 1982). Eggshell thickness is higher than eggshell thickness from H'mong chickens with 0.37 mm and higher than Ho chickens and Dong Tao chickens with 0.23 mm and 0.22 mm, respectively. This result was in line with the study of Duy et al. (2020), in which the eggs from indigenous breeds do not seem more fragile than those commonly produced in industrial production units (Duy et al., 2020). This point could be a potential for egg transportation from farm to farm and for the egg processing industry. Finally, the most important criterion in egg quality is the Haugh unit, which can be used to describe egg protein quality and freshness (Moula et al., 2009). In this study, the Haugh unit was above 85, which can be beneficial for the nutrient value in the eggs of Ac chickens. The USDA recommends that the finest quality eggs (AA eggs) have Haugh units of 72 or higher. Haugh unit from Ac chickens is much higher than the recommendation. This result was similar to the statement of Duy et al. (2020), who found that eggs from indigenous breeds are usually fresher than this. Compared with other internation breeds, the Haugh unit is also higher than the values for the Barred Plymouth Rock, White Leghorn, Rhode Island Red and White Rock layers, which range between 45.81 and 58.68. The results of the Haugh unit are also higher than those of other native chickens in Vietnam,with 76.14–77.67 for Ri chickens and 81.53-82.15 for Ho and Dong Tao chickens. Overall, the differences between studies might be due to differences in breeds, age, nutrition, environmental conditions and so on.

CONCLUSION

The results clearly indicated that the reproductive performance of Ac chickens is not high, but egg quality is widely accepted by local consumers in Vietnam. The eggs have a better yolk

color and Haugh unit, which can be good indicators for increasing human demand. The recommendation for further research is to observe the reproductive performance of Ac chickens in the later phase and after one year of rest.

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