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THE EFFECTS OF SLOW FEATHERING GENE (k) ON PRODUCTIVE PERFORMANCE OF DANDRAWI CHICKENS UNDER SUBTROPICAL CONDITIONS

By

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Abstract: *Data of 369 Dandrawi laying hens (23-74 wks) which represent two genotypes namely slow feathering (K/-) and rapid feathering (k/-) were used to evaluate the effect of sex-linked K gene on the productive performance. The results obtained can be summarized as follow:*

1- *The rapid feathering pullets (k/-) reached to sexual maturity earlier than slow feathering (K/-) by about 4 days. The presence of K allele led to a significant reduction (P<0.01) in egg number till 90 days and throughout the production cycle (23-74 wks) by about 16.20% and 12.90%, respectively.*
2- *A significant reduction in egg weight and total egg mass due to presence of K allele was 3.60% and 15.60%, respectively.*
3- *The slow feathering birds (K/-) were lower body weight at 24, 40, 52 and 72 wks of age by about 19.70%, 7.50%, 11.90% and 9.90% than their rapid feathering counterparts, respectively. Mortality rate due to K allele within the production cycle increased by 47%.*
4- *There were no significant effects due to feathering type on albumen and yolk percentages, whereas the eggs from slow feathering birds exhibited a significant reduction in egg shell quality.*
5- *The presence of K allele reduced significantly feather percentage by about 27.50%. Also, it reduced carcass and dressing percentages by about 5% and 4%, respectively. Only the K allele increased abdominal fat by about 28.50%.*
6- *The slow feathering birds had a remarkable reduction in ovary, oviduct and serum calcium level without any significant effect due to feathering type on serum phosphorus level. The slow feathering females had lower body temperature by about 0.3°C than their rapid feathering counterparts.*

Evidently, more research works are still needed to identify the genetic manipulation of feather coverage and the pleiotropic effects of K allele on the other physiological parameters. Also, it could be advised to apply a selection program against the increment of frequencies the K allele in basic stocks.

INTRODUCTION

It is well known that at the time of hatch, there's a difference between breeds and strains in feathering conditions. A single pair of sex-linked gene is reported to be responsible for this difference as a result of slow feathering (K) that was dominant to rapid feathering (k) gene. North (1984) indicated that it could be possible to produce chicks automatically sexed at hatching time to minimize the sexing costs.

Lou *et al*. (1992) found that slow feathering gene (K) and naked neck gene (Na) reduced feather coverage in broilers by similar amount. Conflicting results on its effect on growth performance have been reported in broiler and egg layer stocks (Lou *et al*., 1992; Ajang *et al*., 1993; Abd El-Latif and Abd El-Rahman, 1999 and Fosta *et al*., 2001).

Previous studies have shown detrimental effects associated with K gene on bird performance and mortality in layers (Harris *et al*., 1984; Bacon *et al*., 1988 and Abd El-Rahman, 2004). The results of Katanbaf *et al*. (1989a,b,c) reported no significant differences between slow and rapid feathering broiler breeder in the most of studied traits.

The inconsistent results were attributed to pleiotropic effects of K allele (Dunnington and Siegel, 1986 and Smith and Nelsen, 1993). Harris *et al*. (1984) and Bacon *et al*. (1988) indicated that alleles of sex-linked feathering locus have been associated directly or indirectly with changes in physiological and production characteristics in Leghorn stocks. Among late feathering White Leghorn females, the detrimental effect of K gene was related to a tightly linked with Ev21 endogenous viral gene increasing the immunological tolerance toward exogenous avian leucosis virus injection (Havenstein *et al*., 1989). Moreover, avian leucosis virus and infectious endogenous viruses (Ev) were associated with poor production (Gavora *et al*., 1991).

Etches (2001) reported a retroviral insertion has been associated with the gene that cause slow feathering, although it is unclear how this insertion affects feather growth. Furthermore, it is not clear what is encoded by slow feathering locus and how the protein exerts its effect.

Knowledge on the relationship of sex-linked K gene to the performance would be important in the poultry breeding programs. The objective of this work was to investigate the pleiotropic effects of slow feathering gene on egg production performance and some anatomical and physiological parameters in Dandrawi chickens under prevailing environmental conditions.

MATERIALS AND METHODS

This work was carried out on a basic stock of Dandrawi chickens maintained in the Experimental Poultry Farm of Assiut University during the period from 2002-2004.

Birds and Management:

Ten years ago, it was noticed that a percentage of Dandrawi chicks had slow growing feathers than the expected rate. Yearly, the slow feathering chicks were isolated together till age at sexual maturity and were multiplied by mating both slow males and females. The identification of rapid and slow feathering at hatching time could be possible by examining the primary feathers of the wing as described by Abd El-Latif and Abd El-Rahman (1999).

The inheritance details of mutant slow feathering and its effects on growth were discussed before by Abd El-Latif and Abd El-Rahman (1999). Matings were made to produce slow or rapid feathering males and females in this study. Slow feathering males (K/K) were mated with normal or rapid (K/-) feathering females (k/-) to produce slow feathering males (K/K) and females whereas the rapid feathering males (k/k) and females (k/-) were mated to produce the normal birds. Birds were reared in pens and exposed daily to 14 lighting hours under prevailing environmental temperature and humidity (Table 1). All birds were fed ad libitum on the same commercial diets (16% protein and ME 2800 K Cal/kg) throughout the experimental period (20-74 wks of age).

Traits studied:

Body weight (B.W) of 369 laying hens at 24, 40, 52 and 72 wks, age at sexual maturity (ASM), total egg number (TEN) throughout 13 successive laying periods (28 days each) egg number till 90 days from sexual maturity (E90), average laying rate (ALR), average egg weight (AEW) and total egg mass (TEM) were recorded individually.

At 40, 52 and 72 wks of age, rectal body temperature (B.T) was measured by thermocouple thermometer and a random samples of 180 eggs were taken to study egg quality traits (Egg weight, proportions of the egg and % of albumen, yolk and shell quality was measured by shell percentage, breaking strength and shell thickness). At the same ages, 120 females were slaughtered, feather removed and eviscerated, giblets, carcass and reproductive organs were removed and weighed (Gilbert *et al*., 1983). Calcium and phosphorus were determined using commercial diagnostic kits.

Mortality rate % throughout the 13 laying periods for the two genotypes were recorded and transformed to arcsine prior to statistical analysis.

Statistical analysis:

Data of egg production from 369 hens and mortality rate were subjected to analysis of variance using General Linear Models (GLM) procedure of SAS (SAS Institute, 1990) by the following model:

$$\mathbf{Y_{ij} = \mu + G_i + E_{ij}}$$

where Y_{ij} is the j^{th} observation of the i^{th} genotype, μ is overall mean, G_i is the effect of i^{th} genotype and E_{ij} is the random error.

Results of egg quality, anatomical and physiological parameters were analysed according the following model:

$$\mathbf{Y_{ijk} = \mu + G_i + A_j + (GxA)_{ij} + E_{ijk}}$$

where A_j is the effect of j^{th} age; $(GxA)_{ij}$ is the interaction between genotype and age and other factors in this model are as that in the previous model. Duncan's Multiple Range Test (Duncan, 1955) was used for means comparisons.

RESULTS AND DISCUSSION

Production parameters performance

In general, summary of the results and the ANOVA are provided in Table (2). Feathering type had highly significant ($P<0.01$) effects on the performance of all traits measured.

Rapid feathering pullets (k/-) reached to sexual maturity earlier than slow fathering (K/-) by about 4 days. O'Sullivan *et al.* (1991b) reported that early broiler females matured at younger ages (187.4 d) than late feathering females (209.6 d). The delay in age at sexual maturity of K/-

pullets is coincided with a significant decrease (P<0.01) of egg production and laying rate during the first 90 days (E90) by about 16.20%. Verma and Singh (1983) found a later age at first egg and slightly lower hen-day production for late feathering hens.

As shown in Fig. (1) and Table (1) rapid feathering hens (k/-) produced more eggs during 13 laying periods (28 days each) than late feathering counterparts (K/-). The reduction due to K allele in total egg number and average laying rate was 12.90% and these results are in accordance with that reported by Harris *et al*. (1984); Havenstein *et al*. (1989) and O'Sullivan *et al*. (1991b).

The partial reduction in feather coverage due to management or genetic factors (Naked neck gene, Frizzle gene) was associated with an advantage in body weight and egg production performance under moderate conditions and more pronounced under subtropical and tropical conditions (Abd El-Rahman, 2000a,b,; Abd El-Rahman and El-Hammay, 2000 and Mahrous *et al*., 2003). The results in the present study were in disagreement with the previous findings where the presence of K allele cause a remarkable reduction (P<0.01) in egg production. In the study of O'Sullivan *et al*. (1991b) it was found that early feathering hens (k/-) had a substantial advantage in intensity and persistence of egg production which resulted in their producing 25 eggs more than late feathering hens (K/-) till 505 days. The differences in egg production between early and late genotypes was consistent with the earlier observation in White Leghorn Stocks (Harris *et al*., 1984).

On the other hand, Hunnicken *et al*. (1994) reported that late feathering hens (K/-) reared at heat stress (31.6°C) exhibited a significant reduction in mortality rate higher egg production and egg weight with less shell percentage, showing a higher reproductive adaptability under tropical conditions. The environmental conditions in the present study (Table 1) was the same at tropical conditions. The results obtained here using slow feathering hens (K/-) were in disagreement with Hunnicken (1994) findings and this confirm the hypothesis that K allele is pleiotropic effects and the results differ according to genetic background.

The presence of K allele does not only reduce the egg number but also it had a detrimental effect on egg weight where it reduces egg weight by about 3.60% and these results were in disagreement with that reported by O'Sullivan *et al*. (1991b) and Hunnicken *et al*. (1994). O'Sullivan *et al*. (1991b) indicated that late feathering females laid heavier egg weight than rapid feathering one. The consistently heavier egg weight of late feathering corroborate differences reported between these alleles in other genetic backgrounds. Differences in egg weight between the alleles suggested that they had pleiotropic effects and not associated directly with overall lower ovulations of late feathering females (O'Sullivan *et al*., 1991b). As might be expected, the decrease in egg number and egg weight due to the presence of K allele cause a significant (P<0.01) reduction in total egg mass by about 15.60%.

The presence of K allele was associated with better body weight, growth rate and meat yield during growth period (O'Sullivan *et al*., 1991a; Lou *et al*., 1992; Ajang *et al*., 1993 and Abd El-Latif and Abd El-Rahman, 1999). The observation of Fosta *et al*. (2001) showed that slow feathering gene (K) did not influence growth rate, feed intake and efficiency in both males and females and the K allele did not appear as an adaptation factor to heat stress in light or medium size lines.

As shown in Table (2), it could be observed that slow feathering females (K/-) exhibited significant (P<0.01) reductions in body weight at different ages, where, it was about 19.70%, 7.50%, 11.90% and 9.90% at 24, 40, 52 and 72 wks of age, respectively. Katanbaf *et al*. (1989a) reported no significant differences in body weight of slow and rapid feathering broiler type stocks. In this work, the detrimental effect associated with K allele appear after the beginning of the production cycle.

With regard to mortality rate, K allele increased significantly (P<0.01) mortality rate during production period (13 laying periods) by about 47%. The increase in mortality rate due to K allele is either a consequence of or is very closely linked with the presence of an endogenous avian leucosis viruses Ev 21 (Bacon *et al*., 1988). Havenstein *et al*. (1989) demonstrated that chicks receiving endogenous viruses either by injection or from their parents have prolonged viremia and delayed antibody response along with subsequent infection with exogenous virus. Thus, it appears that the presence of Ev21 probably results in higher rates of infection and shedding in the K/- than in k/- dams were EV21 is not present.

O'Sullivan *et al*. (1991b) reported no differences in mortality rate between rapid (27.3%) vs slow feathering (32%) broiler till 507 days of age. Mortality from Lymphoid leucosis was higher in slow (17.90%) than rapid feathering (0.9%). No differences between the main variables were found for mortality from cardiac disease, bacterial infection or miscellaneous causes.

From the previous discussion, several mechanisms appeared to be responsible for lower productivity of slow feathering birds (K/-). 1) It was assumed likely due to close linkage between this allele and the Ev21 which encodes for the leucosis virus. Moreover, avian leucosis virus and infectious endogenous viruses were associated with poor production traits (Harris *et al*., 1984; Havenstein *et al*., 1989; Gavora *et al*., 1991 and O'Sullivan *et al*., 1991a). 2) The remarkable reduction in production due to K allele may share pleiotropic association with growth, feed efficiency and disease resistance or may cause changes in these traits by altering physiological responses to the environment (Dunnington and Siegel, 1986). 3) The research suggests that morbidity and mortality may be the indirect causes of lower production and could be ascribed in part to some closely linked genes on the same chromosome (Bacon *et al*., 1988). 4) During the whole production cycle, the negative influence of K allele on egg production may also due to a depletion of reserves in essential amino acids and reduced ability to absorb these ingredients or other causes.

Egg quality parameters:

Results of egg quality parameters per genotype with each age are presented in Table (3). The results showed no significant effect due to interaction between genotype and age in all traits studied with the exception of egg weight.

As previous discussed, the results showed that the slow feathering allele (K) reduced significantly ($P<0.01$) egg weight by about 5% as compared to eggs from the rapid feathering birds (k/-). Although, Roush *et al*. (1984) suggested that heavier egg weight could be associated with the lower rate of egg production. The slow fathering birds (K/-) had lower egg number (Table 2) and egg weight (Tables 2, 3) than their rapid feathering (k/-) counterparts. The results exhibited that no differences due to feathering type on albumen and yolk percentage where albumen was 55.90% and 56.30% from rapid and slow feathering genotypes, respectively. The corresponding values for yolk percentage was 33.10% and 33%, from the two genotypes, respectively.

With regard to shell quality, it was observed a significant difference in egg shell quality due to feathering type. The presence of K allele reduced shell percentage by about 3%. Also, the results in Table (3) exhibited that this allele reduced significantly ($P<0.01$) not only shell percentage but also shell strength and thickness where it reduce shell strength by about 6.40% whereas shell thickness was 0.397 and 0.374 mm in egg from rapid and slow feathering genotypes, respectively. These results are in accordance with that obtained by Abd El-Rahman (2004) who reported that these effects increased egg weight loss during storage or incubation period which cause a significant reduction in hatchability of slow feathering genotype eggs.

In previous studies, Abd El-Rahman (2000a,b, 2003) reported that Na gene which reduce feather coverage with similar amount of K allele had also detrimental effects on egg shell quality and these results confirmed a relationship between genes reduce feather and egg shell quality and this may be attributed to a pleiotropic effects or the linkage between these genes and others responsible for egg shell formation.

The results in Table (3) showed highly significant ($P<0.01$) differences due to age of birds on egg weight and albumen, yolk percentages. Also, no differences due to age on shell percentage or shell strength. Shell thickness reduced significantly ($P<0.05$) with advancing the age, where it was 0.396, 0.385 and 0.387 mm at 40, 52 and 72 wks of age, respectively. These results were in accordance with that reported by Rouqe and Soares (1994).

Anatomical and physiological parameters:

The results of anatomical and physiological traits are presented in Table (4). There were no significant interactions between feathering type and age of bird in the most of traits studied. Less informations are available on the relationship between K gene and physiological parameter.

It was observed that, the presence of K allele reduced feather coverage by about 27.50%. Although the genes reduce feather coverage (naked neck and frizzle) was associated with a remarkable increase in carcass and meat yield (Abd El-Rahman, 1998; Deeb and Cahaner, 2001 and Fathi *et al*., 2003). The slow feathering birds (K/-) exhibited a reduction in eviscerated carcass and dressing percentages by about 5% and 4%, respectively. Ajang *et al*. (1993) and Abd El-Latif and Abd El-Rahman (1999) found that eviscerated carcass and dressing percentage of slow feathering line (K/-) was significantly ($P<0.01$) better than rapid feathering (K/-) during growth period.

A significant relationship between genes that reduce feather coverage and the reduction in abdominal fat was reported by Ajang *et al*. (1993); Abd El-Rahman (2000b) and Abd El-Rahman and El-Hammady (2000). The slow fathering birds (K/-) exhibited an increase in abdominal fat by about 28.50% and this may be due to the reduction in laying rate and egg weight (Table 2).

Taking into consideration the effect of K allele on ovary and oviduct percentages, it reduced ovary and oviduct by about 27.20% and 24.40%, respectively. This reduction is coincided with the remarkable reduction in egg production and weight and this may be attributed to the K allele which caused a reduction in hormones which responsible on the activity of reproductive organs. Also, a significant ($P<0.01$) reduction in serum calcium level due to the presence of K allele which led to a decrease in egg shell quality as presented in Table 3 whereas no differences were found in serum phosphorus level between the slow or rapid feathering genotypes. Finally, the slow feathering birds (K/-) exhibited a significant reduction in body temperature (B.T) by about 0.3°C than their rapid feathering (k/-) counterparts. A significant relationship between genes reduced feather and the reduction in B.T. was reported by Katanbaf *et al*. (1989a); Eberhart and Washburn (1993a) and Abd El-Rahman (2000a). Eberhart and Washburn *et al*. (1993a) reported that both acclimated and unacclimated bird showed a rise in B.T. upon exposure to high environmental temperatures, but the acclimated birds had the capacity to stabilize their B.T. above the normal body temperature whereas the B.T. of unacclimated birds continued to rise at rapid rate.

Although the birds of the two genotypes were exposed to the same environmental temperature (Table 1), the slow feathering birds had lower B.T. but they exhibited unfavorable performance within the production cycle. This confirms that B.T. was not the main factor of determining the productive adaptability but there are a pleiotropic effects of K allele and its linkage with other genetic factors responsible on the physiological status of the bird. Finally, the results in Table (4) exhibited a highly significant ($P<0.01$) effect due to age of birds on the most of the traits studied.

Evidently, more research works are still needed to identify the genetic manipulation of feather coverage and the pleiotropic effects of K allele on the other physiological parameters. Also, it could be advised to apply a selection program against the increment of frequencies of K allele in the basic flocks.

Table (1): Minimum and Maximum degrees of ambient temperature (°C) and relative humidity (%) during the experimental period (23-74 wks).

Laying period	Age	Temperature (°C)		Humidity (%)	
		Min.	Max.	Min.	Max.
1	23-26	22.20	38.10	25	54
2	27-30	23.20	39.20	28	60
3	31-34	23.70	38.30	36	70
4	35-38	19.90	37.70	40	75
5	39-42	16.90	30.20	35	70
6	43-46	11.10	28.70	33	72
7	47-50	10.50	25.50	39	80
8	51-54	8.90	15.70	30	75
9	55-58	12.70	20.50	32	73
10	59-62	15.60	31.40	27	70
11	63-66	16.80	34.20	19	59
12	67-70	18.40	36.20	16	54
13	71-74	22.10	37.10	15	51
Average	-	17.10	31.80	28.80	66.40

Table (2): Means ($\overline{X}$) and standard errors of productive parameters in rapid (k/-) and slow (K/-) feathering Dandrawi genotypes.

Variable	Genotypes		Significance	Effect of slow feathering (K/-) %
	Rapid (k/-)	Slow (K/-)		
Age at sexual maturity (ASM) days	164.10 ± 1.20^{B}	168.20 ± 1.05^{A}	**	+ 2.50
Egg till 90 days (E 90)	62.50 ± 0.80^{A}	52.40 ± 0.60^{B}	**	- 16.16
Laying rate till 90 days (LR 90) %	69.50 ± 0.70^{A}	58.20 ± 0.60^{B}	**	- 16.30
Total egg number (TEN)	192.10 ± 4.40^{A}	167.40 ± 2.10^{B}	**	-12.90
Average laying rate (ALR) %	52.76 ± 0.60^{A}	46.00 ± 0.50^{B}	**	- 12.80
Average egg weight (AEW) g	42.96 ± 0.24^{A}	41.40 ± 0.20^{B}	**	- 3.63
Total egg mass (TEM) kg	8.260 ± 0.09^{A}	6.972 ± 0.07^{B}	**	- 15.60
Body weight at 20 wk (B.W. 24) g	1270.20 ± 0.20^{A}	1020.50 ± 0.18^{B}	**	- 19.70
Body weight at 40 wks (B.W. 40) g	1406.10 ± 0.39^{A}	1301.10 ± 0.33^{B}	**	- 7.50
Body weight at 52 wks (B.W. 52) g	1607.70 ± 0.48^{A}	1415.90 ± 0.39^{B}	**	- 11.90
Body weight at 72 wks (B.W. 72) g	1632.10 ± 0.48^{A}	1471.20 ± 0.36^{B}	**	- 9.90
Mortality % during 13 laying period	0.54 ± 0.05^{B}	1.02 ± 0.07^{A}	**	+ 47.06

A, B. means within each row with different superscript are significantly different ($P<0.05$).
** Highly significant ($P<0.01$)

Table (3): Means ($\overline{X}$) and standard errors of egg quality parameters in rapid (k/-) and slow (K/-) feathering Dandrawi genotypes.

Factor	Group	Egg weight (g)	Albumen (%)	Yolk (%)	Shell (%)	Shell strength (kg)	Shell thickness (mm)
Genotype (G)	1- Rapid	47.86±0.35 ^{A}	55.90±0.30	33.08±0.30	11.01±0.10 ^{A}	4.84±0.10 ^{A}	0.397±0.004 ^{A}
	2- Slow	45.47±0.45 ^{B}	56.31±0.40	32.98±0.35	10.71±0.09 ^{B}	4.53±0.10 ^{B}	0.374±0.004 ^{B}
Age (A)	1- 40 wks	43.97±0.40 ^{B}	57.93±0.30 ^{A}	31.14±0.30 ^{B}	10.93±0.12	4.82±0.12	0.396±0.005 ^{A}
	2- 52 wks	48.34±0.45 ^{A}	56.03±0.40 ^{A}	33.07±0.40 ^{AB}	10.90±0.12	4.77±0.13	0.385±0.005 ^{A}
	3- 72 wks	47.68±0.40 ^{A}	54.40±0.40 ^{B}	34.85±0.40 ^{A}	10.75±0.10	4.46±0.12	0.375±0.006 ^{B}
***Interactions* (G x A)**	G_1xA_1	45.91±0.40 ^{B}	57.91±0.40	30.98±0.45	11.11±0.17	5.04±0.18	0.407±0.006
	G_1xA_2	49.65±0.60 ^{A}	55.19±0.60	33.77±0.50	11.04±0.20	4.87±0.15	0.397±0.006
	G_1xA_3	48.00±0.40 ^{AB}	54.64±0.40	34.50±0.40	10.87±0.17	4.61±0.19	0.385±0.008
	G_2xA_1	42.02±0.40 ^{C}	57.95±0.40	31.30±0.40	10.75±0.17	4.62±0.17	0.385±0.006
	G_2xA_2	47.04±0.50 ^{B}	56.87±0.50	32.37±0.50	10.76±0.14	4.66±0.20	0.372±0.008
	G_2xA_3	47.36±0.75 ^{B}	54.10±0.75	35.27±0.70	10.63±0.15	4.30±0.17	0.365±0.009
Source of variation	**d.f**	**Probabilities**					
Genotype (G)	1	**	N.S.	N.S.	*	*	**
Age (A)	2	**	**	**	N.S.	N.S.	*
(G x A)	2	*	N.S.	N.S.	N.S.	N.S.	N.S.
Error	174						

A, B, C, Means within the same factor within the same column with different superscripts are significantly different (P<0.05).
N.S. = Not significant. * Significant (P<0.05). ** = Highly significant (P<0.01).

Table (4): Means ($\overline{X}$) and standard errors (S.E.) of anatomical and physiological parameters in rapid (k/-) and slow (K/-) feathering Dandrawi genotypes.

Factor	Group	Feather (%)	Carcass (%)	Giblets (%)	Dressing (%)	Abdominal fat (%)	Ovary (%)	Oviduct (%)	Calcium mg/100 ml	Phosph. Mg/100 ml	B.T (°C)
Genotype (G)	1- Rapid	4.29±0.15^{A}	63.99±0.05^{A}	4.3±0.03^{B}	68.30±0.5^{A}	2.74±0.18^{B}	3.01±0.10	3.24±0.10	21.12±0.47^{A}	6.36±0.11	42.86±0.05^{A}
	2- Slow	3.11±0.10^{B}	60.80±0.3^{B}	4.7±0.05^{A}	65.50±0.4^{B}	3.52±0.17^{A}	2.19±0.10	2.45±0.07	18.90±0.46^{B}	6.46±0.08	42.57±0.04^{B}
Age (A)	1- 40 wks	4.29±0.20^{A}	63.51±0.6^{A}	4.38±0.06^{B}	67.88±0.6^{A}	2.55±0.20^{B}	2.92±0.11	3.21±0.10	22.07±0.6^{A}	6.19±0.10	42.70±0.07
	2- 52 wks	3.62±0.15^{AB}	61.13±0.4^{C}	4.70±0.09^{A}	65.83±0.3^{B}	3.37±0.24^{A}	2.95±0.12	2.95±0.12	20.20±0.5^{B}	6.42±0.14	42.70±0.04
	3- 72 wks	3.20±0.14^{B}	62.55±0.6^{B}	4.46±0.07^{B}	67.00±0.6^{A}	3.50±0.20^{A}	2.38±0.07	2.38±0.08	17.80±0.5^{C}	6.53±0.10	42.76±0.07
Interactions (G x A)	G_1xA_1	4.76±0.40	65.78±0.8	4.50±0.09	70.28±0.8	2.12±0.2	3.27±0.10^{A}	3.59±0.11^{A}	23.25±0.5	6.08±0.25	42.90±0.12
	G_1xA_2	4.21±0.20	62.49±0.6	4.36±0.07	66.85±0.5	2.90±0.3	3.42±0.10^{A}	3.58±0.10^{A}	21.60±0.8	6.54±0.20	42.80±0.09
	G_1xA_3	3.90±0.14	63.70±0.9	4.10±0.10	67.80±0.9	3.20±0.2	2.04±0.16^{B}	2.56±0.10^{AB}	18.50±0.6	6.50±0.15	42.90±0.09
	G_2xA_1	3.82±0.13	61.23±0.7	4.25±0.09	65.48±0.7	2.96±0.3	2.57±0.17^{AB}	2.85±0.12^{AB}	20.90±0.5	6.30±0.14	42.49±0.07
	G_2xA_2	3.02±0.13	59.78±0.5	5.04±0.08	64.82±0.4	3.84±0.3	2.00±0.10^{B}	2.33±0.08^{B}	18.80±0.7	6.50±0.14	42.59±0.7
	G_2xA_3	2.50±0.10	61.40±0.5	4.83±0.11	66.22±0.5	3.77±0.3	1.99±0.15^{B}	2.20±0.09^{B}	17.00±0.8	6.59±0.15	42.66±0.09
Source of variation	**d.f**	**Probabilities**									
Genotype (G)	1	**	**	**	**	**	**	**	**	N.S.	**
Age (A)	2	**	**	**	**	**	**	**	**	N.S.	N.S.
(G x A)	2	N.S.	N.S.	N.S.	N.S.	N.S.	**	**	N.S.	N.S.	N.S.
Error	114	114	114	114	114	114	114	114	114	114	369

A, B, C, Means within the same factor within the same column with different superscripts are significantly different ($P<0.05$).
** = Highly significant ($P<0.01$). * Significant ($P<0.05$). N.S. = Not significant.

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الملخص العربى

تأثيرات جين الترييش البطئ على أداء إنتاج البيض فى دجاج الدندراوى تحت الظروف شبه الاستوائية

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أجريت هذه التجربة فى مزرعة الدواجن البحثية التابعة لجامعة أسيوط وأستخدم في التجربة ٣٦٩ دجاجة دندراوي (عمر ٢٣-٧٤ أسبوع) تمثل تركيبين وراثيين أحدهما دجاج بطئ الترييش والآخر سريع الترييش لمعرفة تأثير جين بطئ الترييش المرتبط بالجنس على أداء إنتاج البيض . وأمكن تلخيص النتائج مما يلي :

١- أظهر الدجاج السريع الترييش تبكيراً فى النضج الجنسي بحوالي ٤ أيام بالمقارنة بالدجاج البطيء الترييش. وأدى وجود جين بطء الترييش إلى انخفاض معنوي (مستوى ١%) فى إنتاج البيض لمدة ٩٠ يوماً من النضج الجنسي أو إنتاج البيض طوال الموسم بحوالي ١٦,٢٠، ١٢,٩٠% على التوالي.

٢- أدى وجود جين بطئ الترييش إلى انخفاض فى متوسط وزن البيضة بحوالي ٣,٦٠% كما انخفضت كتلة البيض الناتج بحوالي ١٥,٦٠%.

٣- أظهر الدجاج البطيء الترييش انخفاضاً فى وزن الجسم بحوالي ١٩,٧٠%، ٧,٥٠%، ١١,٩٠%، ٩,٩٠% عند ٢٤، ٤٠، ٥٢، ٧٢ أسبوع من العمر عن الدجاج سريع الترييش كما ازداد معدل النفوق خلال دورة الإنتاج بحوالي ٤٧%.

٤- لم يظهر البيض الناتج من الدجاج البطيء الترييش فروقاً فى نسبة البياض أو الصفار ولكن انخفضت صفات جودة القشرة معنوياً فى بيض الدجاج البطيء الترييش بالمقارنة بالدجاج السريع الترييش.

٥- أدى وجود آليل بطء الترييش إلى انخفاضاً فى وزن الريش بحوالي ٢٧,٥٠% كما انخفضت نسبة الذبيحة المعدة للطهى ونسبة التصافي بحوالي ٤% ، ٥% على التوالي، مع زيادة نسبة دهن التجويف البطني بحوالي ٢٨,٥٠%.

٦- أدى وجود أليل بطء الترييش إلى انخفاضاً معنوي (مستوى ١%) فى نسبة المبيض والقناة المبيضية ونسبة الكالسيوم بينما لم تختلف نسبة الفوسفور فى سيرم الدم لكل من الدجاج البطيء أو السريع الترييش. كما انخفضت درجة حرارة جسم الدجاج البطيء الترييش بحوالي ٠,٣°م .

من الواضح أن هناك حاجة لمزيد من البحوث لكي نحدد التأثير الوراثي على الترييش والتأثيرات المتعددة لآليل بطء الترييش على الصفات الفسيولوجية الأخرى. وتوصى الدراسة بوضع برنامج انتخابي لمنع تكرار أو تقليل تواجد هذا الآليل فى القطعان الأساسية وذلك لتأثيرة السئ على معظم الصفات.