

Genetic Study to Re-Evaluate the Performance of Fayoumi Chickens

• Means and Heritabilities of Growth Performance (Body Weight and Weight Gain) in Growth Line (Gg)

Abdelatif, H. A.; Om hashem Y. Mahfoz ; M. H. Abdelfatah and A. M. Rezk
Animal Production Research Institute, ARC, Dokki, Giza, Egypt



ABSTRACT

A total of 494 progenies (from 12 sires and 120 dams) of Fayoumi (GG) and 351 progenies (from 12 sires and 96 dams) of Fayoumi (RR) were produced in two successive pedigreed hatches, seven days apart, respectively. The studied traits: Body weight, body weight gain were recorded at 1day, 8 and 12 week of age for each hen by lines. The following results were obtained: 1. GG line were significantly ($P \leq 0.05$) heavier than RR line at 8 and 12 wk of age, and had significantly ($P \leq 0.05$) body weight gain at all periods. 2. GG and RR had higher h2D at all ages (0.41 and 0.89) may be due to the influences of maternal effects. 3. weight gain were ranged from (0.01 to 0.40) and not consistent.

INTRODUCTION

Fayoumi fowl was known since a long time ago in Fayoum governorate and spread all over the country. El Hossari (1970), developed two lines of Fayoumi chicken (PP) as a production line and (GG) as a growth line and There is also a random-bred control (RR) flock at Fayoum Poultry Research Station. In this study we will discuss the genetic parameters of Fayoumi chickens, line (GG) and line (RR). Non genetic information about the two lines are available since 2007. First, we will study means and heritability estimates of body weight and body weight gain. The present study aimed to predict the early ages to improve live body weight (BW) in line (GG). Genetic progress for body weight or meat production in chickens has been accomplished by continuous selection.

The estimation of heritability is therefore important to designing effective selection programmes for the improvement of the (GG) and in determining the appropriate age at which to execute the selection programme to achieve optimal selection response.

The large estimates based on dam half-sib correlations (h²D) at 8 weeks of age in Fayoumi chickens indicated a large maternal effect as reported by several investigators (Amer, 1965, Abdel Gawad and El Ibiary, 1971, Dourgham, 1980, Shoukry, 1981, Sharma *et al.*, 1992, Abdel Warith, 1993 and Khalil *et al.*, 1993) ranged from (0.48 to 1.19).

On the contrary, several authors (Ragab and El Hossari, 1970, Abdel Latif, 1989 and El Full, 1989) reported large estimates based on parental half-sib correlations (h²_s) indicating sex-linked effects on LBW at 8 weeks of ages ranged from (0.41 to 0.76).

MATERIALS AND METHODS

Genetic Stocks, Management and Measurements:

This work was carried out during the period from March 2014 to February, 2015 on Fayoumi (Fay) (GG) and (RR) chickens maintained by El Azab Poultry Research Center, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

A total number of (494) and (351) chicks from Fayoumi (GG) and (RR) arose from 2 hatches by artificial insemination, 12 sires and 120 dams for line (GG) and 12 sires and 96 dams for line (RR), insemination was done twice a week and each rooster was mated to the same hens at every inseminate to obtain pedigreed chicks. All birds

were routinely raised on floor in a conventional-type houseduring early ages.

All chicks were wing-banded, immunized for Mareks disease immediately after hatching and brooded in floor brooders. The feeding and management practices were kept uniform as possible throughout the experimental period.

The chicks were weighed at 1day, 8 and 12 wks of age.

Statistical analysis:

Data were corrected for hatch effect before estimating genetic parameters. The following model was fitted, by lines, to each of the traits to calculate the genetic parameters:

$$Y_{ijk} = M + S_i + D_{ij} + e_{ijk}$$

Where:

Y_{ijk} = expresses the observation of the ijk^{th} hen

M = is the overall mean

S_i = is the effect of i^{th} sire

D_{ij} = is the effect of the i^{th} dam mated to i^{th} sire

e_{ijk} = is the error term accounted for the k^{th} hen of the j^{th} dam and i^{th} sire

Estimation of heritabilities

Heritability estimates were calculated according to Becker (1985) as follows:

$$h^2_s = 4\sigma^2_s / \sigma^2_s + \sigma^2_D + \sigma^2_w$$

$$h^2_D = 4\sigma^2_D / \sigma^2_s + \sigma^2_D + \sigma^2_w$$

$$h^2_{s+D} = 2\sigma^2_{s+D} / \sigma^2_s + \sigma^2_D + \sigma^2_w$$

where:

σ^2_s : is the sire component of variance,

σ^2_D is the dam component of variance

σ^2_w : is the remainder of the genetic variance plus the environmental variance

Also, standard errors for heritabilities were calculated according to Swiger *et al.* (1964) as follows:

$$\text{Var}(\sigma^2_g) = 2/k^2 * \sum_g \text{MSG}_g / f_g + 2$$

$$\text{S.E}(\sigma^2_g) = \sqrt{\text{Var}(\sigma^2_g)}$$

where:

K :coefficient of the variance component being estimated,

MSG_g : the g^{th} mean square used to estimate the variance component.

f_g : the degrees of freedom of the g^{th} mean square.

RESULTS AND DISCUSSION

• Performance of body weights:

Regardless of sex, the GG chicks had heavier LBW at different studied ages.

• **Age effect**

It is evident that LBW's of both lines were remarkably increased as birds advanced in age as shown in Table 1.

• **Sex effect**

Table 1 presents means of body weight and weight gain from 1 d to 12 wk of age for males and females. GG line were highly significantly heavier ($P < 0.05$) than RR line at 8 and 12 wk of age and all periods in body weight gain. Males of both lines had heavier LBW than their females at 8 and 12 weeks of age being 538.83 and 859.99g for the GG males vs 452.16 and 694.61g for their females and 521.85 and 822.01g for the RR males vs 431.88 and 649.74g for their females, respectively. Abdel

Magid (2006) reported that the PP females had significantly heavier LBW at 8 and 12 weeks of age than those of the RR. Lower estimates for LBW_8 were reported by Al Mufti (1978) for White Baladi, Dourgham (1980) for Fayoumi, Rizkalla (1982) for White Baladi, Abdel Latif *et al.* (1999) for Dandarawi. Lower LBW_{12} estimates were cited for Fayoumi (Sabri, 1979 and Abdel Latif and El Hammady, 1992), White Baladi (Atta, 1985). However, heavier weights at 8 and 12 weeks of age were reported by Abdel Warith (1976) for Fayoumi, Sabri *et al.* (1995) for Dandarawi, Abdel Latif (2001) and Moawad (2002) for Dandarawi.

Table 1. Means ± SE of body weight and body weight gain at different ages for males and females of two lines of Fayoumi chickens (GG and RR).

Line	AGE	Body weight		Body weight gain		
		M	F	period	M	F
GG	1 day	28.20±0.22	27.85±0.15	1day-8weeks	510.64±6.43**	424.48±5.93**
	8	538.83±6.51**	452.16±5.96**	8weeks-12weeks	321.16±7.64**	242.44±6.60**
	12	859.99±9.91**	694.61±8.01**	1day-12weeks	831.79±9.85**	666.92±7.97**
RR	1 day	27.81±0.15	27.68±0.19	1day-8weeks	494.05±5.06	404.03±4.16
	8	521.85±5.07	431.88±4.19	8weeks-12weeks	300.15±6.22	217.85±4.67
	12	822.01±7.87	649.74±6.45	1day-12weeks	794.19±7.87	621.88±6.41

** Significantly at $P \leq 0.05$

• **heritability estimates of body weight at different ages:**

Mostly medium to high heritability estimates based on paternal and maternal half-sib correlations for LBW at 1d, 8 and 12 weeks of ages in GG and RR of Fayoumi fowl chickens are presented in Table 2. A general trend of higher h^2_D than h^2_S (0.41 to 0.54 vs 0.22 to 0.27) for the GG line and the RR line (0.45 to 0.89 vs 0.13 to 0.32) estimates was shown for LBW at different ages for all sex by line groups which may be due to the influences of maternal effects. Similar trends that LBW at 8 weeks of

age seemed to be affected also by maternal effects with $h^2_D > 0.60$ were reported by Abdel Magid (2006). Similar trends of maternal effects on LBW at 8 and 12 weeks of age (El Full, 1989, Abdel Latif, 2001 and Moawad, 2002). However, some reports suggested sex-linked influence on LBW_8 Alexandria (El Tahaway, 2000) and LBW_{12} (Dandarawi, Abdel Latif, 2001).

The results showed that heritability estimates of weight gain ranged from (0.01 to 0.40) and its lower than those of the body weight as shown in table 3.

Table 2. Heritability estimates ± SE for livebody weight (LBW) based on paternal (S), maternal half-sibs (D) and full-sib (S+D) correlations at different ages in Fayoumi chickens.

Trait	Line	h^2	1 day		8		12	
			M	F	M	F	M	F
LBW	GG	S	0.24±0.09	0.23±0.09	0.22±0.08	0.22±0.08	0.24±0.09	0.27±0.09
		D	0.54±0.08	0.51±0.08	0.49±0.08	0.45±0.07	0.41±0.08	0.44±0.08
		S+D	0.38±0.06	0.37±0.06	0.36±0.06	0.34±0.05	0.33±0.06	0.36±0.06
	RR	S	0.15±0.12	0.28±0.16	0.20±0.12	0.13±0.11	0.20±0.13	0.32±0.16
		D	0.89±0.18	0.87±0.18	0.45±0.15	0.76±0.17	0.77±0.16	0.58±0.15
		S+D	0.52±0.10	0.57±0.11	0.32±0.09	0.44±0.09	0.48±0.09	0.45±0.11

Table 3. Heritability estimates ± SE for body weight gain (BWG) based on paternal (S), maternal half-sibs (D) and full-sib (S+D) correlations at different periods in Fayoumi chickens.

Trait	Line	h^2	1-8		8-12		1-12	
			M	F	M	F	M	F
BWG	GG	S	0.11±0.06	0.31±0.08	0.21±0.05	0.33±0.15	0.24±0.07	0.28±0.08
		D	0.24±0.12	0.12±0.05	0.18±0.06	0.37±0.17	0.16±0.06	0.26±0.09
		S+D	0.18±0.09	0.22±0.07	0.20±0.06	0.21±0.10	0.05±0.05	0.13±0.05
	RR	S	0.02±0.20	0.20±0.13	0.11±0.06	0.11±0.07	0.36±0.09	0.23±0.05
		D	0.35±0.65	0.24±0.12	0.29±0.33	0.33±0.14	0.01±0.04	0.17±0.07
		S+D	0.19±0.43	0.22±0.13	0.40±0.19	0.22±0.11	0.19±0.07	0.20±0.06

CONCLUSION

It could be concluded that reliable h^2 estimates have been deduced for body weight for line (GG) ranged from (0.22 to 0.54). These results indicate that selection programs to improve this trait are essential.

REFERENCES

Abdel Latif, H. A. (2001). Inheritance of certain plasma constituents and their association with some economic traits In Dandarawi and Golden Montazah hens. M. Sc. Thesis, Fac. Agric., Fayoum, Cairo Univ., Egypt.

- Abdel Latif, M. A. (1989). Genetic study on Dandarawi chickens. 1. Heritabilities and genetic correlations of body weight and weight gain. *Genet. Sel. Evol.* 21: 81-92.
- Abdel Latif, M. A. (1999). Selection for body weight at eight weeks of age in Dandarawi chicken. II- realized Heritabilities and correlated response to selection for growth measurements. *Egypt Poult. Sci.* 19: 691-707.
- Abdel Latif, M. A. and H. El Hammady (1992). Heritabilities of some egg production and egg quality traits in Dandarawi chickens. *Egypt. Poult. Sci.* 12: 751-764.
- Abdel Magid, M. A. (2006). Inheritance of certain plasma constituents and their association with some productive traits in two strains of Fayoumi hens. M. Sc. Thesis, Fac. Agric., Fayoum Univ., Egypt.
- Abdel Warith, A. A. (1976). Selection for egg production based on brothers characters. M. Sc. Thesis, Ain Shams Univ., Egypt.
- Abdel Warith, A. A. (1993). Genetical studies to improve the local Fayoumi fowl. Ph. D. Thesis, Fac. Agric., Zagazig Univ., Egypt.
- Abdel-Gawad E.M. (1961) Genetic and phenotypic parameters in the Fayoumi breed and their relationship to the environment through breeding. Ph. D. Thesis, Faculty of Agriculture, Alexandria University, Egypt
- Abdel Gawad, E. M. and H. M. El Ibiary (1971). Heritability estimates of productive traits in the Fayoumi, Leghorn and Rhode Island Red chickens live body weight, shank length, rate of feathering and chick viability. *Agric. Res. Rev. Minis. Agric. Cairo.* 49: 69-77.
- Al Mufti, A. M. (1978). Improving broiler weight in the White Baladi chicken. M. Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.
- Amer M.F. (1965) Heritability of body weight in Fayoumi. *Poult Sci.* 44, 741-744
- Atta, A. M. M. (1985). Physiological and economical differences between selected and non-selected White Baladi chicken lines. M. Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.
- Becker, W. A., 1985. *Manual of Quantitative Genetics*, (4th Ed). Academic Enterprises Pullman, Washington, U. S. A.
- Dourgham, S. A. (1980). Genetic differences between two strains in Fayoumi chickens with special reference to heterosis. M. Sc. Thesis, Fac. Agric., Ain Shams Univ., Egypt.
- El Full, E. A. (1989). Studies on some economical traits in Fayoumi chickens with its crosses. M. Sc. Thesis, Fac. Agric. Fayoum, Cairo Univ., Egypt.
- El Hossari, M. A., 1970a. The effect of selection for high body weight and high number on genetic and phenotypic variation in two strains of Fayoumi chickens. *U. A. R. J. Animal Prod.* 10: 55-63.
- El Tahawy, W. S. A. (2000). Genetically improvement of some productive and reproductive traits in local chickens. M. Sc. Thesis, Fac. Agric., Alex. Univ., Egypt.
- El-Masri G. (1959) A study of feathering and Its relationship to body size in Fayoumi chickens. M. Sc. Thesis, Faculty of Agriculture, Alexandria University, Egypt.
- Khalil, M. H., M. Hanafi, A. E. F. El Labban and M. M. Iraqi (1993). Genetic evaluation of growth traits in Dokki-4 chickens. *Egypt. J. Anim. Prod.* 30 :263-287.
- Moawad, N. A. (2002). Genetic study of some plasma constituents and their association with growth traits in Dandarawi and Golden Montazah chickens. M. Sc. Thesis, Fac. Agric., Fayoum, Cairo Univ., Egypt.
- Ragab, M. T. and M. A. El Hossari (1970). Selection for high egg yield and rapid growth in a closed flock of Fayoumi fowl. *U.A.R. J. Anim. Prod.* 1: 27-35.
- Rizkalla, H. E. (1982). A study on the correlated traits associated with selection for increased eight-week body weight in White Baladi chickens. M. Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.
- Sabri, H. M. (1979). Genetical studies on meat characteristics in Fayoumi chickens. M. Sc. Thesis, Ain Shams Univ., Egypt.
- Sabri, H. M., K. A. Ibrahim and M. S. Khattab (1995). Performance of distinct chicken genotypes fed two levels during the growing period. *Egypt. Poult. Sci.* 15: 421-443.
- Sharma, R., S. K. Varma and U. D. Gupta (1992). Inheritance and association of growth and production traits in White Leghorn various inbreeding levels. *Ind. J. Anim. Sci.* 62:181-182.
- Shoukry, M. M. A. (1981). Comparative study on the Fayoumi and Dandarawi fowl. M. Sc. Thesis, Fac. Agric., Menia Univ., Egypt.
- Swiger, L. A., Harvey, W. R., Everson, D. O., and K. F. Gregeory, 1964. the variance of infra class correlation involving groups with one observation. *Biometrics* 20: 818-820.

دراسة وراثية لإعادة تقييم أداء الدجاج الفيومي

• المتوسطات والعمق الوراثي لصفات النمو (وزن الجسم الحي ومعدل الزيادة في وزن الجسم) في خط النمو

هشام احمد عبد اللطيف ، أم هاشم يوسف محفوظ ، محمد حامد عبد الفتاح و احمد محمد رزق
مركز البحوث الزراعية

تم عمل التجربة بمحطة بحوث الدواجن بالفيوم على سلالة دجاج الفيومي خطي GG وهو الخط المنتخب لزيادة وزن الجسم عند عمر ٨ اسابيع وخط RR وهو خط الكنترول وذلك لعمل المقارنه بينه وبين الخط الآخر. تم استخدام عدد (٤٩٤) كتكوت من خط GG وعدد ٣٥١ من خط RR. تم عمل قياس فردي لوزن الجسم عند عمر الفقس و ٨ و ١٢ اسبوع من العمر وتم حساب معدل الزيادة في وزن الجسم. وكانت اهم النتائج المتحصل عليها انه كان هناك فرق معنوي في وزن الجسم عند عمر ٨ و ١٢ اسبوع من العمر ومعدل الزيادة في وزن الجسم في كل الفترات المحسوبه عند مستوى (P≤0.05) لصالح خط GG. أظهرت نتائج حساب العمق الوراثي ان وزن الجسم عند الأعمار المختلفة في كلا الخطيين كان مرتفع وتراوح بين (٠.٤١ إلى ٠.٨٩) من ناحية الأم وهذا يدل على وجود التأثيرات الأمية. اما بالنسبة لمعدل الزيادة في وزن الجسم فكانت قيمه غير ثابتة وكانت منخفضة عن قيم وزن الجسم. وبناء على هذه النتائج المتحصل عليها من وجود فرق معنوي واضح بين خطي GG و RR مع وجود عمق وراثي مرتفع لصفة وزن الجسم لذا من الضروري وضع برنامج انتخاب لعمل تحسين في وزن الجسم.