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EVALUATION THE LAYING PERFORMANCE OF HETEROZYGOUS NAKED NECK CHICKENS (SHARKASI) PRODUCED FROM DIFFERENT CROSSING SYSTEMS UNDER PREVAILING ENVIRONMENTAL CONDITIONS.

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Abstract: A total number of 519 Na/na laying hens derived from three natural mating pathways, namely 1- maternal Na/Na x na/na ♂, 2- na/na ♀ x paternal Na/Na and 3 - homogeneous Na/na ♀ x Na/na ♂ were used to assess the effective crossing method to obtain the optimal laying performance of Na/na chickens under the prevailing environmental conditions.

The main results obtained can be summarized as follows:

1- The Na/na birds derived from maternal Na/Na were significantly earlier ($P<0.01$) in age at sexual maturity by about 4-5 days when compared to other birds obtained from paternal Na/Na or pure Na/na genotype.

2- The Na/na birds issued from maternal line exhibited a significant increase ($P<0.01$) in average laying rate during the production cycle (23-54 wks). The increase in egg number within the first 90 days was about 6.50% and 4.80% from Na/Na maternal and paternal lines when they compared with pure line. The corresponding values for TEN were 9.30% and 3.44%, respectively.

3- The Na/na birds derived from maternal Na/Na exhibited a significant increase ($P<0.01$) in egg weight when they compared with other crossing systems which reflect a superiority in TEM where, it was about 16.30% and 6.20% for Na/na birds derived from maternal and paternal Na/Na lines, respectively.

4- The crossing system had no significant effect on body weight at 24, 40 and 52 wks of age although the birds derived from paternal Na/Na were heavier body weight.

5- The eggs of maternal and paternal Na/Na birds were less ($P<0.01$) in albumen and yolk % as compared with eggs from pure line. The differences in egg shell % were insignificant and the eggs from maternal line were better in shell strength and thickness than paternal line eggs.

6- The females derived from maternal Na/Na line recorded the highest values of ovary, oviduct percentages and lowest abdominal fat as compared with other crossing systems. Also, no significant differences were found in dressing percentage and serum calcium and phosphorus due to crossing system.

The results exhibited that crossing between different genotypes reflect a remarkable improvement of laying performance. Also, the results lead to a conclusion that using homozygous naked neck (Na/Na) as a maternal line was the effective crossing methods which may help to find out good results for the previous traits studied in this work.

Key words : Crossing, Na/na, production, physiology.

Introduction

In Upper Egypt, the naked neck gene (Na) is widespread in unselected local chicken populations and known by peasants at various areas as Sharkasi chickens (Abd El-Rahman, 1998). This gene which reduced feather mass by about 25-40% and was associated with advantage in egg production performance under moderate conditions which was more pronounced under subtropical and tropical conditions (Abd El-Rahman, 2000a,b; Abd El-Rahman and El-Hammady, 2000; Singh *et al.*, 2001; El-Safty *et al.*, 2003; Abd El-Rahman and Makled, 2006 and Makled and Abd El-Rahman, 2006). Also, the Na gene is believed to confer not only the productive adaptability to the tropical climates but also resistance to diseases (Abd El-Rahman, 1990 and Fathi *et al.*, 2005).

The findings of Horst and Mathur (1992, 1994) indicated that the presence of Na gene increases egg number and egg mass at 32°C by about 6% and 7.4% with a remarkable persistency especially in medium or high body weight birds than in lighter ones. Also, Horst *et al.* (1996) reported that under moderate temperature (i.e. 18-20°C) the Na gene improved egg number, egg weight and egg mass by about 13.10%, 3.40% and 12.90%, respectively.

It is worthy to mention that a slight disadvantage of the naked neck birds (Na/-) was observed for egg shell quality especially for the Na/Na genotype (Merat, 1990; Abd El-Rahman, 2000a,b; Singh *et al.*, 2001; Abd El-Rahman and Makled, 2006 and Makled and Abd El-Rahman, 2006). However, Galal *et al.* (2000), Galal and Fathi (2002), El-Safty *et al.* (2003) and Mahrous *et al.* (2003) reported that Na gene improved egg shell quality compared to na allele.

Poultry breeders have used breed crosses and more recently strain crosses to obtain the advantage of heterosis (Fairfull, 1990). However, strain and breed crossing are effective methods to improve body weight, egg number, weight and mass (Verma *et al.*, 1985; Khairy, 1997; Nawar and Abdou, 1999; El-Gendy, 2000; Osama and Abou El-Ella, 2006 and Zaky, 2005, 2006).

Since 1985 till now, the comprehensive studies by the author on the effects of Na gene proved that heterozygous naked neck (Na/na) birds exhibited better productive adaptability of the most studied traits than homozygous (Na/Na) or normals (na/na) especially under tropical and subtropical environmental conditions. There is little available information, concerning the significance of maternal effects on the productive performance of the naked neck chickens.

The objective of this study was to assess the effective crossing method to obtain the optimal laying performance of Na/na chickens (Sharkasi) under prevailing environmental conditions.

Materials and Methods

Birds and management.

The current study was conducted at Poultry Farm, Animal and Poultry Production Department, Faculty of Agriculture, Assiut Unviersity. From a basic stock, the heterozygous naked neck (Na/na) birds were derived from three natural mating bathways:

Mating 1: Maternal homozygous naked neck females ♀ (Na/Na) x Normal feathering (na/na) males ♂.

Mating 2: Normal feathering females (na/na) ♀ x Paternal homozygous naked neck (Na/Na) males ♂.

Mating 3: Heterozygous naked neck females ♀ (Na/na) x Heterozygous naked neck (Na/na) males ♂ (homogeneous line or control).

All Na/na offsprings chicks from the previous mating systems were wing-banded and reared under constant managerial conditions. At 18 wks of age. pullets were received 14-16 lighting hours under prevailing environmental conditions (Table 1). Birds were reared in floor pens and they fed a diet containing 17% protein and 2840 Kcal ME/kg. Feed and water were available ad libitum throughout the whole experimental period (18-54 wks of age).

Table(1): Minimum and maximum degrees of ambient temperature (°C) and relative humidity (%) during the experimental period (18-54 wks).

Laying period	Age (wks)	Ambient temp. (°C)		Relative humidity %	
		Min.	Max.	Min.	Max.
-	18-22	15	32	22	60
1	23-26	18	34	23	58
2	27-30	17	31	27	62
3	31-34	19	33	30	64
4	35-38	15	30	30	66
5	39-42	13	27	32	68
6	43-46	15	28	33	73
7	47-50	12	22	35	75
8	51-54	13	24	35	73
Average	-	15.20	29.0	29.60	66.50

Traits studied:

Body weight (BW) at 24, 40 and 52 wks of age, age at sexual maturity (ASM), laying rate (LR%) throughout 8 successive laying periods (28 days each), total egg number (TEN), average egg weight (AEW), average laying rate (ALR%), egg number and laying rate from sexual maturity till 90 days (E90, LR90%) and total egg mass (TEM) were recorded.

At 40 and 52 wks of age, random sample of 80 eggs from each line were taken to determine egg quality parameters which include egg weight proportions and percentages of albumen, yolk and shell. Shell quality measured by thickness and breaking strength using a cracking machine (WAZAU-Germany). At the same ages random sample of 40 females from each line were slaughtered, feather removed and eviscerated, giblets, carcass and reproductive organs were removed and weighed. Serum calcium and phosphorus were detected by using diagnostic kits from Bio-Analysis (American Company).

Statistical analysis:

Data from 519 birds (166, 183 and 170 birds from mating 1, 2 and 3, respectively) for body weight and laying parameters 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 jth observation of ith genotype, μ is overall mean, G_i is the effect of i genotype and E_{ij} is the random error.

Results of egg quality, anatomical and physiological traits 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 jth age, $(GxA)_{ij}$ is the effect of interaction between genotype and age. The other factors in this model are similar to those in the first model. Duncan's Multiple Range Test was used for means comparisons.

Results and Discussion

Egg laying rate (%) of 8 successive laying periods (28 days each) and other parameters of laying production are listed in Tables (2, 3).

The Na/na birds issued from maternal naked neck line had significantly (P<0.01) reached sexual maturity earlier by about 4-5 days compared to Na/na layers from other mating systems (Table 3). The results are in agreement with that reported by El-Safty *et al.* (2003) who found that Na/na birds issued from maternal naked neck line was earlier in sexual maturity than those from paternal line (na/na). This favourable effect may be attributed to additive cytoplasmic inheritance which given only from dams (El-Safty *et al.*, 2003). Bordas *et al.* (1996) found marked differences between reciprocal crosses in age at sexual maturity when two lines of Rhode Island Red were crossed. The results in this study indicated that dam effect is more important than sire effect for sexual maturity.

It is of interest to note that early sexual maturity of Na/na issued from the maternal Na/Na reflect a significant (P<0.01) increase in laying rate within laying cycle (23-54 wks). Abd El-Rahman (2000a,b) and Makled and Abd El-Rahman (2006)

Table(2): Means ($\overline{X}$) ± S.E. of laying rate (%) for the heterozygous naked neck (Na/na) derived from different crossing systems within 23 - 54 wks of age.

Age (wks)	laying Rate (L.R %)	Mating 1 Na/Na ♀ x na/na ♂ (N=166)	Mating 2 na/na ♀ x Na/Na ♂ (N=183)	Mating 3 Na/na ♀ x Na/na ♂ (N=170)	%Difference from homogeneous Na/na		Probability
					Maternal Na/Na	Paternal Na/Na	
23-26	LR1	39.41 ^{A} ± 0.52	34.66 ^{B} ± 0.70	34.87 ^{B} ± 0.60	13.00	- 0.60	**
27-30	LR2	78.11 ^{A} ± 0.55	76.26 ^{B} ± 0.40	76.26 ^{B} ± 0.50	2.40	0.00	*
31-34	LR3	83.30 ^{A} ± 0.45	79.08 ^{B} ± 0.90	74.20 ^{C} ± 0.40	12.20	6.50	**
35-38	LR4	83.86 ^{A} ± 0.60	74.11 ^{B} ± 0.70	69.48 ^{C} ± 0.72	20.70	6.60	**
39-42	LR5	66.28 ^{A} ± 0.50	65.50 ^{A} ± 0.71	62.44 ^{B} ± 0.54.	6.10	4.90	**
43-46	LR6	68.10 ^{A} ± 0.40	64.39 ^{B} ± 0.50	65.00 ^{B} ± 0.47	4.70	- 0.90	**
47-50	LR7	66.98 ^{A} ± 0.60	64.20 ^{B} ± 0.82	62.06 ^{C} ± 0.67	8.00	3.40	**
51-54	LR8	59.45 ^{A} ± 0.43	58.11 ^{A} ± 0.80	54.85 ^{B} ± 0.40	8.30	5.90	**
Average	ALR %	68.19 ± 0.20	64.54 ± 0.27	62.39 ± 0.25	9.30	3.43	**

a,b and c = Means with no common superscript in each raw differ significantly (P<0.05).

** = Highly significant (P<0.01).

* = Significant (P<0.05).

N = Number of experimental birds.

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Table(3): Means ± S.E. of egg production parameters and body weight for the heterozygous naked neck (Na/na) derived from different crossing systems within 23 - 54 wks of age.

Parameters	Mating 1 Na/Na ♀ x na/na ♂ (N=166)	Mating 2 na/na ♀ x Na/Na ♂ (N=183)	Mating 3 Na/na ♀ x Na/na ♂ (N=170)	% Difference from homogeneous Na/na		Probability
				Maternal Na/Na	Paternal Na/Na	
A.S.M. (days)	167.74 ^{A} ±0.41	169.96 ^{B} ±0.60	173.42 ^{C} ± 0.50	-5.68 days	-3.46 days	**
B.W. 24 wks (g)	1298.00 ±11.00	1300.00 ± 9.00	1271.00 ± 10.0	2.12	2.28	N.S.
E 90	63.33 ^{A} ±0.40	62.31 ^{A} ± 0.60	59.46 ^{B} ± 0.50	6.50	4.79	**
LR90 %	70.37 ^{A} ±0.50	69.22 ^{A} ± 0.50	66.06 ^{B} ± 0.52	6.50	4.80	**
B.W. 40 wks (g)	1467.00 ±13.00	1469.00 ± 11.00	1438.00 ± 12.30	2.02	2.15	N.S.
B.W. 52 wks (g)	1560.00 ± 11.70	1571.00 ± 14.00	1560.00 ± 13.10	0.00	0.70	N.S.
TEN	152.75 ^{A} ±0.50	144.57 ^{B} ± 0.60	139.77 ^{C} ± 0.55	9.29	3.43	**
AEW (g)	46.91 ^{A} ±0.15	45.21 ^{B} ± 0.21	44.06 ^{C} ± 0.14	6.47	2.61	**
TEM (kg)	7.163 ^{A} ±0.029	6.540 ^{B} ± 0.045	6.159 ^{C} ± 0.033	16.30	6.19	**

a,b and c = Means with no common superscript in each raw differ significantly ($P<0.05$).

** = Highly significant ($P<0.01$).

N.S = Not significant.

N = Number of experimental birds.

reported that Na/Na birds were the earlier in sexual maturity than Na/na and na/na genotypes and this effect was observed when the Na/Na genotype used as a maternal genotype in this work. Kosba (1978) reported higher egg production in Fayoumi crossbreds than in purebreds. Similar results were also obtained by Nawar and Abdou (1999).

Within genotypes issued from the different mating systems, the maximum laying rates were from 2^{nd} to the 4^{th} laying period, whereas the lowest rates were observed mainly at the 5^{th} and 8^{th} laying periods (Table 2). Under, prevailing temperatures (Table 2), the results exhibited that Na/na birds issued from maternal naked neck line had significantly (P<0.01) more persistent effect on laying rate within laying cycle which reflect a remarkable improvement in average laying rate (ALR%). It was about 68.20%, 64.54% and 62.39% for the offsprings derived from mating 1, 2 and 3 respectively.

With regard to egg number, the results listed in Table (3) showed a superiority of Na/na birds issued from maternal line for egg number within the first 90 days and TEN. Egg number (E90) significantly (P<0.01) increased by 6.50% and 4.80% of maternal and paternul when they compared with pure Na/na line (mating 3). Similar trend was also obtained for laying rate (%) within the first 90 days (LR 90%). El-Safty *et al.* (2003) reported no significant differences in (E90) of Na/na birds differed in maternal and paternal lines.

Average of total egg number (TEN) was also improved significantly (P<0.01) of Na/na produced from matarnal Na/Na (mating 1) when they compared with other mating systems. TEN was 152.74, 144.57 and 139.77 eggs for the Na/na hens from the crossing 1, 2 and 3 respectively. The improvement percentage was about 9.30% and 3.43% when compared with pure Na/na. The results obtained by Abd El-Rahman and Makled (2006) and Makled and Abd El-Rahman (2006) found a significant increase in egg number (E90 and TEN) associated with naked neck hens (Na/-) when compared with their normally feathered counterparts.

It was observed that heterosis as a result of crossing in this work cause a remarkable increase in egg production especially in the Na/na derived from maternal line. Dominance was broadly believed to be the only cause of heterosis (Fairfull *et al.*1983). Sheridan (1980) stated that dominance was not sufficient to explain heterosis that occurred between different breeds or between unrelated strains of same breed. Epistasis effect was shown to be a major mechanism of heterosis in Leghorn strain crossing (Fairfull *et al.* 1987). Also, Sabri and Abd El-Warith (1998) reported that crosses between Leghorn female and Fayoumi males showed higher egg production than their reciprocal cross. Similar trend was also obtained by Nawar and Abdou (1999) and Zaky (2006).

It could be stated that heterosis was positive and significant for all egg number measurements. Although, heterosis could be due to different degrees of dominance or epistasis (Fairfull *et al.*1983, 1987), the highly significant ($P<0.01$) differences between crosses in this experiment would suggest that some genes, responsible for dominance and epistasis effects are presented on sex-chromosome and accountable for maternal and sex linked effects (Poggenpoel *et al.* 1996 and Sabri and Abd El-Warith, 1998).

Average egg weight of Na/na hens derived from maternal Na/Na line was heavier (46.91 g) than those obtained from paternal line (45.21g) or homogeneous Na/na line (44.06 g). The deviation increase ($P<0.01$) in egg weight from homogeneous line due to crossing was about 6.50 and 2.60% for mating 1 and 2, respectively. The maternal increase due to crossing supports the results obtained by Bordas *et al.* (1980) who found that under moderate (20°C) or high (32°C) ambient temperatures, the mean egg weight was superior for Na/Na females by 2.5 and 4.5 g than those Na/na and na/na ones. Also, Abd El-Rahman (2000a,b), Younis (2002), Abd El-Rahman and Makled (2006) and Makled and Abd El-Rahman (2006) reported that there was a significant association in average egg weight with genotype at Na locus. The ratio of egg weight to body weight also has a positive effect on egg weight (Horst *et al.*, 1996 and Singh *et al.*, 2001) but no one referred to how the Na gene was embedded via sires or dams.

As might be expected, the increase in egg number and weight lead to an increase in egg mass. The Na/na birds derived from maternal (Na/Na) had a significant ($P<0.01$) increase by 16.30% whereas it was 6.20% when Na/na birds derived from paternal (Na/Na) genotype. The results are in agreement with that reported by El-Safty *et al.* (2003) who reported that Na/na hens from maternal line produced heavier egg mass than those of Na/na genotype issued from paternal line.

Throughout the previous comprehensive work on naked neck gene (Na), it was found that Na/- birds produced heavier egg mass than na/na genotype without significant differences between Na/Na and Na/na genotype (Abd El-Rahman and Makled, 2006 and Makled and Abd El-Rahman, 2006). Heterotic effects due to crossing on egg mass are the most non additive genetic effects. They reflect existence of gene interaction within single locus (dominance) or among loci (epistasis). Therefore, for loci with overdominance, the heterozygous state is considered to be superior (Fairfull *et al.*, 1983). It can be concluded, that crossing irrespective the mating systems (1 or 2) improved significantly the laying performance within production cycle in this work (23–54 wks). It was reported that crossing for use heterosis optimize average genetic merit of performance traits for adaptability to various climatic and nutritive environments encountered in poultry production (Zaky, 2005 and 2006).

Taking into consideration, the effect of crossing in mating 1 and 2 on body weight of layers at 24, 40 and 52 wks of age as compared with that in mating 3 (Table 3), it was observed that Na/na birds derived from paternal line were heavier body weight than those obtained from other mating systems although the differences were insignificant. The results obtained by Buss (1990) concluded that body weight of turkey is strongly determined by an additive expression of several gene. Also, Fairfull (1990) reported that heterosis is usually greater for reproductive traits than growth performance. The obtained results (Table 3) are partially in accordance with that obtained by Zaky (2005) who found that body weight was heavier for Fayoumi male x Rhode Island female than reciprocal cross.

Egg quality parameters:

Results of egg quality traits per each mating system and age are listed in Table (4). The results showed that no significant interaction effect between mating system (G) and Age (A).

As previous discussed, the eggs of the Na/na derived from the maternal line recorded the heavier ($P<0.01$) egg weight than eggs obtained from other mating systems. The increase in egg weight reflect a significant ($P<0.01$) increase in albumen percentage (%) where albumen % of Na/na eggs derived from mating 1, 2 and 3 was 56.55, 56.58 and 55.25%. The differences between egg components percentages (albumen %, yolk % and shell %) derived from maternal and puternal lines were insignificant. The values of yolk percentages were 31.78%, 31.78 and 33.15% for Na/na eggs derived from maternal, paternal and homogeneous lines, respectively.

With regard to egg shell quality, it could be noticed that no significant difference in egg shell % due to crossing where the Na/na eggs produced from mating 1, 2 having nearly similar egg shell percentage (11.65%) when they compared with shell % (11.60%) of eggs produced from mating 3. Abd El-Rahman, (2000 a,b), (2003), Abd El-Rahman and Makled, (2006) and Makled and Abd El-Rahman (2006) reported that Na/Na eggs recorded the lowest value of shell percentage when they compared with na/na or Na/na eggs, but the differences between na/na and Na/na were insignificant.

The author concluded that the remarkable reduction in egg shell quality measured by %, breaking

Table(4): Means ($\overline{X}$) ± S.E. of egg quality parameters for heterozygous naked neck chickens (Na/na) derived from different crosing systems (G) at 40 and 52 wks of age (A).

Factor	Group	Egg weight (g)	Albumen %	Yolk %	Shell %	Shell strength (kg/cm^2)	Shell thickness (mm)
Genotype (G)	G1	51.12^{A} ± 0.48	56.55^{b} ± 0.26	31.78^{B} ± 0.24	11.67±0.10	5.18^{B} ± 0.12	0.408^{B} ± 0.004
	G2	50.53^{A} ± 0.42	56.58^{A} ± 0.22	31.78^{B} ± 0.21	11.64±0.09	4.95^{B} ± 0.10	0.389^{C} ± 0.004
	G3	48.74^{B} ± 0.39	55.25^{B} ± 0.29	33.15^{A} ± 0.27	11.60±0.10	5.56^{A} ± 0.11	0.421^{A} ± 0.003
Age (A)	40 wks	48.06^{B} ± 0.34	56.71^{A} ± 0.23	31.58^{B} ± 0.22	11.71±0.08	5.32 ± 0.09	0.410^{A} ± 0.003
	52 wks	52.20^{A} ± 0.28	55.55^{B} ± 0.18	32.89^{A} ± 0.17	11.56±0.07	5.13 ± 0.10	0.401^{B} ± 0.003
Interactions (GxA)	G1xA1	48.81 ± 0.59	57.09 ± 0.40	31.19 ± 0.34	11.72±0.17	5.23 ± 0.18	0.413 ± 0.007
	G1xA2	53.04 ± 0.57	56.01 ± 0.30	32.37 ± 0.30	11.62±0.16	5.12 ± 0.16	0.402 ± 0.05
	G2xA1	48.40 ± 0.62	57.10 ± 0.32	31.10 ± 0.33	11.80±0.11	5.04 ± 0.14	0.394 ± 0.005
	G2xA2	52.37 ± 0.40	56.07 ± 0.28	32.45 ± 0.25	11.48±0.15	4.86 ± 0.15	0.384 ± 0.006
	G3xA1	46.67 ± 0.50	55.94 ± 0.46	32.45 ± 0.43	11.61±0.12	5.72 ± 0.14	0.424 ± 0.004
	G3xA2	50.81 ± 0.40	54.56 ± 0.31	33.86 ± 0.28	11.58±0.15	5.40 ± 0.18	0.419 ± 0.006
Source of variation	d.f	Probabilities					
G	2	**	**	**	N.S.	**	**
A	1	**	**	**	N.S.	N.S.	*
G x A	2	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Error	234						

a,b and c = Means within the same factor within the same column with different superscripts are significantly different (P<0.05).

G1 = Na/na derived from Na/Na ♀ x na/na ♂.

G2 = Na/na derived from na/na ♀ x Na/Na ♂.

G3 = Na/na derived from Na/na ♀ x Na/na ♂.

** = Highly significant (P<0.01).

* = Significant (P<0.05).

N.S.= Not significant

strength and thickness may be attributed not only to a direct gene effect but also due to that Na/- birds were more egg number and heavier egg weight compared with na/na eggs. Although, the results in the present study exhibited that using Na/Na as maternal line the Na/na eggs recorded shell % values better than those obtained from previous studies (Abd El-Rahman, 2000a,b, 2003). Makled and Abd El-Rahman (2006) proved that it is possible to correct the disadvantage of the Na gene on egg shell quality by increasing the intake of dietary calcium level (3.47%) which improved significantly not only egg shell quality but also egg number and egg mass as compared with low calciun level (2.51%).

With respect to the term of breaking strength (kg/cm^2). The hen eggs derived from maternal or parernal Na/Na recorded less values (5.18 and 4.95) when they compared with Na/na eggs derived from homogeneous line (5.56) and the differences were highly significant (P<0.01).

Concerning the egg shell thickness, it could be stated that the differences between eggs from matings were also highly significant (P<0.01). The values of egg shell thickness were 0.408, 0.389 and 0.421 mm, from eggs of the previous matings, respectively.

Although, Zaky (2006) reported that using Leghorn females x Fayoumi males increased egg quality parameters, the results in this work exhibited that eggs from pure line recorded the best egg shell quality than other crossing systems. The increase in egg shell quality here may be due to that hens of this mating had lower egg number and egg weight than hens derived from other mating systems (Tables 2 and 3). It can be concluded, that irrespective of mating system the crossing between Na/Na ♀ x na/na ♂ improved egg shell quality parameters when compared with their reciprocal cross (paternal line).

Results listed in Table (4) show significant differences due to age of birds on egg weight, albumen %, Yolk % and shell thickness. Although, advancing age from 40 to 52 wks reduced shell percentage and strength the differences were insignificant. This is in accordance with the results reported by Lopez and Leeson (1995), Abd El-Rahman and Makled (2006) and Makled and Abd El-Rahman (2006).

Carcass and physiological parameters:

Data of carcass and physiological parameters are listed in Table (5). The results showed no significant interaction between Na/ na genotypes and age of birds for all traits studied.

The results exhibited that carcass percentage of Na/na birds derived from different mating system were insignificant where, it was 60.34, 61.87 and 59.74% of genotype 1, 2 and 3 respectively (Table 5). There are significant differences (P<0.01) in giblets percentage due to genotype,

Table(5): Means ($\overline{X}$) ± S.E. of carcass and physiological parameters for heterozygous naked neck chickens (Na/na) derived from different crossing systems (G) at 40 and 52 wks of age (A).

Factor	Group	Carcass %	Giblets %	Dressing %	Abdominal fat %	Ovary %	Oviduct %	Calcium (mg/100 ml)	Phosphorus (mg/100 ml)
Genotype (G)	G1	60.34±1.40	5.30^{A}±0.09	65.65±1.47	1.90^{B}±0.10	3.42^{A}±0.07	4.07^{A}±0.08	21.86±0.48	6.77±0.12
	G2	61.87±0.45	4.91^{B}±0.10	66.78±0.40	2.24^{B}±0.11	3.20^{A}±0.11	3.99^{A}±0.07	21.60±0.52	6.91±0.12
	G3	59.74±0.56	4.86^{B}±0.11	64.10±0.52	2.91^{A}±0.16	2.95^{B}±0.07	3.66^{B}±0.09	21.95±0.50	6.84±0.1
Age (A)	40 wks	60.26±1.0	4.89^{B}±0.07	65.15±1.0	2.15^{A}±0.10	3.19±0.08	3.94±0.07	22.38^{A}±0.39	6.91±0.10
	52 wks	60.71±0.44	5.16^{A}±0.09	65.87±0.42	2.54^{B}±0.12	3.19±0.07	3.87±0.08	21.05^{B}±0.40	6.87±0.09
Interactions (GxA)	G1xA1	59.16±2.80	5.21±0.11	64.37±2.8	1.61±0.10	3.42±0.11	4.11±0.15	22.48±0.56	6.78±0.14
	G1xA2	61.53±0.69	5.40±0.15	66.93±0.70	2.18±0.16	3.42±0.12	4.03±0.12	20.69±0.75	6.76±0.16
	G2xA1	62.49±0.58	4.72±0.15	67.20±0.50	2.18±0.15	3.09±0.18	4.01±0.10	22.0±0.72	7.04±0.17
	G2xA2	61.25±0.68	5.11±0.15	66.37±0.60	2.30±0.16	3.31±0.11	3.97±0.10	21.20±0.70	6.70±0.18
	G3xA1	60.14±0.07	4.75±0.10	63.89±0.70	2.66±0.20	3.05±0.10	3.69±0.09	22.66±0.70	6.92±0.19
	G3xA2	59.34±0.85	4.98±0.18	64.31±0.80	3.16±0.20	2.85±0.09	3.62±0.10	21.25±0.60	6.76±0.16
Source of variation	d.f	Probabilities							
G	2	N.S.	**	N.S.	**	**	**	N.S.	N.S.
A	1	N.S.	*	N.S.	**	N.S.	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								

a,b and c = Means within the same factor within the same column with different superscripts are significantly different (P<0.05).

G1 = Na/na derived from Na/Na ♀ x na/na ♂.

G2 = Na/na derived from na/na ♀ x Na/Na ♂.

G3 = Na/na derived from Na/na ♀ x Na/na ♂.

** = Highly significant (P<0.01).

* = Significant (P<0.05).

N.S.= Not significant

where it was 5.30, 4.91 and 4.86% from Na/na hens of mating 1, 2 and 3, respectively.

With regard to dressing percentage, it could be observed that Na/na genotype derived from maternal Na/Na recorded 65.65% whereas it was 66.87% for Na/na hens from paternal Na/Na genotype but they did not differ significantly when they compared with Na/na from mating 3 (64.10%). Abd El-Rahman and Makled (2006) reported that dressing percentage improved by about 8.10 and 9.70% of Na/na and Na/Na when they compared with the normal (na/na) birds.

As shown in Table (5) the results exhibited a highly significant difference ($P<0.01$) in abdominal fat due to genotype where the lowest value (1.90%) obtained from Na/na birds derived from mating 1 (maternal line) followed by that obtained from mating 2 (2.24%) whereas it was 2.91% from birds of bure line Na/na (mating 3). The lower abdominal fat which obtained from Na/na birds of mating 1 and 2 may be due to the utilization of a higher proportions of lipids for thermoregulation and activity (Yahav *et al.*, 1998 and Abd El-Rahman and El-Hammady, 2000) or may be associated with higher egg number and heavier egg weight (Egg mass) when they compared with birds from mating 3 (Tables 2 and 3).

It could be observed that Na/na birds issued from maternal line (mating 1) and mating 2 had the highest ovary and oviduct percentage (Table 5). As a deviation from mating 3, the increase in ovary was 15.90% and 8.50% for mating 1 and 2, respectively. The corresponding figures for oviduct were 11.20% and 9%. The increase in reproductive organs may be due to the higher productivity of Na/na layers issued from maternal or paternal Na/Na genotype or may be attributed to the heterosis effect.

Moreover, the differences between genotypes in serum calcium and phosphorus were insignificant (Table 5). The results of egg shell quality (Table 4) exhibited that the Na/na birds of pure genotype (mating 3) recorded the highest values of egg shell quality compared with other mating systems, and these birds had a highest calcium level which may be attributed to the decrease in egg number and egg weight when they compared with Na/na birds issued from maternal and paternal Na/Na genotype.

Also, it was observed that giblets and abdominal fat significantly ($P<0.01$) increased whereas the serum calcium level ($P<0.05$) reduced with advancing age (Table 5). Similer results were also obtained by Makled and Abd El-Rahman (2006).

Finally, the results in the present study indicated the possibility of improving the fitness traits of the Na/na birds by crossing to obtain heterosis effect. The results lead to conclusion that using homozygous naked neck (Na/Na) as a maternal line was the effective method compared with other mating systems which may help to find out good results for the previous traits studied in this work.

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تقييم أداء إنتاج البيض للدجاج العارى الرقبة الخليط (الشركسى) الناتج من طرق خلط مختلفة تحت الظروف البيئية السائدة

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في دراسة على ٥١٩ من الدجاج العاري الرقبة الخليط والناتجة من ثلاثة طرق خلط مختلفة وهما إناث عاري أصيل × ذكور طبيعية الترييش . ٢- إناث طبيعية الترييش × ذكور عارية أصيل، ٣ – إنــاث عاريــة الرقــبة خليط × ذكور عارية الرقبة خليط . بهدف معرفة طريقة الخلط الفعالة للحصول على أحسن أداء لإنتاج البيض من الطيور العارية الرقبة الخليطة تحت درجات الحرارة السائدة وأمكن تلخيص النتائج كما يلي :

١- أظهــرت الطيور الخليط الناتجة من الخط الأمي (إناث عارية أصيلة × ذكور طبيعية) تبكيراً واضــحاً فــي النضج الجنسي بحوالي ٤ – ٥ أيام (مستوى ١%) عند مقارنته بالناتج من الخط الأبوي (إناث طبيعية × ذكور عارية أصيلة) أو حتى الناتجة من التزاوج الثالث (إناث × ذكور خليطه).

٢- تحســن أداء الإنــاث والناتجة من الخط الأمي معنويا (مستوى ١%) فى معدل وضع البيض حــتى ٩٠ يوما من النضج الجنسي أو خلال فترة التجربة (٢٣ – ٥٤ أسبوع) وكانت الزيادة في عدد البيض حتى ٩٠ يوما بحوالي ٦,٥% ، ٤,٨% لكل من التأثير الأمي والأبوي بينما كانت هذه الزيادة طوال فترة الإنتاج بحوالي ٩,٣٠% ، ٣,٤٣% لكل من التأثير الأمي والأبوي عند مقارنته بالخط النقي.

٣- أظهــرت إنــاث الخط الأمي زيادة معنوية في وزن البيضة (مستوى ١%) بالمقارنة بطرق الخلــط الأخرى مما أدى إلى زيادة معنوية في كتلة البيض بحوالي ١٦,٣٠% ، ٦,٢٠% لكل من التأثير الأمي والأبوي عند مقارنته بالطيور الناتجة من طيور خليطه نقية.

٤- لــم يظهــر نظــام التزاوج تأثيراً معنوياً على وزن الجسم للإناث عند عمر ٢٤ ، ٤٠ ، ٥٢ أسـبوع علــى الرغم من أن طيور الخط الأبوي كانت أعلى وزناً من الطيور الناتجة من طرق التزاوج الأخرى .

٥- أظهر بيض الطيور الناتجة من الخط الأمي والأبوي زيادة معنوية في نسبة البياض وانخفاضاً فــي نسبة الصفار عند مقارنته بالبيض الناتج من طيور خليطه نقية و أظهرت نسبة القشرة عدم وجود فروقاً معنوية بين التراكيب الوراثية الناتجة من الطرق المختلفة للخلط. سجلت نتائج البيض الــناتج مــن الخط الأمي زيادة معنوية في قوة التحمل وسمك القشرة بالمقارنة بالبيض الناتج من الخط الأبوي على الرغم من أن البيض الناتج من أمهات خليطه نقية كان أفضل في جودة القشرة.

٦- سـجلت إنــاث الخط الأمي زيادة في نسبة المبيض والقناة المبيضية وانخفاضاً في نسبة دهن التجويف البطني بالمقارنة بطرق الخلط الأخرى. كما لم تتأثر نسبة التصافى و نسبة الكالسيوم أو الفوسفور في دم الدجاج بطرق الخلط المختلفة.

وأظهــرت النــتائج علــى أن الخلط بين التراكيب الوراثية للوصول إلى التركيب الوراثي الخليط يعكــس تحسنا معنويا لصفات إنتاج البيض تحت ظروف الحرارة الطبيعية وتوصى الدراسة بأن تزاوج إناث الدجاج العاري الرقبة الأصيل مع ذكور الدجاج الطبيعي الترييش تعتبر طريقة فعالة والتي يمكن أن تساعد لكي نصل منها إلى نتائج جيدة للصفات التي تم دراستها في هذا البحث.