Increase in egg production, egg quality and immunity of local chicken resulted by cross-breeding

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Abstract

A series of study aimed to improve egg production, egg quality and immunity resulted by cross-breeding with Arab chickens and laying chickens has been observed on 400 chickens of 5-month old of hens was used and treatment was divided into 2 groups: medium and heavy type hens. Randomized Block Design was used and hens were fed on a laying diet contained 18% of crude protein content and 2900 kcal/kg of metabolism energy. Parameters observed were the number of daily eggs (hen /day), clutch, egg weight, egg shape, shell thickness, Haugh unit (HU) and the total percentage of egg production during one production cycle. Immunity was observed by thymus size and time of thymus regression. The results showed that daily and total egg production, clutch spacing, egg weight, egg shape, hemp thickness, Haugh unit (HU) of egg in both heavy and medium type were significantly higher than pure local chicken. However, all the parameters of egg production and egg quality on the type of weight were significantly higher than the light type. In terms of immunity, time of thymus regression on crossbreed hen type occurred at 14-16 weeks of age. It concluded that crossbreeding between local chicken increased egg production and egg quality on derivatives of local chicken. It was also informed that the immunity of derivatives of local chicken resulted by crossbreeding against endemic diseases was better than that of in natural breed chicken.

1. Introduction

Improving the ability of poultry to produce meat and eggs can be designed with the approach and application of directed and sustainable genetic improvement programs. This program will involve a poultry breeding and selection system which is applied to produce poultry derivatives that have the best genetic quality. Improvement of genetic quality on local chickens through genetic selection and breeding programs is a long-term strategy. This program must be well designed especially in an effort to improve the genetic quality of local chickens to produce prospective parent stock candidates for the future. One of the important breeding programs for local chickens is cross-breeding with superior chickens to produce a better derivative in producing meat and eggs. The goal of crossbreeding programs in local chickens is to increase egg production and quality to meet consumer needs. The egg of the local chicken has its own distinctive features that have a high number of customers. Cross-
breeding in poultry will have the mutual benefit of substituting the nature of the parent and male origin to take advantage of heterozygote [4]. Currently, the result of crossing between local chickens, Arab and laying chicken has produced a derivative of local chicken for egg production. This chicken has the ability of egg production is much higher than the local chicken. Genetic influence is an important factor in determining the quality of local chicken. In addition, egg production is also affected by maintenance systems, feed quality and chicken health [14] [6]. The local chicken produced by crossbreed program has an advantage in the production and quality of eggs, hatchability, shape, and weight of life compared to native local chickens. Derivatives of local chicken is a hybrid chicken that can be maintained in an open and limited area (backyard system) and it has a high egg production. Efforts to improve the genetic quality and ability local chicken for egg production still continue through a strict breeding program followed by selection on derivatives local chicken. Nowadays, there are 2 types of derivated local chickens were maintained: medium and heavy type. Both of chicken types still have variation in the ability of egg production between 177-240 eggs [9]. It needs to be uniformed for the future and also to improve the quality of eggs both internal quality (nutrient content) and external (weight, shape and eggshell thickness). It is also very important to evaluate the ability of immunity of Kamaras chicken against endemic poultry disease. This is an important point of local chicken because the maintenance of laying hens requires a long period of time. It is necessary to select the type of chicken that has high egg productivity, good egg quality, and immunity.

2. Materials and methods
The present study used 400 hens, 5-month-old and divided into 2 groups: medium and heavy types. Each type of hen was divided into 4 groups consisting of 25 hens. Each treatment group was maintained in a backyard cage size 5x7 meters. Backyard cage was equipped with egg nesting, feeder, and drinker. Hens were fed on a commercial layer feed containing 17% crude protein and EM 2900 Kcal/kg.

2.1. Parameter measured
All data on both chickens types: medium and heavy type was collected after the adaptation period in the backyard cage for 4 weeks. The parameter was evaluated on egg production: egg production, hen/day, feed intake, feed conversion, egg weight, and egg mass were recorded during 46 weeks trial. Egg production was recorded daily at the same time and was calculated on a hen-day basis. The total number of eggs collected divided by the total number of live chicken per day in each group. Records of the feed intake were taken on a monthly basis. Hens were observed twice daily; the weight of dead birds was used to adjust for feed consumption. Feed conversion was calculated as the ratio of grams of feed to grams of the egg mass. In each group, 25 egg of hens were taken in each month to assess the characteristics of egg quality. Egg mass was calculated as a factor of egg weight and hen-day egg production. Eggs were saved 2-day monthly to measure egg weight. Measurement of eggshell was done by using an auto egg thickness meter and the measurement of indigo Haught unit was measured by using automatic egg analyzer. The time of thymus regression was evaluate on 2 hens of each group and slaughtered every week. Thymus was taken off and then counted the number of lobes and weighed thymus weight.

2.2. Statistical analysis
All collected data were determined by using the SPSS version 16 (SPSS, Cary, NC, USA) statistical analysis program. P value of <0.05 was considered for significant differences among groups and the comparison of means was considered by using Duncan’s Multiple Range Test [8].
3. Results and Discussion

3.1. Egg Production and Egg Quality

The result of present study showed that there was a high significant effect due to differences in type of hens (medium and heavy types) derived Kamaras chickens on body weight, feed consumption, egg production and egg quality. Body weight of heavy type hens is heavier than that of medium type chickens. This was influenced by the difference in feed consumption, whereas heavy chicken consumes more than medium type chickens. In accordance with [1] which stated that the differences in body size and weight will affect feed consumption. In laying hens egg production will be determined by ideal body weight during adult sex and daily feed consumption [2].

Table 1. Differences in parameter of egg production and egg quality in different of derivated local chickens maintained in a backyard system

| Parameter                        | M1          | M3          | M6          | M1          | M3          | M6          |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Initial Body Weight (gr)         | 1491.00 a   | 1567.00 b   | 1670.00 b   | 1612.00 b   | 1745.00 c   | 1812.00 d   |
| Feed Consumption (gr/hen)        | 87.50 a     | 91.20 b     | 101.40 c    | 88.90 a     | 95.60 b     | 112.35 c    |
| Mortality (%)                    | 0.00 0.005  | 0.005       | 0           | 0           | 0           | 0           |

A. Egg Production:

Hen-day (%)                        | 23.40 a     | 46.80 b     | 63.80 c     | 32.24 b     | 51.12 c     | 69.45 d     |
Total egg production (egg/month/total hens) | 1380 a    | 2820 b     | 3840 c     | 1920 b     | 3120 c     | 4170 d     |

B. Egg Quality

Egg weight (gram)                  | 32.12 a     | 36.27 ab    | 39.22 b     | 34.21 ab    | 38.11 bc    | 42.20 c     |
Egg shell thickness (mm)           | 0.32 a      | 0.33 a      | 0.36 a      | 0.35 a      | 0.38 b      | 0.39 b      |
Haught Unit                        | 62.42 a     | 65.17 ab    | 66.67 ab    | 64.12 a     | 66.67 ab    | 69.2 b      |

*) The number of hens used for each chicken type group was 200 hens.
**) The similar letter in different column showed the significantly different (P<0.05).

It was known that the main factors that body conformation and bodyweight of hens was greatly affected by egg production of hen [10]. Besides that, the amount of feed consumption also affected egg production on light, medium or heavy type of hen [8], informed that the size, shape, and weight of the egg are affected by the condition of the reproductive medium and heavy type hens will an option for breeders of commercial laying chickens due to both types of chicken produce high egg production and good egg quality. This is caused by a Differences in body weight of hen affect the size of the chicken body and it will affect the condition of the reproductive organ for egg production [7]. From the side of egg quality, the results indicated that heavy type of derived local chicken produced a better egg quality than medium type chicken. Heavy-weight chicken eggs produced egg weight, eggshell thickness and HU value were higher than medium-type chicken. According to [9] and [3], informed that heavy chickens of later have the ability to produce a high quality of eggs but the period of egg production becomes shorter.

3.2. The development of immune system on chicken

The development of the immune system on derivatives of local chicken could be evaluated on the development of thymus. In the present study, results showed that the increase in thymus weight of hens occurred in the age range of 1 – 15 weeks and reached the maximum weight at 15 weeks of age. Thymus weight decreased until regression that occurred at the age of 16 – 17 weeks. In the present study, thymus regression at the age of 18-19 weeks. It
was observed that the number of thymus lobes of derivatives of local chicken was 5 - 9 lobe and the time of thymus regression occurred at the age of 18 - 19 weeks.

Figure 1. The average of thymus on derivatives of local chicken resulted by crossbreeding

[5] reported that thymus is a very important organ in young animals for immunity. The development starts from before puberty to adulthood and thymus size will be smaller as the animal ages. The thymus secretes messengers, including timosin, which stimulates the progression and T-sensitization of lymphocytes after they leave the thymus [4]. The lymphoid organ of the poultry immune system consists of primary and secondary lymphoid organs. Thymus, bone marrow and Fabricius’s bursa include primary lymphoid organs while the spleen, mucosal associated lymphoid tissue, lymph nodes and germinal centers include secondary lymphoid organs (Hewajuli and Dharmayanti, 2015). Lymphoid organs are the organs necessary for maturation, differentiation and proliferation of lymphocytes [13].

4. Conclusion
This present study has shown that crossbreeding produced crossbred chicken with genetic potential for improvement of local chicken. It was well known that egg production and egg quality on derivated local chickens influenced by chicken type. Heavy type chickens had a better egg production and egg quality compared than medium type chickens. It was affected by difference in body weight and feed consumption. It was also concluded that the number of thymus lobes of derivatives of local chicken were 5 - 9 lobe and the time of thymus regression occurred at the age of 18 - 19 weeks. However, more studies are needed to explore other factors like growth performance, disease resistance and adaptability to harsh environment of the derivated local chicken. Findings from such studies could be a significant prelude to the improvement of the local chicken for future.
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