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Study on the Egg Quality of a Breed and Three Crossbreds at Various Ages Under Semi Scavenging System of Management

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Abstract: A breed and three crossbreds (Fay, RIRxFay, NNxRIR, NNxFay) were studied for egg quality at different age under semi-scavenging system of management. The egg weight was highest (41.87, 44.03, 44.7 and 46.97 g) for RIR x Fay at sexual maturity, one, two and three months after sexual maturity. RIRxFay showed the highest (0.335, 0.337 and 0.340 mm) shell thickness and Albumen height (7.77, 8.48, 8.54 mm) at sexual maturity, one and three months after sexual maturity with exception at 2 months after sexual maturity (0.320 and 8.02 mm) for shell thickness and albumin height, respectively. Although yolk height was highest in case of RIR x Fay at sexual maturity NNxFay and NNxRIR showed the highest (19.82 and 19.03 mm), respectively for the next 2 months and at 3 months after sexual maturity NNxFay was found to be highest (19.93 mm). The highest yolk colour score (10.78) was in RIRxFay at sexual maturity and there after decreased over time. In case of Haugh unit RIRxFay showed the highest (77.7 and 82.21) at sexual maturity and 3 months after at sexual maturity but NNxFay and Fay showed the highest (83.17 and 82.29) at one month and two months after sexual maturity, respectively. It may be concluded that RIRxFay might be the best for quality egg production under semi-scavenging system of management.

Key words: Egg quality, breed, cross breed, age, semi-scavenging

INTRODUCTION

The quality of egg depends on physical make up and chemical composition of its constituent namely egg shell, albumen and yolk. The internal quality of egg involves the quality of yolk and albumen, which are influenced by breeding, feeding, housing and management. One egg weighing 55 g day⁻¹ meets the 50% of protein requirements of a child up to 5 years of age^[1].

It is obvious that quality of egg is important from producer's point of view. Thus breeding companies are shifting selection emphasis to improved egg quality^[2].

The agriculture based economy of the country includes large number of indigenous domestic fowl and ducks^[3]. Almost three-quarters of the country's rural families keep poultry and expansion of poultry production in the country is being severely hampered by lack of suitable stocks^[4]. It appears that birds with the Naked Neck character interact well when crossed with other stocks and this results in better performing progeny. Fayoumi (Fay) the exotic pure breed is extensively used in rural areas. There are many reported works on crossing of Fay with exotic breeds to improve egg size^[5].

Rode Island Red (RIR) is an American breed, comparatively heavy and used for dual purpose. The

approximate weight of the hen is 2 kg, egg weight 55 g of brown color. A crossbred of Fay female and RIR male has been reported to perform better egg production and egg size. Farmers are used to supplement feeds only when the surplus grains available, mainly during the period of harvesting crops.

Semi scavenging and scavenging systems of poultry production are regular practices in rural areas of Bangladesh. A model for small holding poultry rearing has been adopted under Participatory Livestock Development Project-PLDP^[6] to be viable poverty alleviation tool. 95% of the beneficiaries of PLDP are key rearers^[7], who keep their hens under semi scavenging conditions and feed with supplementary food. Therefore, to develop a breed of high quality egg a cross breeding program using indigenous chicken the present experiment was undertaken to compare among a breed and three crossbreds (Fay, RIRxFay, NNxFay and NNxRIR) under the management of semi-scavenging system.

MATERIALS AND METHODS

The experiment was designed to test the quality of egg of a breed and three crossbreds under the management of key rearers of Participatory Livestock

Development Project (PLDP) at 13 different villages of three locations at Badalgachi thana in Naogaon district.

Breed/breed combinations: Mating and the symbol of breed/breed combinations used for the study are shown below-

Males	Females	Symbol
Fayoumi	Fayoumi	Fay
Rode Island Red	Fayoumi	RIRxFay
Native Naked Neck	Fayoumi	NNxFay
Native Naked Neck	Rode Island Red	NNxRIR

NN cocks, collected from local market were used for crossing with RIR and Fayoumi hens with a cock: hen ratio of 1:10. Males were kept with females for two weeks before collecting eggs for incubation. The eggs were hatched at the hatchery of Rangpur Govt. Poultry farm in May/2001. All the chicks were reared separately according to breed and breed combinations at the poultry-rearing unit of Rangpur Govt. Poultry Farm up to 14 weeks of age under the same management and environmental conditions.

At 14 weeks of age, all the experimental pullets were taken to the study area for distribution among the key rears.

Feeding: During confined rearing the chicks were fed with a balanced diet from Bangladesh Rural Advancement Committee (BRAC), containing 20% CP and 2850 Kcal, MEkg⁻¹ of feed.

The chickens were allowed for scavenging around the homestead and in the neighborhood for a period of 2 h in the morning and 2 h in the evening and provided supplementary feeding in day shelter between 2 scavenging period using a bamboo made cafeteria, feeder.

There was a continuous supply of drinking water in side the day shelter and there was easy access during the day when they were scavenging. The feeder and watering was cleaned twice a week. At night and during unfavorable weather conditions they were sheltered in a bamboo basket placed on the ground in a room. Laying box was placed in the day shelter so that the hens can lay eggs with security and in peace.

Vaccination and medication: The incidence of two major viral diseases like Newcastle and Infectious Bursal Diseases are very often in Bangladesh. Therefore, the chickens were vaccinated against those diseases.

Data collection: At the time of quality test fresh eggs were collected and carried in a certain place. First test was

performed fifteen days after their sexual maturity and then every one-month.

Number of egg for quality test was ranged from 7- 40 eggs per breed at different time of tests and was based on one day production at farm. Egg weight, eggshell thickness, albumen height, yolk height and yolk color was considered for determination of egg quality. Fresh eggs were collected separately for different breeds and weighed daily basis by using an electronic digital balance. Albumen height was measured by using a semi-automatic device. The eggs were broken on a metal plate and the height of the albumin was measured by the distance between the metal plate and the electrode placed on top of the thick egg white of the broken egg. In order to correct for difference in egg weight the albumin height was converted into Haugh unit as reported by Haugh^[8]. The formula was as follows:

$$HU = \log_{10} (-1.7 \cdot e^{(0.37) \cdot \ln(\text{egg weight, g})} + 7.6 + \text{albumen height, mm}) \cdot 100.$$

The same semi-automatic device, which was used for albumen height, measured the yolk height; measuring the distance between the metal plate and the electrode placed on top of the yolk of the broken egg. Shell thickness was measured by using a micrometer. The shell was cleaned, washed and air dried at room temperature until constant weight and then thickness was measured from the equator lines. Yolk color was determined by adjusting the score of yolk color fan. The score was recorded after the albumen and yolk height was measured for each of the eggs under test.

Analysis were performed simultaneously by the use of an analysis of variance using the GLM procedure (Type III SS) of SAS^[9] and then tested by the F-test. Multiple comparisons among the breeds, at various age of hen were tested by their least square means corrected for other effects in the model.

RESULTS AND DISCUSSION

Egg weight: The egg weight was found highest for RIRxFay at all ages of quality test. The highest (46.97 g) was shown at three months after sexual maturity.

Shell thickness: Shell thickness was highest for the same with an exception at 2 month after sexual maturity. The highest value was at 3 months after sexual maturity (0.34 mm).

Yolk colour: RIR x Fay showed the highest score (10.78) at the age of sexual maturity and thereafter gradually decreased.

Table 1: Performance on external quality of eggs of different breed/breed combinations at different age of hen

Traits	Age of hen	NNxRIR	NNxFay	RIRxFay	Fay
Egg weight (g)	1	41.17a	35.00b	41.47a	40.47a
	2	39.07b	40.37ab	44.03c	41.39a
	3	43.04bc	41.17ac	44.70b	40.95a
	4	44.20a	40.21b	46.97c	42.60a
Shell thickness (mm)	1	0.31b	0.32ab	0.33a	0.33a
	2	0.28b	0.28b	0.33a	0.33a
	3	0.30b	0.33a	0.32ab	0.33a
	4	0.32ab	0.32a	0.34b	0.31a

Difference between means with same or without letter in a row is not significant

Age of hen: 1= At age of sexual maturity, 2= 1 month after sexual maturity, 3= 2 month after sexual maturity, and 4= 3 after sexual maturity.

Table 2. Performance on internal quality of eggs of different breed/breed combinations at different age of hen

Traits	Age of hen	NNxRIR	NNxFay	RIRxFay	Fay
Albumen height (mm)	1	5.74b	5.27b	7.77a	7.51a
	2	7.91a	8.43a	8.48a	8.03a
	3	7.51ab	7.29b	8.02a	8.29a
	4	7.63bc	7.27c	8.54a	7.81ac
Yolk height (mm)	1	17.71a	16.29b	18.82c	18.62ac
	2	19.20	19.82	18.95	19.80
	3	19.03	17.94	18.40	18.69
	4	18.70ac	19.93bc	19.22b	18.15a
Yolk color fan score	1	9.27a	8.94a	10.78a	9.48a
	2	7.61b	9.97a	9.69b	10.32a
	3	10.03	9.90	9.59	9.82
	4	8.24ac	9.57b	8.93bc	7.53a

Difference between means with same or without letter(s) in a row is not significant ($p < 0.05$)

Table 3: Haugh unit of different breeds in different ages

Traits	Age of hen	NNxRIR	NNxFay	RIRxFay	Fay
Haugh unit	1	60.63a	59.19a	77.70b	76.09b
	2	80.52	83.17	82.17	80.40
	3	75.89a	74.84a	79.00ab	82.29b
	4	76.95ab	75.10a	82.21b	78.38ab

Difference between means with same or without letter(s) in a row is not significant

Albumen height: RIR x Fay showed the highest at all ages among the breeds and the highest was (8.54 mm) at 3 months after sexual maturity.

Yolk height: Different breed showed different yolk height at their different ages. Yolk height was highest 18.82, 19.82, 19.03 and 19.93 mm for RIR x Fay, NN x Fay, NN x RIR and again for NN x Fay at age of sexual maturity and one, two and three months after sexual maturity.

Haugh unit: Haugh unit had the similar trend of yolk height. It was highest 77.7, 83.17, 82.29 and 82.21 for RIR x Fay, NN x Fay, Fay and RIR x Fay at age of sexual maturity, one, two and three months after sexual maturity.

DISCUSSION

There was significant increase in egg weight with the increase of age among the breed/breed combinations. Increased egg weight was observed^[2,10,11] over time. Yoo *et al.*^[12] and Weatherup and Foster^[13] reported considerable differences in egg weight at different ages. These are in support with results of the present study.

There are significant differences in eggshell thickness with differences of age among the breed/breed combinations in the present study. Eggshell thickness was decreased and then increased over time. Decreased eggshell thickness was observed by Akbas *et al.*^[14] over time. Ketelaere *et al.*^[2] obtained declined eggshell thickness in Hisex White, Bovans White and a White Leghorn line (M) over time, which partially contradict with the present study. The differences might be due to the differences in rearing systems. The main chemical component of eggshell is calcium. Because of the differences in rearing system, the uptake of calcium was varied, which prohibited the full expression of the effect of age in the present study.

Influence of age was found significantly different in albumen height among the breed/breed combinations. Noddegaard^[15] has shown influence of age in albumen height, which is in agreement with the findings of the present study. Akbas *et al.*^[14] and Lapao *et al.*^[16] found decreased albumin height with the increase of hen age. But in contrast Petersen and Linn^[17] did not see any differences in albumen quality with age. Albumen height seems to be influenced by various factors.

Highly significant differences existed in haugh unit at different ages of hen. Increased haugh unit was obtained at 2nd test then was decreased over time. Akbas *et al.*^[14] has shown that haugh unit decreases with the increase of hen age.

Yolk height was found to increase with the increase of age up to 2nd test and then had a tendency to decrease

over time. Akbas *et al.*^[14] found decreased yolk height with the increase of hen age, which contradicts, with the result of the present study.

Yolk color did not differ up to 3rd test and then decreased in the last test. Stockberg and Wegner^[18] reported yolk color to be improved during the laying year.

It can be concluded that with the improved conditions RIR x Fay (Sonali) might be potential in relation to egg quality in semi scavenging system of management.

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