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NATURAL MOLTING IN THE FAYOUMI FOWL
2- A COMPARTIVE STUDY OF TWO LINES OF FAYOUMI FEMALES FEATHERING AND ITS RELATIONSHIP WITH EGG PRODUCTION TRAITS

By

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Abstract: *One hundred and two, one-day-old female Fayoumi chicks, hatched late April (out of season), were used in this experiment. They represented two lines (41 PP chicks from a line selected for high egg production and 61 GG chicks from a line selected for high body weight at 8 wks of age).*

Results obtained indicated that, PP line was superior than GG line in: number of tail feather at ten-days of age (T10); early age at sexual maturity(SM); lighter body weight at sexual maturity (MBW); less number of days to produce the first ten eggs (DP10); higher intensity of production(I %); egg production until 60, 90 and 365 days (P60, P90 and P365). While the GG line females were superior than the PP line females in: body weight at four weeks (BW4); body weight at eight weeks (BW8); persistency (PERS) however these differences were not significant. The GG line females were lower layer mortality than the PP line females.

The differences between these two Fayoumi lines were examined . Average number, of primary and secondary feathers at hatch were 7.1 and 1.5 feathers in the PP and 7.1 and 1.4 feathers in the GG line. Number of tail feather at ten-days of age (T10) were 11.2 and 9.3 feathers in the PP and GG lines, respectively.

*There were significant **positive** correlations between secondary feathers score at hatch (SEC0) and: P90; between DP10 and: SM and MBW; between number of primary feathers at hatch (PR0) and: number of primary feathers at eight weeks (PR8); and between COV8 and: T10, BW4 and number of secondary feathers at eight weeks (SEC8) and BW8.*

*Significant **negative** correlations between DP10 and: P60, P90 and P365, PERS, and I %; between SM and: P90, P365, I % and BW4; between PR8 and: BW8 and BW4; between MEW and: both BW4 and BW8; between*

MBW and: P60, P90, P365 and I %; between SEC0 and: PERS; and between PR8 and: BW4 and BW8.

The PP line was early in molting than the GG line. The Pubic Bones Spread (PBS) of the PP line females were larger than the GG line females at 12, 14, 15 and 18 months of age. The Pubic Bones Condition (PBC) of the PP line females had better score (thin and flexible) than the GG line females (thick and hard) from 14 until 18 months of age . However, the GG line females had larger comb area (CA) and darker red comb color (CC) than the PP line females. The GG females had more rounded abdomen (AB) than the PP females. The Capacity (CAP) of the GG line females were better from 12 to 18 months of age than the PP line females. The maximum CAP was obtained at 12 and 13 months and the minimum at 15 month of age. Significant differences were obtained between the PP and the GG in their egg production from May to July (12 -14 months).

This work was done to help the small and medium egg producers to improve their egg production, from Fayoumi chickens, without going into prolonged breeding programs.

INTRODUCTION

In commercial egg production, there is often a concern about the quality of feathering needed to optimize feed efficiency. Feather development is under the direct control of hormones such as thyroxin and estrogen and indirectly by testosterone **(Spearman, 1971).** Environmental or nutritional status that influences such hormonal output will indirectly affect feathering.

Egg production could be improved when selection is practiced either to decrease age at sexual maturity or to decrease the number of pausing days. Therefore, combining these two traits with egg number, in a selection programmer, would make selection more efficient and useful. Furthermore, establishing new lines by selecting against these characters would be helpful in strain-cross studies **(El-Hossari , 1980).**

The standard breeds (such as RIR, Leghorn …etc) have been established by poultry-breeders through culling, since computer-methods were not known yet. Culling poultry was used before pedigree. Culling is suitable for the small breeder in Egypt. With the high cost of feed, culling the stock is essential, even in purebred poultry. Profits obtained from the laying stock are directly related to egg production. As egg production in the flock increases, the income over feed costs rises much more rapidly than the total cost of production. Since the cost of feed amounts to about two thirds

Fayoumi, Primary, Secondary, Tail feathers, production, Physical appearance.

of the total cost, of producing eggs, it is necessary to cull poor layers from the flock as soon as they can be identified. One advantage of culling poor layers, early in the laying year, is that their eggs are not available to produce more layers. Also birds that have laid well for a short period but stopped laying, for one reason or another, should be culled promptly. In order not to affect production, culling the whole flock, by using catching crates, should be done after 2 PM, by which time most eggs for the day have been laid. The amount of culling that should be done from time to time, throughout the year, depends on the amount of feed consumed and the amount of eggs produced.

The development of the Physical Appearance characteristics is dependent upon the production of both androgens and estrogens **(Itoh *et al.*, 1988).**

Natural molting is a natural physiological process for the birds to renew old feathers at the end of the first year of laying. The time of onset and duration of the first annual molting are important points in distinguishing the poor and good layers **(Sastry *et al*., 1983).**

Molting is a natural process that allows the hen to replace old, worn feathers and rejuvenates her oviduct, the organ that “makes” eggs. With the molt, the hen puts the bulk of her energy into feather growth, leaving little for egg production. Also, natural molting is a seasonal process related to changes in day length. It usually occurs in the fall after chicks fledge, but in domestic birds it can occur at any time , especially if the hen is exposed to some stress. Rapid feather loss by the entire flock usually is the result of a serious stressful event such as lack of water and / or feed or lighting problems **(Hermes, 2003).**

Early molters are usually poor layers . Such birds start molting early and take unusually long time (24 weeks or so) to complete molting. Often they stop laying during the molting period. They shed only one primary feather, at a time, at intervals of two weeks during the molting period. In contrast to this , good layers start molting late in their first year of laying. Their molting process is complete in 1 to 2 months only where as poor layers may take up to 6 months to molt.

Often pullets undergo a partial molt , involving the neck and tail feathers. This condition can usually be eliminated by purchasing pullets hatched in April or later and by following proper management practices. The length and incidence of a molt are influenced considerably by the bird’s body weight, physical condition and environmental conditions such as nutrition and management **(Smith, 1997) .**

Leason and Walsh (2004) reported that in broilers, the differences between a rapid and slow moulter is not due to a difference in growth rate of the individual feather, but because the rapid moulter renews of feathers and lay at the same time. With this knowledge, the rate of moulting can be ascertained by examining the number of flight feathers on the wing being replaced simultaneously. If a hen is found to have grown some of her primaries before starting to molt her secondaries, it may be assumed that she lay well into the molt and was therefore a good layer.

In Egypt, summer is characterized by high ambient temperatures. The aim of the present work is to comparative study of two lines of females Fayoumi feathering and its relationship to egg production traits and natural molting in, out of season, Fayoumi fowl. This would help the small breeders to be able to cull their birds correctly.

MATERIALS AND METHODS

This experiment was carried out at Fayoum Poultry Research Station, Agricultural Research Center, Egyptian Ministry of Agricultural.

One hundred and two, day-old female Fayoumi chicks, hatched late April, 2003 were used in this experiment. These birds represented two lines of Fayoumi chickens, 41 chicks from an egg production line (denoted as PP) and 61 chicks from a growth line (denoted as GG). The PP line was selected for high egg number, while the GG line was selected for heavy body weight, at 8 wks of age **(El-Hossari , 1970).**

All chicks were wing-banded to keep their pedigree and immediately immunized for Marke's disease using (HVT) vaccine by subcutaneous injection, in the hatchery, and individually weighed. The primary wing feathers were counted. The secondary feathers were given two arbitrary scores, the first score was denoted as short while the second one denoted as long. The experimental chicks were reared on floor pens within a closed house.

At ten days of age, tail feathers were counted. The birds were weighed at 4 weeks of age. At eight weeks of age, chicks were weighed again and their primary and secondary feathers were counted. Three arbitrary scores for body feather covering were given as follows: (3) fully feathered. (2) back feathered with sides bare and (1) back and sides bare . Dead chicks were recorded daily.

All birds were kept under the same managerial and hygienic condition from hatch up to the end of the egg production period. The laying cycle was assumed to be for 365 days from the 1st egg (annual cycle).

Fayoumi, Primary, Secondary, Tail feathers, production, Physical appearance.

Traits studied were: primary (PR0) and secondary (SEC0) feathers frequency distributions (at hatch and at eight weeks), number of tail feathers (at ten days) (T10) and back feathers covering (at eight weeks) (COV8). Body weight was measured, to the nearest gram, at 0, 4 and 8 weeks (BW0, BW4 and BW8), and at sexual maturity (MBW). Age at sexual maturity (SM), number of days to produce the first ten eggs (DP10), egg number (P60, P90 and P365) and weight of first egg (MEW) were recorded. Persistency (PERS) (Number of eggs produced during the last 60 days of production), refers to a bird's ability to continue laying late in the Fall at the end of her laying year **(James *et al*.,1949)** was obtained. Intensity of production (I %) (Number of eggs laid over the number of days the female had opportunity to lay X 100 transformed to arc sin) according to **Bray *et al* (1960)** was calculated. Hatchability was calculated as the percent of hatched chicks to the fertile eggs. Layer mortality rates (LM %), as a percentage, from age of sexual maturity until one year of production, were calculated. Also, The phenotypic correlations between the studied traits for the PP and GG Fayoumi females, were calculated.

At twelve to eighteen months of age, some body measurements (Physical Appearance) were obtained: Comb Area (CA), length of comb from front to back times middle height; Comb Color (CC), arbitrary color scores were given as follows: (8) dark red, (6) red and (4) pale red color; Abdomen Shape (AB), two arbitrary scores for abdomen shape were given as follows: (4) round and (2) pointed abdomen; Vent Shape (VS), two arbitrary scores for vent shape were given as follows: (4) large, oval and moist and (2) small, round and dry; Pubic Bones Spread (PBS), distance between the inside of the pubic bones were measured by a clipper and Capacity (CAP), distance between the pubic bones and the tip of the keel was also measured by a clipper. Pubic Bones Condition (PBC), were given two arbitrary scores as follows: (4) soft and (2) hard. Production during Molting was recorded.

Statistical Analysis :

Data were analyzed using SAS software **(SAS, 2000)** using the General Linear Model (GLM) procedure . Duncan's Multiple Range Test **(Duncan, 1955)** was used to test significance between treatment means when significant difference existed. Significance level was set at 5 % . All percentages were transformed to arc sin before the analysis.

RESULTS AND DISCUSSION

Data presented in Table (1) indicated that the PP line had significantly higher: T10; I %; P60; P90 and P365 than the GG line and lower BW4;

BW8; SM; MBW; and DP10 than the GG line. However, there were no significant differences between the PP and GG lines in: BW0; PR0; SEC0; PR8; SEC8; COV8; MBW and PERS (Table 1).

Number of tail feather at ten- days of age (T10)

Data in Table (1) showed that the mean T10 of PP line females was more than the GG line. This difference was statistically significant ($P \leq .05$).

Body weight at four weeks of age (BW4)

Data presented in Table (1) showed that the mean body weight of the PP line females was lighter than the GG line females. This difference was statistically significant ($P \leq .05$). **Hossari (1958)** reported that Fayoumi females weighted 134 gm at four weeks of age. While **Abdel–Wares (1976)** reported that the females body weight at four weeks of age were 183 and 193 gm for the PP and GG lines, respectively . Also, **Amer (1980)** reported that the average females body weight at four weeks of age were 190 and 212.8 gm for these PP and GG lines, respectively and this difference was statistically significant ($P \leq .01$).

Body weight at eight weeks of age (BW8)

Data presented in Table (1) indicates that the mean BW8 of the PP line females (428 gm) was lighter than the GG line females (494 gm). This difference was statistically significant ($P \leq .05$). Hossari (1958) reported that Fayoumi females weighted 361 gm at eight weeks of age . Whereas **Phillips and Nordskog (1954)** reported that the average of the Fayoumi females without lines weighted 499 gm at eight weeks of ag . **Warren and Moore (1954)** reported that the average of the Fayoumi females without lines weighted 551 gm at eight weeks of age. **Abdel-Wares (1976)** reported that the PP line females weighed 430 gm while the GG line females weighed 482 gm at eight weeks of age. **Amer (1980)** reported that the PP line females weighed 511 gm while the GG line females weighed 550 gm at eight weeks of age. This difference between lines was statistically significant ($P \leq .01$).

Age at sexual maturity (SM)

Data presented in Table (1) Indicates that the mean SM of PP line females (166 days) was less than that of the GG line(170 days). **Hossari (1958)** reported that Fayoumi females reached sexual maturity at 187.6 days of age. However, **Warren and Moore (1954)** reported that the SM of Fayoumi females was 196 days. **Hossari *et al.*(1992)** reported that age at sexual maturity was 172 days for Fayoumi hens. **El Full (2005)** reported that the age at first egg for Fayoumi females was 141 days. While **Zaky**

(2005) reported that the age at first egg was earlier by about 29 days in Fayoumi hens (132 days) as compared to the second generation (161 days) in the same flock. These fluctuations in SM is probably due to season and managerial conditions.

Body weight at sexual maturity (MBW)

Data presented in Table (1) showed that the mean body weight of the PP line females (1302 gm) at sexual maturity was lighter than the GG line females (1521 gm) at the same age. **Amer (1980)** also reported that average mature body weight of the PP line females (1431 gm) was lighter than the GG line females (1662 gm) at the same age . This difference was statistically significant ($P \leq .01$). **Hossari (1958)** reported that mean body weight of Fayoumi females was 1485 gm at sexual maturity. Whereas, **Phillips and Nordskog (1954)** reported that Fayoumi females weighed 1600 gm at sexual maturity. **Zaky (2005)** reported that the Fayoumi females weighed 1216 gm at sexual maturity in one generation, while it was 1420 gm in the next generation.

Number of days to produce the first ten eggs (DP10)

The mean DP10 for the PP line females (36 days) was less than that of the GG line females (65 days) (Table 1). This difference was statistically significant ($P \leq .05$).

Amer (1980) reported that average time to produce the first ten eggs for the PP line females (16 days) was less than that of the GG line females (18 days) . This difference was statistically significant ($P \leq .01$).

Intensity of Production (I %) or Rate of Production

Data presented in Table (1) demonstrated that the intensity of egg production for first ten eggs for the PP line females was more than that of the GG line females. This difference was statistically significant ($P \leq .05$). **Amer (1980)** also reported that the rate of production for first ten eggs for the PP line Fayoumi females (61.7 %) was more than that of the GG line females (45.6 %) . He stated that this difference was statistically significant ($P \leq .01$).

Egg production at 60, 90 and 365 days (P60 , P90 and P365)

Data found in Table (1) showed that the mean egg production of the PP line females (20, 28 and 127 eggs) was more than the GG line females (14, 18 and 81 eggs) at 60, 90 and 365 days, respectively. These difference were statistically significant ($P \leq .05$). **Amer (1980)** reported that the average number of eggs produced during 90 days for the PP line females (59 eggs) was more than the GG line females (53 eggs). This difference was statistically significant ($P \leq .01$).

Hossari (1958) reported that mean egg productions for the Fayoumi breed were 10.3, 21.3 and 126 eggs at 60 , 90 and 365 days , respectively. **Abdel-Gawad and El-Ibiary (1971)** reported that the average number of eggs in first ninety days, of egg production, was 35.1 eggs for Fayoumies . **Abdou and Kolstad (1984)** stated that the egg numbers for the first 90 days, of egg production, were 54, 44 and 41 eggs in White Leghorn, Fayoumi and White Baladi hens, respectively. **Zaky (2005)** reported that the rate of lay was significantly higher in Fayoumi than Sinai hens. The average rate of production for first generation was 36.9 % compared to 33.8 % for Sinai hens during the same laying period.

Persistency (PERS)

Data in Table (1) showed that the egg production during the last 60 days of the first season for the PP line females (17 eggs) was less than that of the GG line females (18 eggs).However, this difference was not significant. **Hossari (1958)** reported that Persistency of Fayoumi females was 16.2 eggs (27.3 %).

Hatchability

Data presented in Table (2) show variations in hatchability between the PP and GG Fayoumi lines . Hatchability of the PP line was higher than that of the GG line late April. These results are similar to those obtained by **Zaky (2005).** He reported that Fayoumi hatchability was 76.7 %, under desert condition. However **Rizkalla (1996)** reported that the hatchability of the Fayoumi breed was 84.21 %, during January.

Layer mortality rate (LM %)

Layer mortality of the PP line females was 11 % while it was 9 % for the GG line. **Hossari (1958)** reported that layer mortality rate in Fayoumi breed was 14.50 %. However, **Phillips and Nordskog (1954)** reported that layer mortality of Fayoumi females was 11 %. **Warren and Moore (1954)** showed that the layer mortality of Fayoumi females was 12 %.

Phenotypic correlations between studied traits

A significant **positive** phenotypic correlation coefficient was obtained between SEC0 and P90; between T10 and: BW4, COV8, P365 and I % ; between PR0 and: PR8; between COV8 and: T10, BW4 and SEC8 and BW8 (Table 3).

Fayoumi, Primary, Secondary, Tail feathers, production, Physical appearance.

Significant **negative** phenotypic correlation coefficients were also obtained between the DP10 and: P60, P90 and P365, PERS and I %; between SM and: P60, P90 and P365, I % and BW4; between SM and: P60, P90, P365 and I % were fairly high and **negative** . In different lines of chickens, comparable significant **negative** correlations between these two traits were reported by **Venkatramaiah *et al.* (1986) , Krishna and Chaudhary (1987) , Pricop (1988) , Chaudhary *et al.* (1990) , Thakur *et al.* (1990), Shebl (1991) and Abd-El-Sayed (1995).** Significant **negative** phenotypic correlation coefficient was obtained between PR8 and BW8; and between MEW and: both BW4 and BW8 (Table 3)..

Significant **negative** phenotypic correlation coefficients were also obtained between MBW and: P60, P90, P365 and I % (Table 3) . These results are similar to those reported by **Hossari (1974 a).** He reported negative phenotypic correlation between egg production at 50 days of production after first egg and body weight at sexual maturity . However, he reported a large positive correlation between mature body weight and Spring egg production (March to May) . **Hogsett and Nordskog (1958)** obtained a highly significant negative correlation between mature body weight and egg production when using regression analysis. However when the variance component analysis was used, the correlation became positive and small. It seems, therefore, that the method of estimation used, can have a profound effect upon the results obtained .

Also, significant **negative** phenotypic correlation coefficient was obtained between SEC0 and PERS (Table 3). Furthermore, significant **negative** phenotypic correlation was obtained between PR8 and BW4 and BW8. Moreover, a negative and significant correlation between MBW and I % (Tables 4) was also obtained .

Physical Appearance of the PP and GG Fayoumi lines

The PP line was early in molting 11 (35.91 %) than the GG line 8 (24.95 %) (Table 4). This difference was statistically significant ($P \leq .05$).

Data presented in Table (5) indicated that the GG line females had larger comb area(CA) and darker red comb color (CC) than the PP line females . **Senior (1974), Williams & Sharp (1977), Sharp *et al.* (1977) and Itoh *et al.* (1988)** reported that plasma concentrations of luteinizing hormone (LH), testosterone, estrogens and progesterone are associated with the onset of lay and the comb size.

Data presented in Table (5) shows that the GG females had more rounded abdomen (AB) than the PP females. Also, the vent shape (VS) of the PP females were large, oval and moist at 12, 15, 16 and 17 months while GG line females were large, oval and moist at 13, 14 and 18 months of age.

Pubic Bones Spread (PBS) of the PP line females (Table 5) were larger than the GG line females at 12, 14, 15 and 18 months of age . While the GG line females had larger DPB than the PP line females at 13, 16 and 17 months of age.

Capacity (CAP) of the GG line females (Table 5) were larger from 12 to 18 months of age than the PP line females . The maximum CAP was obtained at 12 and 13 months and the minimum at 15 month of age.

Pubic Bones Condition (PBC) of the PP line females (Table 5) had higher score (thin and flexible) than the GG line females (thick and hard) from 14 month until 18 month of age .

Natural Molting

With respect to egg production , the PP line laid significantly more eggs than the GG line during May to July (Table 6). However, no significant differences were observed between the two lines , in egg production, for August to November.

Both the PP and the GG lines can be referred to as " early molters ". They begin to molt after only a few months in production. They drop only few feathers at a time and may take as long as four to six months to complete the molt. Early molters are usually poor producers in a flock.

CONCLUSIONS

This work was done to help the small and medium egg producers to improve their egg production, from Fayoumi chickens, without going into prolonged breeding programs. In early age we can possibly improve Fayoumi egg production by selecting the female baby chicks at hatch by their longer secondary feathers. Again at ten days of age we can select the females that have at least eleven tail feathers. This would give us a head start in selecting the potentially better egg produces.

Table (1): Effect of the PP and GG Fayoumi females lines on different characteristics studied

Line	Trait	T10	BW4 (gm)	BW8 (gm)	SM (days)	MBW (gm)	DP10 (day)	I %	P 60 (egg)	P 90 (egg)	P 365 (egg)	BW0 (gm)	PR0 Feather	SEC 0	PR8 Feather	SEC8 Feather	COV8	MEW (gm)	PERS (egg)
PP	Mean	11.2 [a] ± 0.42	153 [b] ± 4.94	428 [b] ± 13.18	166 [b] ± 1.09	1302 [b] ± 21.14	36 [b] ± 5.89	39 [a] ± 1.79	20 [a] ± 1.10	28 [a] ± 1.45	127 [a] ± 6.30	29.8[a] ± 0.34	7.1[a] ± 0.04	1.5[a] ± 0.08	8.6[a] ± 0.09	12.7[a] ± 0.09	2.34[a] ± 0.08	34.3[a] ± 0.60	17[a] ± 1.29
	N	**41**	**41**	**41**	**37**	**37**	**37**	**37**	**36**	**36**	**33**	**41**	**41**	**41**	**41**	**41**	**41**	**37**	**33**
GG	Mean	9.3 [b] ± 0.35	168 [a] ± 4.05	494 [a] ± 10.81	170 [a] ± 0.89	1521 [a] ± 16.82	65 [a] ± 5.30	28 [b] ± 1.61	14 [b] ± 1.05	18 [b] ± 1.29	81[b] ± 5.37	29.9[a] ± 0.28	7.1[a] ± 0.03	1.4[a] ± 0.06	8.6[a] ± 0.07	12.6[a] ± 0.07	2.39[a] ± 0.06	34.5[a] ± 0.48	18[a] ± 1.02
	N	**61**	**61**	**61**	**56**	**56**	**56**	**56**	**54**	**54**	**51**	**61**	**61**	**61**	**61**	**61**	**61**	**56**	**51**

PP : Fayoumi line selected for high egg production. **GG :** Fayoumi line selected for heavier 8-week body weight. **N :** Sample size.
T 10 : Number of tail feathers at 10 days. **Bw4 :** Body weight at 4 weeks. **BW8 :** Body weight at 8 weeks
SM : Age at sexual maturity. **MBW :** Weight at sexual maturity. **DP10:** Number of days to produce the first ten eggs.
I % : Intensity of production. **P 60 :** Egg production until 60 days of production. **P 90 :** Egg production until 90 days.
P 365: Egg production until 365 days of production. **BW0 :** Body weight at hatch. **PR0 :** Number of primary feathers at hatch .
SEC0 : Length of secondary feathers at hatch. **PR8 :** Number of primary feathers at 8 weeks. **SEC8 :** Number of secondary feathers at 8 weeks. **COV8 :** Prin
and Secondary feathers covering at 8 weeks. **MEW :** Weight of first egg.
PERS : Persistency (Egg production for last 60 days).
a, b Values, within characteristics, between lines with different superscript differ significantly ($p \leq 0.05$) from each other (Duncan,1955).

Table (2): Numbers of fertil eggs and hatchability of the PP, GG Chickes

Line	Fertil eggs	Hatch chicks	Hatchability %
PP	442	350	79.19 %
GG	496	375	75.60 %

PP : Line selected for higher egg number.
GG : Line selected for heavier body weight at 8 weeks of age.

Table (3): Phenotypic correlations between the studied traits for the PP and GG Fayoumi Females.

	PR0	Index SEC0	T 10	BW4	PR8	SEC8	Index COV8	BW8	SM	MBW	MEW	DP10	P 60	P 90	P 365	PERS	I %
PR0																	
Index SEC0	0.119 **102**																
T10	- 0.108 **102**	0.087 **102**															
BW4	- 0.025 102	- 0.026 **102**	0.310** **102**														
PR8	0.255** **102**	0.074 **102**	- 0.156 **102**	- 0.255** **102**													
SEC8	- 0.067 **102**	- 0.053 **102**	0.076 **102**	0.121 **102**	0.037 **102**												
Index COV8	0.152 102	- 0.057 **102**	0.313** **102**	0.579** **102**	- 0.120 **102**	0.198** **102**											
BW8	- 0.066 **102**	- 0.019 **102**	0.048 **102**	0.713** **102**	- 0.197** **102**	0.107 **102**	0.401** **102**										
SM	- 0.098 **93**	- 0.088 **93**	- 0.184 **93**	- 0.229** **93**	0.048 **93**	- 0.004 **93**	- 0.149 **93**	- 0.167 **93**									
MBW	0.095 **98**	- 0.062 **98**	- 0.095 **98**	0.323** **98**	- 0.072 **98**	- 0.031 **98**	0.105 **98**	0.529** **98**	0.288** **92**								
MEW	- 0.049 **99**	- 0.091 **99**	- 0.022 **99**	- 0.236** **99**	0.119 **99**	0.015 **99**	- 0.143 **99**	- 0.193** **99**	0.463 **93**	0.104 **98**							
DP10	0.137 **85**	- 0.139 **85**	- 0.175 **85**	0.076 **85**	- 0.014 **85**	0.095 **85**	0.137 **85**	0.152 **85**	0.234** **79**	0.351** **85**	0.104 **85**						
P 60	- 0.211 **75**	0.159 **75**	0.182 **75**	- 0.014 **75**	- 0.002 **75**	0.013 **75**	- 0.065 **75**	- 0.146 **75**	- 0.194 **70**	- 0.265** **75**	- 0.153 **75**	- 0.830** **74**					
P 90	- 0.164 **77**	0.243** **77**	0.182 **77**	- 0. 058 **77**	- 0.007 **77**	- 0.011 **77**	- 0.105 **77**	- 0.162 **77**	- 0.249** **71**	- 0.352** **77**	- 0.168 **77**	- 0.847** **76**	0.941** **73**				
P 365	0.060 **76**	0.170 **76**	0.316** **76**	- 0.059 **76**	- 0.023 **76**	- 0.104 **76**	- 0.008 **76**	- 0.189 **76**	**- 0.255**** **72**	- 0.321** **76**	- 0.161 **76**	- 0.517** **73**	0.598** **64**	0.617** **68**			
PERS	- 0.091 **72**	- 0.244** **72**	0.019 **72**	0.014 **72**	- 0.099 **72**	0.045 **72**	0.022 **72**	- 0.033 **72**	0.128 **67**	- 0.066 **72**	- 0.059 **72**	- 0.231* **71**	0.197 **60**	0.101 **64**	**0.332**** **70**		
I %	- 0.139 **85**	0.1149 **85**	0.291** **85**	- 0.003 **85**	- 0.094 **85**	- 0.071 **85**	- 0.104 **85**	- 0.098 **85**	- 0.285** **79**	- 0.261** **85**	- 0.136 **85**	- 0.855** **85**	0.831** **74**	0.805** **76**	**0.518**** **73**	0.156 **71**	

PP : Fayoumi line selected for high egg production. **GG :** Fayoumi line selected for heavier 8-week body weight.
PR0 : Number of primary feathers at hatch . **SEC0 :** Long of secondary feathers at hatch.
T10 : Number of tail feathers at 10 days. **Bw4 :** Body weight at 4 weeks. **PR8 :** Number of primary feathers at 8 weeks.
SEC8 : Number of secondary feathers at 8 weeks. **COV8 :** Primary and Secondary feathers covering.
BW8 : Body weight at 8 weeks. **SM :** Age at sexual maturity. **MBW :** Weight at sexual maturity.
MEW : Weight of first egg. **D P10 :** Number of days to produce the first ten days.
P 60 : Egg production until 60 days. **P 90 :** Egg production until 90 days. **P 365:** Egg production until 365 days.
PERS : Persistency (Egg production for the last 60 days of production).
I % : Intensity of production (Number of eggs laid over the number of days the female had opportunity to lay X 100 transformed to arc sin).
Bold numbers indicate sample size. * Significant correlations ($P \leq .05$) ** Significant correlations ($P \leq .01$)

Table (4): Number of molting hens for the PP and GG Lines

Line	Sample size	Early molting (9 Month old)	Moderate molting (12-17 Month old)	Late molting (18 Month old)
PP	32	11 (35.91 %) [a]	19 (50.42 %) [b]	2 (14.54 %) [a]
GG	45	8 (24.95 %) [b]	37 (65.05 %) [a]	Zero % [b]

PP : Fayoumi line selected for high egg production. **GG :** Fayoumi line selected for heavier 8-week body weight.
* The percentage form of this trait was transformed to arc sin.
a, b Values, within age of molting, between lines with different superscript differ significantly ($p \leq 0.05$) from each other (Duncan,1955).

Table (5): Effect of the PP and GG lines on secondary sex characteristics (Physical Appearance) of survived pullets .

Line	Age (Month)	N	Characteristics						
			CA (mm2)	CC	AB	VS	PBS (mm)	CAP (mm)	PBC
PP	**12**	**36**	810.06 ± 73.97 [a]	6.94 ± 0.23 [a]	3.06 ± 0.17 [a]	2.67 ± 0.15 [a]	34.81 ± 0.97 [a]	55.75 ± 1.84 [a]	…..
GG		**54**	864.37 ± 58.79 [a]	7.05 ± 0.18 [a]	3.23 ± 0.13 [a]	2.49 ± 0.12 [a]	34.58 ± 0.77 [a]	59.89 ± 1.46 [a]	…..
PP	**13**	**35**	1304.32 ± 90.67 [b]	6.06 ± 0.24 [b]	3.18 ± 0.16 [b]	3.59 ± 0.13 [a]	37.82 ± 1.13 [a]	53.65 ± 2.09 [a]	…..
GG		**47**	533.26 ± 77.11 [b]	7.06 ± 0.20 [a]	3.62 ± 0.13 [a]	3.79 ± 0.11 [a]	39.21 ± 0.96 [a]	59.66 ± 1.78 [a]	…..
PP	**14**	**34**	724.19 ± 73.73 [a]	6.56 ± 0.24 [b]	2.81 ± 0.18 [a]	2.50 ± 0.16 [a]	26.25 ± 1.46 [a]	49.63 ± 2.32 [a]	2.75 ± 0.14 [a]
GG		**47**	840.45 ± 60.83 [a]	7.11 ± 0.2 [a]	2.85 ± 0.15 [a]	2.64 ± 0.14 [a]	25.64 ± 1.20 [a]	50.91 ± 1.92 [a]	2.26 ± 0.12 [b]
PP	**15**	**34**	606.09 ± 71.80 [a]	6.56 ± 0.26 [b]	2.50 ± 0.17 [a]	2.88 ± 0.17 [a]	22.94 ± 1.20 [a]	43.88 ± 1.76 [a]	2.38 ± 0.11 [a]
GG		**47**	776.79 ± 59.25 [a]	7.32 ± 0.21 [a]	2.85 ± 0.14 [a]	2.72 ± 0.14 [a]	22.70 ± 0.99 [a]	48.02 ± 1.45 [a]	2.09 ± 0.09 [a]
PP	**16**	**34**	1242.93 ± 121.66 [b]	6.81 ± 0.26 [a]	2.30 ± 0.17 [b]	3.41 ± 0.19 [a]	24.33 ± 1.21 [b]	44.89 ± 1.96 [b]	2.52 ± 0.19 [a]
GG		**47**	1471.11 ± 92.21 [a]	7.23 ± 0.20 [a]	2.64 ± 0.13 [a]	3.15 ± 0.14 [a]	27.40 + 0.92 [a]	55.32 ± 1.48 [a]	2.23 ± 0.10 [b]
PP	**17**	**30**	1110.96 ± 112.70 [a]	6.75 + 0.25 [a]	3.00 ± 0.19 [b]	4.00 ± 0.11 [a]	34.50 ± 1.12 [a]	50.04 ± 1.85 [b]	2.50 ± 0.18 [a]
GG		**46**	1349.74 ± 80.95 [a]	7.09 ± 0.18 [a]	3.48 ± 0.14 [a]	3.78 ± 0.08 [a]	35.37 + 0.81 [a]	53.52 ± 1.34 [a]	2.48 + 0.13 [a]
PP	**18**	**25**	1217.0 ± 113.21 [a]	6.08 ± 0.26 [b]	2.75 ± 0.20 [b]	3.33 ± 0.17 [b]	33.42 ± 1.30 [a]	46.04 + 2.21 [b]	2.67 ± 0.18 [a]
GG		**45**	1390.42 ± 82.68 [a]	7.02 ± 0.19 [a]	3.29 ± 0.15 [a]	3.64 ± 0.13 [a]	32.40 ± 0.95 [a]	50.60 ± 1.62 [a]	2.49 ± 0.13 [a]

PP : Fayoumi line selected for high egg production. **GG :** Fayoumi line selected for heavier 8-week body weight. **N**=Sample size.
CA= Comb Area; **CC** = Comb Color; **AB**= Abdomen Shape; **VS** = Vent Shape; **PBS** = Distance between the inside of the pubic bones.
CAP = Distance between the pubic bones and the tip of the keel (Capacity) and **PBC** = Pubic bones condition.
a, b Values, within characteristics, between lines with different superscript differ significantly ($p \leq 0.05$) from each other (Duncan,1955).

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الملخص العربى

القلش الطبيعى فى الدجـــاج الفيــومى

2- دراسة مقارنة التريش فى خطين من الدجــاج الفيــومى وعلاقتة بصفات انتـــاج البيض

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استخدم عــدد 102 من إناث كتاكيت الفيومى الفاقسه أخر شهر ابريل 2003عبارة عن خطين (41 كتكوت من خط الفيومى المنتخب لزيادة إنتاج البيض و 61 كتكوت من خط الفيومى المنتخب لزيادة وزن الجسم على عمر 8 أسابيع) وتم دراسة الاختلافات بين الخطين من حيث عدد ريش القوادم والخوافى عند الفقس ، عدد ريش الذيل عند عمر 10 أيام ، وزن الجسم عند 4 ، 8 أسابيع وعند النضج الجنسى وعمر النضج الجنسى ، وزن أول بيضه ، عدد أيام إنتاج ال 10 بيضات الأولى ومعدل إنتاج البيض ، إنتاج البيض لفترات 60 ، 90 ، 365 يوم من النضج الجنسى ، المثابرة فى الإنتاج ، ونسبة فقس الكتاكيت ومعدل النفوق اثناء إنتاج البيض بالإضافة الى دراسة صفات الجنس الثانوية فى الفترة من 12 الى 18 شهر من العمر (مساحة العرف ودرجة لونه ، شكل البطن ، حالة المجمع ، المسافة بين العظام الدبوسية ، السعة " المسافة بين العظام الدبوسية وقمة عظمة القص" ودراسة حالة العظام الدبوسية من 14 الى 18 شهر) ودرس أيضا الارتباط المظهرى بين الصفات المدروسة .

والنتائج تشير الى إن دجاج الفيومى المنتخب لزيادة عدد البيض تفوق عن الدجاج المنتخب لزيادة وزن الجسم فى : عدد ريش الذيل عند عمر 10 أيام وانه مبكر فى عمر النضج الجنسى واخف فى وزن الجسم عند النضج الجنسى أيضا ، اقل فى عدد أيام إنتاج الـ 10 بيضات الأولى و زيادة معدل إنتاج البيض ومتفوق أيضا فى عدد البيض المنتج حتى 60 ، 90 ، 365 يوم من النضج الجنسى عن الخط الآخر بينما الدجاج المنتخب لزيادة وزن الجسم متفوق عن خط إنتاج البيض فى وزن الجسم عند عمر 4 ، 8 أسبوع وانخفاض معدل النفوق فى أثناء فترة الإنتاج .

ووجد علاقة معنوية موجبة بين طول ريش الخوافى عند الفقس وانتاج 90 يوم ؛ وبين عدد ايام انتاج ال 10 بيضات الاولى وكل من انتاج 365 يوم ومعدل انتاج البيض و ريش تغطية الجسم عند عمر 8 اسابيع ووزن الجسم عند 4 اسابيع ؛ وبين عدد ريش القوادم عند الفقس وعدد ريش القوادم عند 8 اسابيع ؛ وبين ريش تغطية الجسم عند 8 اسابيع وكل من عدد ريش الذيل عند 10 ايام ووزن الجسم عند 4 اسابيع وعدد ريش الخوافى عند 8 اسابيع .

ووجد علاقة معنوية سالبة بين عدد ايام انتاج ال 10بيضات الاولى وكل من انتاج 60 ، 90 ، 365 يوم والمثابرة ومعدل انتاج البيض ووزن الجسم عند 4 اسابيع وايضا بين عمر النضج الجنسى وكل من انتاج 90 يوم و 365 يوم ومعدل انتاج البيض . كذلك بين عدد ريش القوادم عند 8 اسابيع ووزن الجسم عند 8 اسابيع ؛ وايضا بين وزن اول بيضة وكل من وزن الجسم عند 4 و 8 اسبوع ؛ بالاضافة الى وجود علاقة معنوية سالبة بين وزن الجسم عند النضج الجنسى وكل من انتاج 60 ، 90 ، 365 يوم ومعدل انتاج البيض ؛ ايضا بين طول ريش الخوافى عند الفقس والمثابرة ايضـــا وبين عــدد ريش القوادم عند عمر 8 اسابيع ووزن الجسم عند عمر 4 و 8 اسابيع كذلك بين وزن الجسم عند النضج الجنسى ومعــدل انتــاج البيض .

وجد ايضا ان خط دجاج الفيومى المنتخب لانتاج البيض كان مبكر فى القلش والمسافة بين العظام الدبوسية كان اكبر عند عمر 12 ، 14 ، 15 ، 18 شهر وحالة العظام الدبوسية رخوة ومرنة

من عمر 14 الى 18 شهر عن الخط المنتخب لزيادة وزن الجسم بينما الخط المنتخب لزيادة وزن الجسم فكانت العظام الدبوسـية سـميكة وصلبة ومساحة العرف كبيرة ولونة احمر داكن و ايضـا شكل البطن مستديرة والسعة افضل من 12 الى 18 شهر عن خط انتاج البيض وكان اكبر سعة عند عمر 12 الى 13 واقل عند عمر 15 شهر .

ووجد ايضا اختلافات معنوية فى انتاج البيض بين خطى الفيومى من شهر مـايو الى شهر يوليــو .

نوصى صغار ومتوسطى منتجى البيض لتحسين انتاجهم من الدجـاج الفيـومى دون اللجوء لبرامج التربية الطويلة ان يتبعوا الأتــى :

= فى عمـر يوم ينتخب اناث الكتاكيت ذات ريش الخوافى الطويل .

= ويعيد الانتخاب فى عمـر 10 أيام للاناث التى يكون عدد ريش ذيلهـا 11 ريشة على الاقل

= ويعيـد الانتخاب فى عمـر النضج الجنسى للدجاج الذى ينتج أول 10 بيضات فى اقل من 36 يوم

= وان يقــوم المربى بعمل فرز للدجـاج المبكر فى القلش من القطيع .

وباتباع مثل هــذة التوصيات يمكن زيادة انتـاج البيض من الدجـاج الفيـومى .