BENHA VETERINARY MEDICAL JOURNAL (2013) 24(2): 11-18

EFFECT OF CROSSING FAYOUMI AND RHODE ISLAND RED ON GROWTH PERFORMANCE, EGG AND REPRODUCTIVE TRAITS UNDER EGYPTIAN CONDITIONS

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A B S T R A C T

This study was conducted to evaluate body weights, average daily gain (ADG), relative growth rate (RGR), average egg weight, hen day egg production% (HDEP%), hen housed egg production% (HHEP%), age at sexual maturity, body weight at sexual maturity, fertility%, scientific and commercial hatchability percentage in a complete 2x2 diallel crossbreeding experiment [Fayoumi and Rhode Island Red (RIR)]. RIR showed significant ($p \leq 0.05$) higher body weight, ADG, RGR, age at sexual maturity and body weight at sexual maturity (1898.76 g, 9.04 g, 19 3.95%, 144.66 day and 1559.05 g, respectively) compared other genotypes. In addition, RIR recorded the highest egg weight, fertility percentage, scientific and commercial hatchability percentage (44.28 g, 85.59%, 94.91% and 81.49%, respectively). While Fayoumi male×RIR female crossbred recorded the highest significant estimate for HDEP % and HHEP % (54.41 and 51.65%).

KEY WORDS: Body weight. Crossing. Fayoumi. Fertility. Hatchability. Relative growth rate. RIR.

(BVMJ 24(2): 11-18; 2013**)**

1. I N T R O D U C T I O N

Poultry constitute 30% of animal protein and will increase to 40% before 2015 in the world [1]. In Egypt, one of the important protein resources is poultry protein (meat and eggs). Most of the Egyptian consumers still prefer eggs from local native strains. The egg is a marketable product with importance as human feed in Egypt considering our country's shortage in animal protein. The productivity of the local native strains is genetically low. A high level of performance, no doubt is the aim of any enterprise involved in the production of eggs. Genetic variation in egg production between breeds, strains and lines has been reported [2]. Crossbreeding is one of the tools for exploiting genetic variation. The main purpose of crossing in chicken is to produce superior crosses (hybrid vigor), to improve fitness and fertility traits and to combine different characteristics in which the crossed breeds were valuable [3]. Moreover, crossing between chicken strains improved the production traits such as body weight at sexual maturity, egg number, egg weight and egg mass compared with those for pure strains [4].

The objective of this study was to evaluate the effect of crossing Fayoumi and Rhode Island Red (RIR) on growth performance (body weights, average daily gain and relative growth rate), egg production traits (average egg weight, HHEP and HDEP) and reproductive traits (age at sexual

maturity, body weight at sexual maturity, fertility percentage, scientific and commercial hatchability %).

2. MATERIAL AND METHODS

2.1. Management of the birds

A. Housing

On the day of hatch, all chicks (120 chicks from Fayoumi, RIR and Rhode Island Red×Fayoumi crossbred also, 111 chicks from Fayoumi×Rhode Island Red crossbred and each genotype was divided into 3 replicate) were wing-banded for their identification. Body weight was recorded individually and the birds of each breed were housed in a litter floor house up to 34 weeks of age. All chicks were medicated similarly and regularly and they were subjected to the same managerial, hygienic and climatic conditions. Feeding and watering were provided ad libitum and done manually.

B. Feeding management:

Starter ration contained 21 % crude protein and 2950 K. cal/kg energy were used during brooding period. While during growing period, the ration contained 16 % protein and 2800 K. cal/kg energy and during egg laying period, the ration contained 18% protein and 2700 K. cal/kg energy.

C. Lighting program:

Lighting program, which used was 24 hours lighting at the first week then 13 hours till 18th week of age. Lighting hours were increased daily by 30 minutes per week up to 17 hours light per day.

D. Egg collection, storage and incubation condition:

Eggs were collected after they were laid. Selection of hatching eggs was done based on their uniform size, good shape and each egg was labeled.

Eggs were stored for 7 days in a cool room at approximately 17°C. Standard relative humidity, temperature and egg turning were programmed on the setter and Hatcher.

2.2. Studied traits:

1. Growth traits:

A. Body weight.

B. Average daily gain.

It is the weight gain related to the number of days calculated.

C. Relative growth rate.

$$\text{Relative Growth Rate (RGR)} = \frac{W_2 - W_1}{1/2(W_2 + W_1)} \text{ X100}$$

Where: - W_1: body weight at the beginning of period and W_2 : body weight at the end of period [5].

II. Egg production traits:

A. Average egg weight.

B. Hen day egg production % (HDEP %).

HDEP was calculated as the number of eggs produced by the number of chickens alive on a particular period [6].

$$\text{HDER(\%)} = \frac{\text{Numberof eggsproduced}}{\text{Numberof hensalive}} \text{X100}$$

C. Hen housed egg production % (HHEP %).

HHEP was calculated as the number of egg produced in a period divided by the number of hen originally housed [6].

$$\text{HHEP (\%)} = \frac{\text{Number of eggs produced}}{\text{Number of hens housed}} \text{X100}$$

III. Reproductive traits:

A. Age at sexual maturity.

B. Body weight at sexual maturity.

C. Fertility%.

$$\text{Fertility \%} = \frac{\text{Number of fertile eggs}}{\text{Total number of eggs set}} \text{X100}$$

[7]

D. Scientific hatchability %.

$$\text{Hatchabili ty \%} = \frac{\text{Number of hatched chicks}}{\text{Number of fertile eggs}} \text{X100}$$ [7]

E. Commercial hatchability %.

$$\text{Hatchability\%} = \frac{\text{Number of hatched chicks}}{\text{Number of set eggs}} \text{X100}$$

IV. Statistical analysis:

Data were analyzed using the General Linear Model (GLM) procedure of the SAS statistical analysis system package [8].

Least Squares Means (LSM) ± standard errors were calculated and tested for significance using "T" test [9].

The data were analyzed using statistical models as following:

$$Y_{ij} = \mu + G_j + e_{ij}$$

Where:- Y_{ij} = any observed value, μ = overall mean, G_j = effect of genotype (j=1, 2, 3 and 4 i.e. Fayoumi , Rhode Island Red, Fayoumi , × Rhode Island Red and Rhode Island Red× Fayoumi) and e_{ij} = random deviation due to unexplained source.

3. RESULTS

Table (1) showed significant differences ($p \leq 0.05$) in body weights between RIR and the other genotypes but there were non-significant differences ($p > 0.05$) between RIR x Fayoumi crossbred and their reciprocal crossbred. In addition, Fayoumi showed significant difference in weight compared other genotypes.

There were significant differences ($p \leq 0.05$) in ADG between RIR and the other genotypes but there were non-significant differences ($p > 0.05$) between RIR x Fayoumi crossbred and their reciprocal crossbred. In addition, Fayoumi showed significant difference in ADG with other genotypes.

RIR and RIR x Fayoumi crossbred recorded non-significant differences ($p > 0.05$) in RGR compared other genotypes. Also, Fayoumi and Fayoumi x RIR crossbred showed non-significant differences ($p \leq 0.05$) in RGR compared other genotypes.

Table (2) observed the highest significant differences ($p \leq 0.05$) in average egg weight between RIR compared other genotypes but there were non-significant differences ($p \leq 0.05$) between RIR x Fayoumi crossbred and their reciprocal crossbred. In addition, Fayoumi showed the lowest significant difference in egg weight with the other genotypes.

There were non-significant differences ($p > 0.05$) in HDEP % and HHEP % between Fayoumi and RIR but it was significant between RIR x Fayoumi crossbred and Fayoumi x RIR crossbred.

Table (3) recorded significant differences ($p \leq 0.05$) in age and body weight at sexual maturity between RIR and other genotypes but there were non-significant differences ($p > 0.05$) between RIR x Fayoumi crossbred and their reciprocal crossbred.

There were non-significant differences ($p > 0.05$) in fertility percentage between all genotypes (Fayoumi, RIR, RIR x Fayoumi and their reciprocal crossbred).

There were non-significant differences ($p > 0.05$) in both scientific and commercial hatchability percentage among all genotypes.

4. Discussion

RIR breed had the heaviest body weight (1898.76 g) followed by Fayoumi x RIR crossbred (1601.70 g) then reciprocal crossbred (1548.77 g) and finally Fayoumi (1350.04 g) (Table 1). These results agreed with the observations of final body weights of Sonali (RIR×Fayoumi) and Fayoumi (1001 and 959 g) at 14 weeks of age with a tendency to be higher for Sonali [10- 11 and 12]. These results contradicted with the observations of the body weights of RIR×Fayoumi crossbreed and reciprocal crossbred at 23 weeks of age were 1449 and 1453 g [13 -12].

RIR breed showed the highest ADG (9.04 g) followed by Fayoumi x RIR crossbred (7.62 g) then reciprocal crossbred (7.37 g) and finally Fayoumi (6.42 g) (Table 1). On the contrary, some authors showed that Fayoumi breed had higher ADG rate than local ecotypes breeds [14-15].

Concerning RGR, RIR breed had the highest RGR (193.95 %) followed by RIR

x Fayoumi crossbred (193.42 %) then Fayoumi (192.41 %) and finally reciprocal

Table (1): Overall Mean ± Standard Errors of body weights, average daily gain and relative growth rate for Fayoumi, RIR and their crossing.

Trait Genotype	Overall Mean ± SE		
	Body Weight (g)	Average Daily Gain (g)	Relative Growth Rate %
FF	1350.04^{c} ± 21.35	6.42^{c} ± 0.10	192.41^{b} ± 0.14
RR	1898.76^{a} ± 23.86	9.04^{a} ± 0.11	193.95^{a} ±0.09
FR	1601.70^{b} ± 37.36	7.62^{b} ± 0.18	192.14^{b} ±0.36
RF	1548.77^{b} ± 24.33	7.37^{b} ± 0.12	193.42^{a} ± 0.12

Overall Means of different genotypes within the same column having different superscripts are significantly different al level ($p \leq 0.05$). FF: Fayoumi × Fayoumi, RR: Rhode Island Red × Rhode Island Red, FR: Fayoumi × Rhode Island Red, RF: Rhode Island Red × Fayoumi.

Table (2): Overall Mean ± Standard Errors (LSM ± SE) of average egg weight, hen day egg production% and hen housed egg production% for Fayoumi, RIR and their crossing.

Trait Genotype	Overall Mean ± SE		
	Average Egg Weight (g)	HDEP%	HHEP%
FF	39.38^{c}±0.54	50.67^{ab}±2.68	49.53^{ab}±2.57
RR	44.28^{a}±0.73	51.24^{ab}±3.21	50.11^{ab}±3.15
FR	41.18^{b}± 0.59	54.41^{a}±3.13	51.65^{a}±2.88
RF	41.99^{b}±0.62	44.70^{b}±2.74	42.80^{b}±2.71

Table (3): Overall Means ± Standard Errors of age and body weight at sexual maturity, fertility%, scientific hatchability% and commercial hatchability% for Fayoumi, RIR and their crossing.

Trait Genotype	Overall Mean ± SE				
	Age at sexual maturity (day)	Body weight at sexual maturity (g)	Fertility %	Scientific hatchability %	Commercial hatchability %
FF	144.29^{b} ±0.10	1172.74^{c} ±17.33	85.00^{a}±3.91	91.35^{a}±3.09	78.22^{a}±5.03
RR	144.66^{a} ±0.13	1559.05^{a} ±25.77	85.59^{a}±4.33	94.91^{a}±1.61	81.49^{a}±4.61
FR	142.00^{c} ±0.04	1332.52^{b} ±23.01	82.04^{a}±3.82	88.83^{a}±1.99	72.95^{a}±3.88
RF	142.00^{c} ±0.08	1291.01^{b} ±19.13	83.99^{a}±4.51	91.06^{a}±2.23	76.63^{a}±4.69

crossbred (192.14 %) (Table 1). In agreement with present study, poor growth rate of Fayoumi breed [12]. Contradicted results obtained by some authors recorded that strain crosses were superior in growth rate over their parents [16].

Regarding average egg weight, RIR egg was higher than Fayoumi egg (44.28 and 39.38 g, respectively) followed by RIR×Fayoumi then reciprocal crossbred (41.99 and 41.18 g, respectively) (Table 2). The obtained results were in the same line of some authors found that egg weight of Fayoumi was lighter than egg weight of RIR×Fayoumi crossbred [17]. Also, egg weight of RIR×Fayoumi (47.5 g) was higher than egg weight of reciprocal crossbred (47 g) [7 -18 and 19]. The results disagreed with some observation of the average egg weight of Fayoumi was 44.23 g [20- 21].

Fayoumi×RIR crossbred recorded the highest hen day egg productionpercentage followed by RIR then Fayoumi and finally reciprocal crossbred (54.41, 51.24, 50.67 and 44.70 %, respectively) (Table 2). These results agreed with some observations of significant differences ($p \leq 0.05$) between Fayoumi×RIR (52.3%) which higher than reciprocal crossbred (48.2%) in HDEP% [13]. On the contrary, observed that RIR× Fayoumi crossbred (37.0%) higher than Fayoumi breed (32.8%) in HDEP% [10-17].

Fayoumi×RIR crossbred had the highest HHEP% followed by RIR then Fayoumi and finally reciprocal crossbred (51.65, 50.11, 49.53 and 42.80 %, respectively) (Table 2). On the contrary, some authors found that RIR×Fayoumi crossbred (32%) was higher than Fayoumi breed (22.4%) in HHEP% [17]. Also, Fayoumi was higher HHEP% than RIR breed [22].

RIR breed laid their first egg at later age than Fayoumi×RIR and reciprocal crossbred (144.66, 142 and 142 day, respectively). Fayoumi breed showed intermediate age at sexual maturity (144.29 day) but earlier than RIR breed (Table 3). The obtained results were in the same line of some observation of a non-significant difference in age at sexual maturity among crossbred chickens [19-22 and 23]. Contradicted results were Fayoumi started egg laying at 231 days and RIR started egg laying at 239 days [18-20].

Body weight at sexual maturity in RIR breed showed the heaviest weight (1559.05 g), Fayoumi×RIR and reciprocal crossbred showed intermediate body weight at sexual maturity but Fayoumi×RIR crossbred heavier than reciprocal crossbred and Fayoumi showed lowest weight (1172.74 g) (Table 3). In agreement with present study, RIR gave the highest body weight at sexual maturity but Fayoumi gave the lightest weight [23]. On the contrary, body weight at first egg of Barred Rock and RIR breed were 1765.354 and 1974.478 g, respectively [20].

RIR breed reported the highest fertilitypercentage followed by Fayoumi then RIR×Fayoumi crossbred and finally reciprocal crossbred (85.59, 85, 83.99 and 82.04 %, respectively) (Table3). These results agreed with some authors reported that there were non-significant differences between RIR, Fayoumi and RIR×Fayoumi in fertility% (93.55, 91.88 and 96.90%, respectively) [24]. In addition, there were non-significant differences in fertility% among different genotypes [7 - 25]. The opposite results obtained by some observation of fertility of Fayoumi was 91.35% [21].

Scientific hatchability % in RIR breed was the highest followed by Fayoumi then RIR×Fayoumi crossbred and finally reciprocal crossbred (94.91, 91.35, 91.06 and 88.83 %, respectively) (Table 3). In agreement with present study, some authors found that there were non-significant differences in hatchability between Fayoumi (86%) and Sonali chicks (87.5%) [25]. Contradicted results showed that hatchability of RIR breed was 64.0% [7]

and there were significant difference in hatchability between Fayoumi (67.9%) and RIR breeds (39.3%) [18].

RIR breed reported the highest commercial hatchabilitypercentage followed by Fayoumi then RIR×Fayoumi crossbred and finally reciprocal crossbred (81.49, 78.22, 76.63 and 72.95 %, respectively) (Table 3). These results agreed with some observations of non-significant difference between RIR, Fayoumi and RIR×Fayoumi in hatchability percentage (80.99, 77.08 and 78.59, respectively) [24]. On the contrary, commercial hatchability % in Fayoumi×RIR was the highest (87.5%) followed by RIR and Fayoumi (80.80 and 75%) [26].

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مجلة بنها للعلوم الطبية البيطرية
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تأثيرخليط الفيومي والرود أيلاند الأحمر على أداء النمو وصفات البيض والتناسل تحت الظروف المصرية

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الملخص العربي

أجريت هذه الدراسة في مزرعة بحوث الدواجن التابعة لقسم تنمية الثروة الحيوانية، كلية الطب البيطري، جامعة بنها، مصر من يوليو 2011 إلى يونيو 2012. القطيع الذي تم عليه اجراء التجربة مكون من اثنين من سلالات الدواجن النقية، وهما الفيومي والرود أيلاند الأحمر وخليطهما المتبادل. هذه السلالات تم الحصول عليها من مشروع الدواجن التكاملي بالعزب بالفيوم. وقد أجريت هذه الدراسة لتقييم وزن الجسم، معدل الزيادة اليومية، معدل النمو النسبي، العمر عند النضج الجنسي، ووزن الجسم عند النضج الجنسي، وزن البيضة، نسبة الخصوبة، نسبة الفقس العلمية، نسبة الفقس التجارية، نسبة البيض بالنسبة لعدد الطيور الكلية، نسبة البيض بالنسبة لعدد الطيور الحية. وقد سجلت سلالة الرود أيلاند الأحمر النقي أعلى قيمة معنوية لوزن الجسم، معدل الزيادة اليومية معدل النمو النسبي، عمر النضج الجنسي والوزن عند عمر النضج الجنسي وكانت 1898.76جرام، 9.04جرام، 193.95%، 144.66يوم و1559.05جرام على التوالي مقارنة بإداء باقي الأفراد الأخرى. وأيضا هذه السلالة سجلت أعلى قيمة لوزن البيضة، نسبة الخصوبة، نسبة الفقس على البيض المخصب ونسبة الفقس على كل البيض داخل الحضانة وكانت 44.28جرام، 85.59%، 94.91 و81.49% على التوالي. بينما سجل خليط ذكور الفيومي مع اناث الرود أيلاند الأحمر أعلى قيمة نسبة البيض بالنسبة لعدد الطيور الحية ونسبة البيض بالنسبة لعدد الطيور الكلية (54.41% و51.65% على التوالي).

(مجلة بنها للعلوم الطبية البيطرية: عدد 24 (2)، يونيو 2013: 11-18)