

Effect of Sex-linked Feathering Genes on Fertility and Hatchability Parameters of Baladi Chickens

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Abstract. A total of 320 twenty weeks-old slow and rapid feathering Baladi pullets were used to study the effect of sex-linked feathering genes on fertility and hatchability parameters. Similar number of Leghorns pullets were also included in the study for the purposes of comparison. The experimental birds of each genotypic group were randomly divided into four replicates and five males of the same age and genotype were added to each. The birds were subjected to standard management practices. Ten eggs of each replicate were collected for three consecutive days during the fourth week of each production period. Experimental eggs were stored at 10-20°C and 55-60% relative humidity for not more than two days and were incubated on the third day of collection following standard hatchery practices. Rapid and slow feathering Baladi and Leghorns had statistically similar percentages of fertility, hatchability, fertile hatchability, total embryonic mortality and embryonic mortality during 1-7 and 8-18 days of the incubation period. With respect to embryonic mortality during 19-21 days of the incubation period, slow feathering Baladi had significantly ($P < .05$) the highest rate compared with its rapid feathering counterparts and Leghorns.

Based on the results of the study it seems that sex-linked feathering genes had no or very little effect upon fertility and hatchability parameters.

Introduction

Very limited information are available on the relationship of sex-linked feathering genes with fertility and hatchability parameters. The results of most previous investigations revealed similar fertility [1-3], hatchability and embryonic mortality for early and late feathering birds [1]. On the contrary, Gredina {cited by Landauer, [4]} found that embryos with the phenotype for rapid feathering hatched better than embryos with the phenotype for slow feathering. The study reported herein was undertaken to assess the effect of sex-linked feathering genes on fertility and hatchability parameters in Saudi Arabian Baladi and to compare their performance with that of rapid feathering Leghorns.

Material and Methods

Slow and rapid feathering Saudi Arabian Baladi were obtained from the Baladi population which has been randomly bred for several years in the Experimental Poultry and Livestock Farm of the Animal Production Department, College of Agriculture, King Saud University. Hundred and sixty 20-week old pullets of each genotypic group were used in this study. The birds in each group were leg-banded and were randomly allotted to four floor pens in an environmentally controlled house, 40 birds in each pen. Each floor pen was considered as a replicate. Five males of the same age and genotypic group were added to each replicate. Similar number of early feathering Leghorns pullets which has been bred under similar conditions were included in the study for the purpose of comparison. The birds received water and the commercial laying ration described in Table 1 ad-libitum throughout the experimental period. Light was increased by half an hour weekly and maintained constantly at 15 h light: 9 h dark. The trial lasted nine 28 days production periods.

Table 1. Commercial diets used in the experiment¹

Nutrients	(%)
Crude protein (min.)	17.00
Crude fat (min.)	3.00
Crude fiber (max.)	5.50
Calcium (max.)	3.60
Phosphorus (min.)	0.60
Salt (max.)	0.35
M.E. Kcal (kg (2695)	

Ingredients:

Yellow Corn, Wheat millfeed Soybean meal, Meat and Bone meal, Alfalfa meal, Animal fat, Molasses, Oyster shell, Calcium carbonate, Phosphate, Salt, Methionine, Manganese, Iron, Iodine, Copper, Cobalt, Zinc, Vitamins. A, D3, K, B12, Riboflavin pantothenic acid, Niacin, Choline, Chloride, Ethoxyquin, Fermentation producer.

Ten eggs of each replicate per day were collected for three consecutive days during the fourth week of each 28 days production period. Experimental eggs were stored at 10-20°C and relative humidity of 55-60% for not more than two days and were incubated on the third day of collection following standard hatchery practices. Eggs seemed infertile and unhatched eggs were broken out at the end of the incubation period to determine fertility (FY), fertile hatchability (FH) and total embryonic mortality (TM) percentages. Percentages of the embryonic mortality at 1-7 (M1), 8-18 (M2) and 19-21 (M3) days of the incubation period and hatchability (H) as a percentage of the total incubated eggs were also calculated (commercial hatchability).

Data collected were subjected to statistical analysis using SAS general linear model (GLM) procedure, KSU Computer Center, according to the following model:

$$Y_{ijk} = U + G_i + P_j + (GP)_{ij} + e_{ijk}$$

Where the Y_{ijk} is the K th observation of the i th genotype (G), j th production period (P). $(GP)_{ij}$ is the interaction between genotype (G) and production period (P). U is the general mean and e_{ijk} is the random error associated with Y_{ijk} observation [5]. Mortality percentages were transformed to arc sin proportion prior to statistical analysis.

Results

Fertility (FY)

As it is stated in Table 2 genotype (G), production period (P) and their interaction ($G \times P$) effects were nonsignificant. Rapid feathering Baladi (RB) tended to have higher Fertility (FY) than their slow feathering counterparts (SB) whereas rapid feathering Leghorns (RL) tended to have the lowest value compared with Baladi (Table 2).

Table 2. Effect of genotype (g) and production period on percentage of fertility (fy), fertile hatchability (fh), hatchability (ht) and total embryonic mortality TM

Parameters				
	FY	FH	HT	TM
	(%)	(%)	(%)	(%)
Genotype (G)	NS	NS	NS	NS
SB	98.39	87.1	85.7	12.9
RB	98.58	89.22	87.98	10.78
RL	98.24	88.69	87.09	11.31
SEM	± .240	± .944	± 1.033	± .939
Period in Weeks (P)	NS	**	**	**
1	98.33	75.37 ^d	74.17 ^d	24.63 ^a
2	98.89	85.36 ^c	84.44 ^{bc}	14.64 ^{bc}
3	97.77	92.04 ^{ab}	89.94 ^{ab}	7.96 ^d
4	97.78	90.06 ^b	88.06 ^b	9.94 ^{bcd}
5	98.33	91.16 ^b	89.64 ^{ab}	8.84 ^{cd}
6	98.89	83.17 ^c	82.23 ^c	16.83 ^b
7	99.33	90.63 ^b	90.03 ^{ab}	9.64 ^{cd}
8	98.43	90.67 ^b	89.30 ^{ab}	9.33 ^d
9	97.88	96.57 ^a	94.50 ^a	3.43 ^c
SEM	± .727	± 1.635	± 1.790	± 1.628
Interaction (GxP)	NS	NS	NS	NS

SB: Slow Feathering Baladi * : $P > .05$

RB: Rapid Feathering Baladi **: $P > .01$

RL: Rapid Feathering Leghorns NS: Nonsignificant

^{a-c} : Means with in column with different superscripts differ significantly ($P < .05$)

Fertile hatchability (FH)

Table 2 shows that production period (P) effect was significant ($P < .01$), whereas that of genotype (G) and their interaction ($G \times P$) was nonsignificant. Rapid feathering Baladi (RB) tended to have the highest FH while rapid feathering Leghorns (RL) tended to have higher FH than slow feathering Baladi (SB). Table 2 also indicated that FH significantly ($P < .05$) increased up to the 3rd production period thereafter decreased at the 6th production period and significantly ($P < .05$) increased again to reach its highest value at the last production period.

Hatchability (HT)

Production period (P) effect was significant ($P < .01$), whereas that of genotype (G) and their interactions ($G \times P$) was nonsignificant (Table 2). Rapid feathering Baladi (RB) tended to have the highest HT compared with other experimental groups, whereas slow feathering Baladi (SB) tended to have the lowest value as shown in Table 2. HT significantly ($P < .05$) increased up to the 2nd production period thereafter decreased at 6th production period and significantly ($P < .05$) increased again to reach its highest value at the last production period (Table 2).

Total embryonic mortality (TM)

Production period (P) effect was significant ($P < .01$), whereas that of genotype (G) and their interactions ($G \times P$) was non significant (Table 2). Rapid (RB) and slow (SB) feathering Baladi tended to have the lowest and highest total embryonic mortality, respectively (Table 2). TM in general decreased with age and significantly ($P < .05$) reached its lowest value at the ninth production period. However, a substantial increase was noticed at the sixth production period but the value was significantly ($P < .05$) lower than that of the first production period.

Embryonic mortality during 1-7 days of the incubation period (M1)

Table 3 shows that genotype (G) effect was non significant, whereas production period (P) and their interaction ($G \times P$) effects were significant at the .05 and .01 level of probability, respectively. Rapid feathering Baladi (RB) tended to have the highest and Leghorn (RL) the lowest M1 value (Table 3). M1 was statistically similar during most production periods, but tended to have the highest and lowest value at the 1st and 9th production periods, respectively (Table 3). Figure 1 shows that the different genotypes had statistically similar M1 most of the production periods. However, rapid feathering Leghorns (RL) and Baladi (RB) had significantly ($P < .05$) the highest value at 1st and 4th production period, respectively.

Embryonic mortality during 8-18 days of the incubation period (M2)

As it stated in Table 3 genotype (G) effect was nonsignificant, whereas production period (P) and their interaction ($G \times P$) effects were significant at the .01 and .05 level of

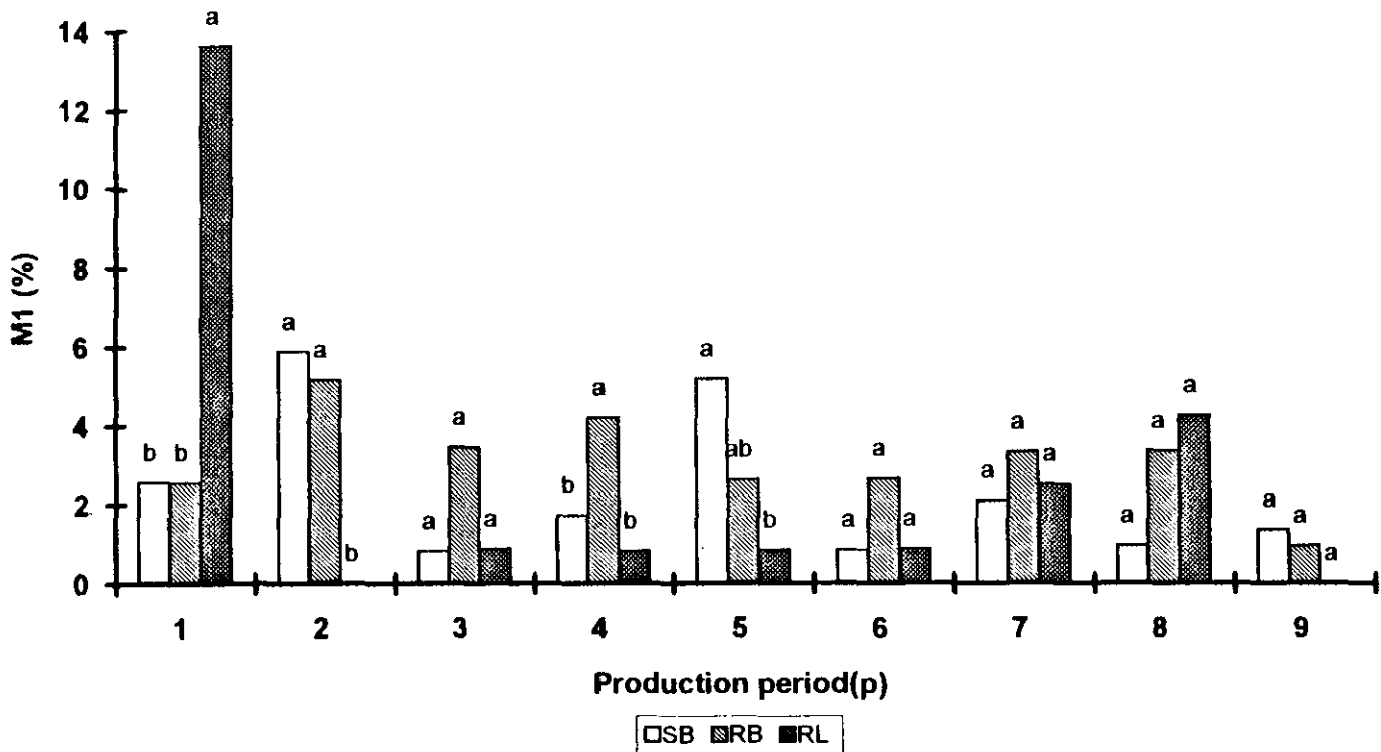


Fig. 1. Effect of G * P on embryonic mortality during 1-7 days of the incubation period (M1).
a b : Columns within each period with different superscripts differ significantly ($P < .05$).

Table 3. Effect of genotype (G) and production period on percentages of embryonic mortality during 1-7 (M1), 8-18 (M2) and 19-21 (M3) days of the incubation period

Parameters			
	M1 (%)	M2 (%)	M3 (%)
Genotype (G)	NS	NS [*]	*
SB	2.78	2.64	7.88 ^a
RB	3.14	2.16	5.47 ^b
RL	2.65	2.16	6.50 ^b
SEM	±.466	±.492	±.695
Period in weeks (P)	*	**	**
1	6.25 ^a	5.40 ^a	12.98 ^a
2	3.69 ^{ab}	2.53 ^{abcd}	8.42 ^{ab}
3	1.73 ^b	1.47 ^{cd}	4.77 ^{cd}
4	2.25 ^{ab}	3.68 ^{ab}	4.01 ^{cd}
5	2.89 ^{ab}	2.28 ^{abcd}	3.67 ^{cd}
6	1.47 ^b	1.13 ^{de}	14.23 ^a
7	2.64 ^{ab}	1.44 ^{bcd}	5.28 ^{bc}
8	2.86 ^{ab}	2.95 ^{abc}	3.52 ^{cd}
9	0.76 ^b	0.0 ^{de}	2.67 ^d
SEM	±.806	±.853	±1.205
Interaction (GxP)	**	*	NS

SB : Slow feathering baladi. * : P<.05

RB : Rapid feathering baladi. ** : P<.01

RL : Rapid feathering leghorns. NS : Nonsignificant

^{a-c} : Means within column with different superscripts differ significantly (P<.05)

probability, respectively. Slow feathering Baladi (SB) tended to have the highest M2 value, whereas rapid feathering Baladi and Leghorns had similar values (Table 3). M2 was statistically similar to most of the production periods but was significantly ($p < .05$) the highest at 1st and the lowest at the 5th and 9th production periods. As it is seen in Fig. 2 the different genotypes had statistically similar values most production periods, however, rapid feathering Leghorns (RL) had significantly ($P < .05$) the lowest and highest value at the first and second production period, respectively.

Embryonic mortality during 19-20 days of the incubation period (M3)

Table 3 shows that genotype (G) and production period (P) effects were significant at the .05 and .01 of probability, respectively, whereas their interaction (G*P) effect was nonsignificant. Slow feathering Baladi (SB) had significantly ($P < .05$) the highest M3 value whereas those of rapid feathering Baladi (RB) and Leghorns (RL) were statistically similar (Table 3). M3 was statistically similar for most production periods. However, M3 during the 1st and 6th were similar and had significantly ($P < .05$) the highest value of all but did not differ significantly from the 2nd production period (Table 3).

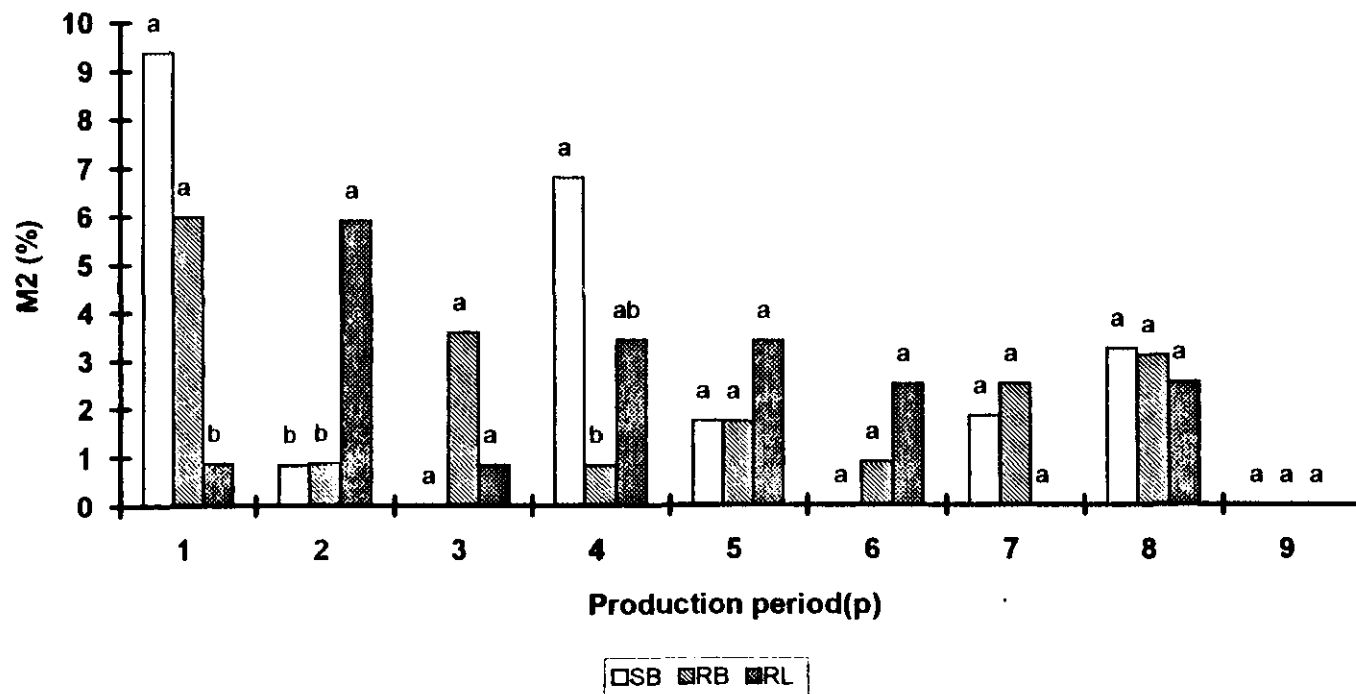


Fig. 2. Effect of G* P on Embryonic Mortality during 1-7 days of the incubation period (M2).
 a b : Columns within each period with different superscripts differ significantly ($P < .05$).

Discussion

Rapid and slow feathering Baladi had statistically similar fertility, hatchability and total embryonic mortality. However, embryonic mortality at the 19-21 days of incubation period was significantly ($P<0.05$) higher for slow feathering Baladi. Similar results were reported by Merat [1]. These results were also confirmed, with regard to fertility by Katanbaf *et al.* [2] and O'Sullivan *et al.* [3]. On the other hand, Gredina, Landauer, [4] found that embryos with the phenotype for rapid feathering hatched better than embryos with the phenotype for slow feathering. The study also revealed that rapid feathering leghorns had statistically similar values as rapid and slow feathering Baladi. The relative low hatchability and high embryonic mortality values during the 1st production period were due to the low relative humidity observed in the incubator, whereas the same trend observed during the 6th production period cannot be explained and might be contributed to experimental error.

Based on the results of the study it seems that sex-linked feathering genes had no or very little effect upon fertility and hatchability parameters.

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تأثير جينات التريش المرتبطة بالجنس على الخصوبة ومعايير الفقس في الدجاج البلدي

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ملخص البحث : أستخدم في هذه الدراسة عدد ٣٢٠ من بدارى الدجاج البلدى بطينة وسريعة التريش عند ٢٠ أسبوع من العمر وذلك لدراسة تأثير جينات التريش المرتبطة بالجنس على الخصوبة ومعايير الفقس في الدجاج البلدى، بالإضافة الى ذلك أستخدم عدد مماثل من بدارى اللجهورن سريعة التريش بغرض المقارنة، قسمت الطيور في كل مجموعة وراثية عشوائيا الى أربع مكررات أضيف الى كل منها خمسة ذكور من نفس المجموعة الوراثية والعمر، وريت الطيور حسب الشروط المألوفة، وتم جمع ١٠ بيضات من كل مكررة لمدة ثلاثة أيام متتاليه في الأسبوع الأخير من كل دورة انتاجية وتخزينها على درجة حرارة ١٠-١٢ °م ورطوبة نسبية ٥٥-٦٠٪ لمدة لاتزيد عن يومين، وفي اليوم الثالث تم تحضين البيض حسب الشروط المألوفة .

دلت النتائج على أنه لاتوجد فروقات معنوية بين الدجاج البلدي سريع وبطيء التريش وكذلك اللجهورن فيما يخص نسب الخصوبة، الفقس، فقس البيض المخصب، هلاكات الأجنة الكلية، هلاكات الأجنة خلال ١-٧ و ٨-١٨ يوم من فترة التفريخ الا أن البلدي بطيء التريش كان الأعلى معنويا ($P<0.5$) من نظيرة سريع التريش وكذلك اللجهورن فيما يخص نسبة هلاكات الأجنة خلال ١٩-٢١ يوم من فترة التفريخ .

كذلك تشير النتائج الى أن جينات التريش المرتبطة بالجنس ليس لها تأثير أو أن تأثيرها ضئيل على الخصوبة ومعايير الفقس .