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SELECTION FOR UNIFORMITY IN ALEXANDRIA LOCAL CHICKEN

1- RESPONSE TO SELECTION

By

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Abstract:*Four lines of Alexandria strain were used; selected meat line [ML] , selected egg line [EL], and their controls [CEL&CML]. The present study was performed for purpose of increasing uniformity in Alexandria chickens. Eight weeks body weight and age at sexual maturity were estimated in the all populations. Bodyweight for chicks at eight weeks was detected in meat line selection for increasing uniformity within the range ($x^- \pm$ S.D.) for females and ($x^- \pm$ 0.5S.D.) for males. Selected chicks were chosen as parents for the next generation and all chicks either lower or higher than these ranges were discarded. Egg line selection was done for increasing uniformity age at sexual maturity age so the layers which in range ($x^- \pm$ S.D.), were chosen as dams for the next generation and all layers above or lower than this range were discarded. Males which will be the sires were taken at random. The males and females of each control line were taken at random from their population.*

The Main Results and Conclusions are Summarized as Follow:

1. The method of selection which used was similar to stabilizing selection so in this experiment there was no selection differential (S) estimated.

2. Over two generations, in meat line selection uniformity percent in males is higher than those in females (48.23 vs. 42.22) in the 1st generation and (52.60 vs. 50.72) in the 2nd generation. However, actual response to uniformity selection in meat line was 1.5% and 18.32% for males and females, respectively after one generation of selection.

3. One generation of selection in egg line selection for uniformity age at sexual maturity increased uniformity from 99.03% to 111.18% based on the percent of their control population. Actual response to selection for uniformity of age at sexual maturity was 7.79% after one generation of uniformity selection.

4. The heritability estimates for body weight at 8 weeks (BW8) were (0.18, 0.08, 0.1 and 0.74 for E.L., C.E.L., M.L. and C.M.L., respectively) based on sire plus dam component of variance.

INTRODUCTION

Flock uniformity within male and female populations is a main goal to achieving maximum performance for broilers and egg production.

Average body weight and body weight uniformity are inseparable topics. Uniform flocks with the proper weight have several advantages: birds are managed in large groups and are exposed to management changes (lighting, feed and housing) at the same time, whether they are physiologically ready or not, are more efficient, have higher peak production and come closest to expressing their full genetic potential.

Traditionally, the emphasis on uniformity of broiler chicks has been dictated by the last part of the production chain. The automated slaughtering process demands uniformity of product entering the processing plant. Often, achieving uniformity is regarded as the broiler farmer's job and indeed, uniformity of broilers at slaughter weight can be greatly influenced by what happens on the broiler farm. As chick uniformity is unlikely to increase during the production process, a key prerequisite to a uniform end product is uniformity in the day olds. Day-old flocks showing poor uniformity are impossible to manage properly, which will result in lower growth, increased feed conversion and higher mortality during the first week (Van de Ven, 2005).

Some confusion arises when it comes to the question of measuring uniformity. Poultry growers generally assess the uniformity of a flock by eye. Information regarding practical standards for measuring the uniformity was defined by (North, 1978); according to him uniformity is measured as the percent of the birds that weigh within ± 10% of the average flock weight. Flocks in which less than 70% of the birds meet these criteria are considered no uniform.

Genetics is a good starting point for achieving uniformity. So, selection for uniformity is a method to increasing it in a population. Good management can also result in more uniformity, (Anonymous, 1997) and (Robinson and Robinson, 1991).

The aim of present study is to increase the uniformity of Alexandria strain the effect of increasing uniformity on productive and reproductive performance atudy.

MATERIALS AND METHODS

The experimental work of this study was done at the Poultry Research Center, Faculty of Agriculture (El-Shatby) and the Department of Animal and Fish Production, Faculty of Agriculture (Saba-Basha), Alexandria University, Egypt, through two seasons (2004/2005 and 2005/2006). The experimental stock comprised two developed Alexandria lines (meat and egg lines) and their two control lines.

Flock History:

Alexandria strain is a local developed chicken which established in 1958 at Faculty of Agriculture (El-Shatby) by Prof. Dr. H. EL-Ibiary. It resulted from crossing between Fayoumi as Egyptian breed and Barred Plymouth Rock, Rhode Island Red and White Leghorn as standard breeds (Kosba, 1966).

The Experimental Plan:

Four lines of Alexandria strain were used in the present study:

1-Egg line (E.L):

This line was obtained in seasons 1992 and 1993 by crossing three strains of chickens i.e. Alexandria, Norfa and Matrouh (Zatter, 1994). This line was selected for age at sexual maturity and egg production traits from season 1995 till now (Ghanem, 1995 and 2003).Then this line was selected for white feather color (Khalil, 2005).

2-Control population for egg line (C.E.L):

Control population for the selected egg line was obtained by random mating of the same base population of egg line without selection for any trait (Zatter, 1994 and Khalil, 2005)**.**

3-**Meat line (M.L):**

Obtained in seasons 1991 and 1992 by crossing four strains of chickens i.e. Alexandria, Gimmizah, Mandarah, and Silver Montazah (EL-Hanoun, 1995).This line was selected for eight weeks body weight and meat production traits from season 1997 till now (Abd Alla, 1997; Abd EL-Halim, 1999; EL-Tahawy, 2000 and EL-Dlebshany, 2004).This line was selected for black feather color (Khalil, 2005).

4-Control population for meat line (C.M.L):

Control population for the selected meat line was obtained by random mating of the same base population of meat line without selection for any trait (EL-Hanoun, 1995 and Khalil, 2005).

Selection Method:

In the present study, beside the general methods of selection which described above, there is another selection for uniformity since in the progeny of the generation (2004-2005); eight weeks body weight and also age of sexual maturity were estimated in the all populations. In the meat line, selection was done for increasing uniformity for eight weeks body weight so the female chicks which in range ($\bar{x} \pm$ S.D.) and the male chicks which in range ($\bar{x} \pm 0.5$S.D.) selection chicks were chosen as parents for the next generation and all chicks above or lower than these ranges were culled. While in the egg line, selection was done for increasing uniformity for age at sexual maturity so the layers which in range ($\bar{x} \pm$ S.D.) were chosen as dams for the next generation and all layers above or lower than this range were culled. But males which will be the sirs were taken at random.

The males and females of each control line were taken at random from their populations.

The Mating Plan:

Season (2004-2005):

Four large breeding houses had been used for mass mating for the four lines Each house had about 6 to 11 sires and 45 to 85 dams for each line (Table 1).

Season (2005-2006):

Twenty five individual breeding pens had been used to produce the chickens of the selected and control lines. seven pens were used In M.L., each pen had one sire mated to a minimum of 8 dams. ten pens were used In E.L, each pen had one sire mated to 5 dams. four pens were used for each line In two control lines, each pen had one sire mated to a minimum of 10 dams**.** The numbers of parents and offspring at hatch for each season and line are shown in Table (1). The numbers of observations of different traits for each season and line are shown in Table (2).The numbers of observations of different traits for all seasons and lines are shown in Table (3).

Table 1: Sires, dams and offspring number of selected and control populations in two seasons

Line	seasons					
	2004/2005[1]			2005/2006[2]		
	Sires	**Dams**	**Offspring**	**Sires**	**Dams**	**Offspring**
E.L	11	85	1405	10	50	481
C.E.L.	6	45	355	4	40	533
M.L.	10	79	1084	7	62	593
C.M.L.	6	45	315	4	41	341
Total	**33**	**254**	**3159**	**25**	**193**	**1948**

1= mass mating& 2= breeding pens mating (family mating)
E.L.= egg line C.E.L.= control egg line M.L.= meat line C.E.L.=control meat line

Table 2: The numbers of observations of different traits for each season and line

E.L.				
Traits	1st Generation		2nd Generation	
	♂	♀	♂	♀
BW8	502	673	154	221
ASM		222		50
C.E.L.				
BW8	107	163	136	223
ASM		81		54
M.L.				
BW8	367	514	192	278
ASM		197		68
C.M.L.				
BW8	121	143	105	161
ASM		63		51

BW8 = body weight at 8 weeks ASM=age at sexual maturity
E.L.= egg line C.E.L.= control egg line M.L.= meat line C.E.L.=control meat line

Table 3: The numbers of observations of different traits for all seasons and lines

Traits	**All observations**
Body weight at 8 weeks	4060
Age at sexual maturity	786

Flock Husbandry:

All experimental parents and hatching eggs received the same managerial treatments for all lines. In season (2005-2006) the identified eggs were collected from dams through trap nesting. In each season the collected eggs were set biweekly in an forced draft type incubator, about 7 biweekly hatches were taken during February and March. On the 18 day of incubation, the eggs were candled to determine the number of fertile eggs and dead embryos. At hatching the chicks were pedigreed (only in season

2005-2006); wing banded, weighed and brooded in floor brooders. At four weeks of age the chicks were weighed. At eight weeks of age the chicks were sexed, weighed and moved to the growing houses. Nearly the sexual maturity the females were assigned to individual laying cages. Feed and water were provided *ad libitum*. Table (4) presents the formatting of the rations used at the different ages.

Table 4: The components (%) and the calculated analysis of the rations used throughout the experiment

Ingredients	Rations type		
	Starter	Developer	Breeder
	0-8 weeks	8-20 weeks	After 20 weeks
Yellow corn	60	73	58
Wheat bran	0	0	14
Soybean meal (44%)	28	15	11
Meat meal (local)	9	9	9
Methionine	0.1	0.06	0.07
Bone meal	1.5	1.5	1
Limestone	0.65	0.69	6.18
Salt	0.5	0.5	0.5
Premix [a]	0.25	0.25	0.25
Total	**100**	**100**	**100**
Calculated analysis			
Crude Protein (%)	21	16	16
M.E.K. cal/kg	2825	2995	2579
C/P ratio/kg	134.5	187.2	161.2
Fat (%)	3.64	4.06	3.8
Fiber (%)	2.94	2.34	2.96
Calcium (%)	1.28	1.26	3.47
Phosphorus(%)available	0.63	0.6	0.52
Arginine (%) of protein	6.78	6.49	6.4
Lysine (%)	5.11	4.26	4.25
Methionine (%)	2.05	2.04	2.05
Cystine (%)	1.59	1.65	1.6
Linoleic acid	1.32	1.54	1.42

a: Each 2-kg contain vit.A (12 M.I.U.), vit.D3 (12 M.I.U.), vit.E (10g), vit.K2 (1g), vit.B1 (1g), vit.B2 (4g), vit.B6 (1.5g), vit.B12 (10g), Pantothenic acid (10g), Nicotinic acid (20g), Folic acid (1000mg), Bidin (50g), Choline Chloride(500g), copper (10g), Iodine (1g), Iron (30g), Manganese (55g), Zinc (5g) and Selenium (0.1g).

Studied Traits:

1. Body weight**:** individual body weight (g) was recorded at eight weeks of age for each sex and line to estimate the percent of uniformity at this age.

2. Age at sexual maturity was estimated for hens as the number of days from hatching to the day of laying its first egg to estimate the uniformity in this trait.

Selection Measurements

1. selection response:

The realized selection response were estimated according to the numerator of the following equation according Guill and Washburen, (1974), for estimated realized heritability

$$\mathbf{h^2_R} = \frac{(\text{selected progeny X} - \text{selected parent X}) - (\text{progeny control X} - \text{parent control X})}{(\text{selected parent X} - \text{parent X})}$$

2. density of selection (V):

It was calculated by the following equation (Falconer, 1983).

$$\text{.Density of selection (v)} = \frac{\text{Number of selected parents}}{\text{Number of all population}} * 100$$

statistical analysis:

After adjusting the data for hatching date, all performance data were analyzed by using SAS for statistical analysis program.

The average (X) and standard deviation (S.D.) were estimated for all studied traits.

Heritability estimates:

Data in second generation two of body weight at eight weeks of age were analyzed according to the following model:

$$Y_{ijk} = \mu + S_i + D_{ij} + e_{ijk}$$

Where:

μ = the overall mean,

S_i = the effect of i th sire,

D_j = the effect of j th dame mated to the i th sire and

e_{ijk} = the remainder error.

Heritability estimates were calculated according to Lerner, (1950).Three estimates of heritability are available as based on sire, dam and both sire plus dam contributions as shown in following equations:

Based on sire components,

$$\mathbf{h_S^2} = \frac{4\sigma_S^2}{\sigma_S^2 + \sigma_D^2 + \sigma_W^2}$$

Where

h_S^2 = the heritability estimate based on sire component,

σ_S^2 = the sire variance components, multiplied by 4 because it has 1/4 additive genetic variance,

σ_D^2 = the dam variance components and

σ_W^2 = the error variance components.

Based on dam components,

$$\mathbf{h_D^2} = \frac{4\sigma_D^2}{\sigma_S^2 + \sigma_D^2 + \sigma_W^2}$$

Where

h_D^2 = the heritability estimate based on dam component,

σ_D^2 = the dam variance component, multiplied by 4 because it has 1/4 additive genetic variance,

σ_S^2 = the sire variance component and

σ_W^2 = the error variance component.

Based on sire plus dam contributions,

$$\mathbf{h^2_{S+D}} = \frac{2(\sigma^2_S + \sigma^2_D)}{\sigma^2_S + \sigma^2_D + \sigma^2_W}$$

Where

h^2_{S+D} = the heritability estimate based on sire plus dam contributions,

$\sigma^2_S + \sigma^2_D$ = (the sire variance component + the dam variance component) multiplied by 2 because it has 1/2 additive genetic variance, and

σ^2_W = the error variance components.

RESULTS AND DISCUSSION

Effect of Selection:

Selection for increasing uniformity at eight weeks body weight and at age of sexual maturity:

.Consequently, in this experiment there was no selection differential(S). However, Table 5 shows the least square means and standard deviation ($\bar{x}$±S.D) for all populations and selected parents of selected lines (M.L. and E.L.) in the first generation.

Table 5 shows that there were no clear differences between the average of eight weeks body weight for all population and selected parents (584.05 vs. 581.78 and 462.97 vs. 466.63 g. for males and females, respectively). On the other hand, as expected the differences were observed in the variability of the population, since the standard deviation of the selected parents was lower than those of the all populations (29.38 vs. 102.98 and 47.80 vs. 91.46g. for males and females, respectively).

The same trend was observed also in the egg line, however, the average of the age at sexual maturity of all populations and selected parent was 158.66 and 157.46 days, while the standard deviation was 13.55 and 7.06.

Uniformity was estimated for two generations as the percentage of birds within ± 10% of the mean (North, 1978). Consequently, actual response to selection for increasing uniformity of body weight at eight weeks and age at sexual maturity were calculated. Table (6) presents the uniformity percent for the meat line and its control in both generations and

shows the actual response to selection. It could be observed that uniformity percent in males is higher than those in females over two generations (48.23 vs. 42.22 in the 1st generation and 52.60 vs. 50.72 in the 2nd generation) for the selected lines. In contrast, Griffin et al. (2005) worked on Ross broiler chickens reported that flock uniformity at 42 days of age was poorer in males than in females when calculated as the percentage of birds within ±10% of the mean body weight (56 vs. 62%, respectively). Actual response to selection was 1.5% and 18.32% for males and females, respectively after one generation of selection. So, it could be concluded that selection for increasing uniformity at eight weeks body weight was more efficient in females than in males. Also table (6) shows that the uniformity in the selected populations was higher than that of the control populations expect that of the females at 1st generation.

Table (6) represents the uniformity percent for the females in E.L. and its control in the two generations. It is clear from this table that the uniformity in the 1st generation was higher than those in the 2nd generation based the absolute figures. As a percent of the selected population on their control one it was 99.03% in the 1st generation and it was 111.18% in the 2nd generation. That means that one generation of selection for uniformity of age at sexual maturity increased uniformity from 99.03% to 111.18% based on the percent of their control population. Table (6) shows the actual response to selection for uniformity of age at sexual maturity was 7.79% after one generation of selection.

Values of selection density for 8-week body weight of males and females in meat line and that of age at sexual maturity in egg line are represented in Table (7).

Table 5: The least squares means and standard deviation ($\bar{x}$±S.D) of BW8 (M.L.) and ASM (E.L.) for all population and selected parent in the first generation.

Meat line		
Sex	**All Population**	**Selected Parent**
♂♂*	584.05±102.98	581.78±29.38
♀♀*	462.97±91.46	466.63±47.80
Egg line		
Pullets**	158.66±13.55	157.46±7.06

* = Eight weeks body weight & ** = age at sexual maturity

Table 6: The uniformity percent for the selected (s) and control (c) lines in both generations and the actual response to selection

	Meat line				Egg line	
	♂♂		♀♀		♀♀	
	S	**C**	**S**	**C**	**S**	**C**
First generation	48.23	43.80	42.22	48.95	77.03	77.78
Second generation	52.60	46.67	50.72	39.13	70.00	62.96
Actual response	**1.5**		**18.32**		**7.79**	

Table 7: Values of selection density (V) in two selected lines

Line	V
Meat line ♂♂	44.69%
Meat line♀♀	71.60%
Egg line ♀♀	64.41**%**

Heritability Estimates:

Heritability estimates for 8-week body weight:

Table (8) presents the heritability estimates and standard error based on sire, dam and sire plus dam components of variance for body weight at eight weeks of age for four lines at the second generation. The heritability estimates for this trait were (0.18, 0.08, 0.1 and 0.74 for E.L., C.E.L., M.L. and C.M.L., respectively) based on sire plus dam component of variance. Working in Alexandria egg number line El-Tahawy (2000) found the heritability estimate based on sire plus dam component of variance for this trait was 0.19.

The estimates for the heritability based on sire component of variance for this trait in C.E.L., M.L. and C.M.L. were none available due to the negative sign or higher than unity. Kosba et al. (1981) reported that the heritability value was 1.39 depending on the sire component on the same strain and trait.

In egg line, the heritability estimate based on dam component of variance gave higher estimate for this trait than the sire component of variance (0.21 vs. 0.16). These results are in agreement with those reported by Kosba et al., (1977); Shawer et al., (1977); Eid, (1979); Shebl, (1980) and Ghanem, (1995). In contrast, Hassan (2006) found that the heritability estimates for this trait on Anshas strain was 0.45 based on dam component of variance compared with 0.50 based on sire component of variance.

Table 8: The heritability estimates and standard error based on sire, dam and sire plus dam component of variance for 8-week body weight for four lines at the second generation

Line	h^2_s	h^2_D	h^2_{S+D}
Egg line	0.16 ± 0.180	0.21± 0.157	0.18 ± 0.154
Control Egg line	NE	0.2 ± 0.113	0.08 ± 0.112
Meat line	NE	0.21± 0.123	0.1 ± 0.111
Control Meat line	NE	0.17± 0.269	0.74± 0.124

NE: Not estimated due to negative sign or higher than unity.

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الملخص العربي

الانتخاب للتجانس في دجاج الاسكندرية المحلي

١ - الاستجابة للانتخاب

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أجريت هذه الدراسه بمركز بحوث الدواجن- كلية الزراعه بالشاطبى – وقسم الإنتاج الحيوانى والسمكى- كلية الزراعه سابا باشا - جامعة الإسكندريه – خلال موسمين 2005/2004 و 2006/2005.

أجريت هذه الدراسه على أربع خطوط من الدجاج الإسكندرانى (خط منتخب لإنتاج البيض– خط مقارنه لإنتاج البيض- خط منتخب لإنتاج اللحم – خط مقارنه لإنتاج اللحم). وذلك بغرض زيادة درجة التجانس فى دجاج الإسكندرانى. تم تسجيل وزن الجسم عند عمر 8 أسابيع وكذلك عمر البلوغ الجنسى فى كل الخطوط. وتم الإنتخاب فى خط اللحم لزيادة درجة التجانس فى وزن الجسم عند عمر 8 أسابيع وذلك بإنتخاب الإناث التى تقع فى المدى (المتوسط الحسابى لوزن الجسم عند عمر 8 أسابيع ± وحده واحده من الإنحراف القياسى) وتم إنتخاب الذكور الواقعه فى المدى (المتوسط الحسابى لوزن الجسم عند عمر 8 أسابيع ± نصف وحده من الإنحراف القياسى) وذلك كأباء للجيل التالى واستبعدت كل الطيور الواقعه خارج هذا المدى، وبالنسبه لخط البيض تم الإنتخاب فيه لزيادة درجة التجانس فى عمر البلوغ الجنسى ولذلك أنتخبت الدجاجات التى يقع عمر بلوغها الجنسى فى المدى (المتوسط الحسابى لعمر البلوغ الجنسى ± وحده واحده من الإنحراف

القياسى) كأمهات للجيل التالى واستبعدت كل الدجاجات الواقع عمر بلوغها الجنسى خارج هذا المدى أما بالنسبه للذكور فقد أخذت عشوائيا وفى كلا من خط المقارنه لأنتاج البيض وخط المقارنه لإنتاج اللحم تم إجراء التزاوج عشوائيا بدون إنتخاب.

كانت الصفات التى درست في كل جيل هى: وزن الجسم عند 8 أسابيع من العمر والعمر عند البلوغ الجنسي

وكانت أهم النتائج التى تم التحصل عليها هى :

١. الإنتخاب لزيادة التجانس يشبه الإنتخاب الثابت وعلى ذلك فى مثل هذه التجارب لا يمكن تقدير الفارق الإنتخابى.

٢. فى خط اللحم : وجد أن نسبة التجانس فى الذكور أعلى منها فى الإناث فى الخط المنتخب خلال الموسمين حيث بلغت 48.23% للذكور مقارنة ب 42.22% للإناث فى الجيل الأول ، وبلغت 52.60% للذكور مقابل 50.72% للإناث فى الجيل التالى. وجد أن الإستجابه الفعليه للإنتخاب لمدة جيل واحد من أجل زيادة درجة التجانس فى وزن الجسم عند عمر 8 أسابيع كانت 1.5% للذكور و18.32% للإناث.

٣. فى خط البيض : وجد أن جيل واحد من الإنتخاب أدى لزيادة درجة التجانس فى عمر البلوغ الجنسى من 99.03% إلى 111.18% وذلك كنسبه من خط المقارنه لإنتاج البيض، وكانت الإستجابه الفعليه 7.79%.

4. المكافىء الوراثي المقدر عن طريق تباين الذكور + الاناث لخط البيض وكنتروله وخط اللحم وكنتروله لوزن الجسم عند 8 أسابيع من العمر 0.18، 0.08 ، 0.1 و0.74 على الترتيب .