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STUDIES ON SOME PRODUCTIVE TRAITS IN NORFA CHICKENS

A.A. Enab, M.E. Soltan, F.H. Abdou and Hend E. Elnoamany
Poultry Production Dept., Faculty of Agriculture, Menoufia University

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ABSTRACT: *The current experiment had been carried out at the Poultry Farm of the Faculty of Agriculture, Minoufiya University, Shebin El-Kom, Egypt in the period of 2012 to 2014 for two generations to investigate the productive performance of Norfa strain as an indigenous Egyptian laying strain. A total of 528 birds (396 females + 132 males) of Norfa chickens were used. Artificial insemination was used as a mating system with sexual ratio 1 male / 3 females, and relatives mating was avoided. At hatching, all chicks were wing banded and pedigreed. Chicks were fed a starter diet containing 18.05% crude protein (CP) till 8th week of age and from 9th to 16th week of age, chickens were fed a growing diet containing 14.01% CP then, pullets were fed at production period a layer ration containing 17.46% CP. Cockerels were separated from pullets in brooding house at the 8th week of age and pullets were moved to individual cages in laying house at 16th week of age. A "step down-step up" lighting program was used durino-g brooding, rearing and production periods.*

Age at sexual maturity (ASM), body weight at sexual maturity (BW_{SM}), body weight at maturity (BW_M), egg weight at sexual maturity (EW_{SM}), egg weight at maturity (EW_M), egg number in first 90 days of laying (EN_{90d}) and egg number till 42 weeks of age (EN_{42WK}) were individually recorded for each laying hen.

Results can be summarized as follows:

1- *In the first generation, Norfa layers had late ASM (193.15d), reasonable egg weights (37.99 and 46.11 g for EW_{SM} and EW_M, respectively) and low egg numbers (28.34 and 33.48 eggs for EN_{90d} and EN_{42wk}, respectively) with light body weights (979.70 and 1078.42 g for BW_{SM} and BW_M, respectively).*

2- *In the second generation, the overall average of ASM of Norfa females was 179.30 d. Average of BW_{SM} was 919.25 g, while BW_M recorded in the studied flock of Norfa layers equaled to 1073.71 g. The mean of EW_{SM} was 32.0 g and the mean value of EW_M was 45.62 g. Egg number means obtained in the second season were 39.0 and 48.02 eggs for EN_{90d} and EN_{42wk}, respectively.*

Key words: *Productive performance, Norfa chickens, economic traits.*

INTRODUCTION

Indigenous chicken is a valuable genetic resource and inseparable part of livestock production system in Egypt. It is very potential for it's adaptability to local environment, high resistance to diseases and it's coping ability to low input rearing system. Moreover, Egyptian consumers prefer the taste and flavor of native chickens and eggs. Local chickens, therefore, play vital role in household food supply/income. It was be advisable to combine these advantages of native breeds with the high performance of the exotic breeds. This was the aim of t he NORFA project which was initiated jointly between Norway and Minoufiya University in 1980. In NORFA project two selected strains of Single Comb White Leghorn (i.e. L_2 and L_7) were imported from Norway to Egypt and crossed with Fayoumi (F) and Baladi (B) breeds in a trial to develop Norfa strain "Norwegian Fayoumi". Abdou (1996) illustrated the breeding plans and steps of developing Norfa chickens.

Since 1980 till 2015 many researchers worked on Norfa strain to evaluate the adaptability, performance of parental pure breeds and their crosses, egg quality characteristics, hatchability in the Native-Egyptian hatchery, effect of different management and environmental conditions, direct selection for general immune response and its relation to some economic

traits and finally productivity under local Egyptian conditions. Furthermore, different selection indices (i.e. general, reduced, restricted, multi-source and two-stage indices) were applied (Enab, 1991, Ben Naser, 2007, Abou Elewa, 2010) in Norfa strain using different economic traits. In general, the results of the previous experiments were promising.

The main purpose of the present study is to estimate the means of some economic traits in Norfa chickens.

MATERIALS AND METHODS

The current experiment had been carried out at the Poultry Farm of the Faculty of Agriculture, Minofiya University, Shebin El-Kom, Egypt in the period of 2012 to 2014 for two generations to investigate the productive performance of Norfa strain as an indigenous Egyptian laying strain.

A total of 528 birds (396 females + 132 males) of Norfa chicken were used. Artificial insemination was used as a mating system with sexual ratio 1 male / 3 females, and relatives mating was avoided. At hatching, all chicks were wing banded and pedigreed. Chicks were fed a starter diet containing 18.05% crude protein (CP) till 8th week of age and from 9th to 16th week of age chickens were fed a growing diet containing 14.01% CP then, pullets were fed at production period a layer ration with 17.46% CP (Table 1).

Cockerels were separated from pullets in the brooding house at the 8th week of age and at 14th week cockerels moved to individual cages in cocks' house while pullets were moved to individual cages in laying house at 16th week of age. A "step down-step up" lighting program was used during brooding, rearing and production periods.

Table (1): The compositions and calculated analysis of the experimental diets.

Ingredients	Ration according to age		
	Starter (0-8 wk)	Grower (9-16 wk)	Layer (17-42wk)
Ground yellow corn	54.91	51.58	58.54
Soybean meal	23.37	8.13	26.88
Wheat bran	18.65	37.46	4.25
Bone meal	2.08	1.6	1.16
Limestone	0.45	0.63	8.46
Vit & Min Mix*	0.25	0.25	0.30
Methionine	0.04		0.10
Sodium chloride	0.25	0.35	0.31
Calculated nutrient content			
Crude protein %	18.05	14.01	17.46
ME Kcal/kg	2605	2401	2699
C/P ratio	144	171	154
Lysine %	0.88	0.58	0.93
M+Cys %	0.62	0.48	0.66
Calcium %	0.9	0.8	3.67
Available phosphorous %	0.4	0.33	0.29
Crude fiber %	4.62	5.51	3.62

*Each Kg Vit. and min. premix contained V . A 12000.000 IU, V. D3 220000 U, VE 10000 Mg. V. K3 2000 Mg, V BI 1000 Mg, v B2 5000 Mg V. B6 1500 Mg 12 10 mg, Niacin 30000 Mg, Biotion 50 Mg Folic acid 1000 Mg Ca. D. Pantothenic 1000 Mg, Zinc 50000 Mg Manganese 6000 Mg Iron 3000 Mg, Copper 4000 mg, Iodine 1000 Mg Selenium 100 Mg, Cobalt 100 Mg, Carrier (Ca Co_3) up to 3 K

Age at sexual maturity (ASM), body weight at sexual maturity (BW_{SM}), body weight at maturity (BW_M), egg weight at sexual maturity (EW_{SM}), egg weight at maturity (EW_M), egg number in the first 90 days of laying (EN_{90d}) and egg number till 42 weeks of age (EN_{42WK}) were individually recorded for each laying hen.

Data were analyzed using IBM Corp. Released (2012). IBM SPSS Statistics for Windows to determine the mean and standard deviation to each trait.

RESULTS AND DISCUSSION

1- Means of studied traits:

Data in Table (2) represent means ± S.D. of the traits studied of first and second generations. It was planned to multiply the number of the first generation by random mating. The aim of this step was to multiply the number of the flock and to get a wide genetic variations as a pre-step to construct some selection indices. Some features can be detect from data of the first generation. Generally, the performance of this generation was low.

Comparing the data of Norfa layers cited in the literature in the first generation had late ASM (193.15 d), reasonable egg weights (37.99 and 46.11 g for EW_{SM} and EW_M, respectively) and low egg numbers (28.34 and 33.48 eggs for EN_{90d} and EN_{42wk}, respectively) with light body weights (979.70 and 1078.42 g for BW_{SM} and BW_M, respectively). This low performance was due to some shortage in the ration ingredients due to low finance.

Data in Table (2) represent the means ± S.D. for studied traits of the current experiment (i.e. ASM, BW_{SM}, BW_M, EW_{SM}, EW_M, EN_{90d} and EN_{42wk}).

1.1. Age at sexual maturity (ASM):

The results in Table (2) shows that, the overall average of ASM of Norfa females which was 179.30 ± 15.58 d. Comparing with the previous studies on Norfa strain we can conclude that, as a general, ASM ranged between 134.1 days (Enab *et al.,* 1992b) and 228.0 days (Sherif 1991). This wide difference may be due to the different management procedures and breeding systems (whereas some of these flocks were selected for egg production either or body weight, and some other flocks were used as a control lines in different selection experiments).

Table (2): Least–Squares means ± S.D. of egg production traits in 1st and 2nd generations

Trait, unit	Means ± S.D.	
	First generation	Second generation
ASM, days	193.15± 29.90	179.30 ±15.58
BW_{SM}, g	979.70 ± 103.33	919.25 ±123.42
BW_M, g	1078.42 ± 132.47	1073.71 ±121.69
EW_{SM}, g	37.99 ± 2.81	32.00 ±3.26
EW_M, g	46.11 ± 4.98	45.62 ±4.24
EN_{90d}, egg	28.34 ± 9.09	39.00 ±6.12
EN_{42WK}, egg	33.48 ± 11.98	48.02 ±10.05

ASM = age at sexual maturity; BW_{SM} = body weight at sexual maturity; BW_M = body weight at maturity; EW_{SM} = egg weight at sexual maturity; EW_M = egg weight at maturity; EN_{90d} = egg number at first 90 day of egg production after sexual maturity; EN_{42wk} = egg number until 42 weeks of age.

1.2. Body weight at sexual maturity (BW_{SM}):

Results reported that, BW_{SM} was 919.25 ± 123.42 g in studied Norfa females (Table 2). Comparing with the previous works on the same strain (Norfa), the average of this trait are in harmony with those found by Abou El-Ghar (1994), Nawar (1995) and Abou-Elewa (2010) with average of BW_{SM} ranged between 986.4 to 1024 g. Slightly higher values were recorded (1051 – 1080.7 g) by some researchers for different constructed light body weight lines (El-Wardany 1987, El-Wardany *et al.* 1992, Enab *et al.* 2000, Ben Naser 2007 and El-Weshahy 2010). In addition, higher values of body weight at sexual maturity were obtained with average ranged from 1114 to 1496.7 g (Enab 1991, Shebl *et al.* 1991, El-Wardany *et al.* 1992, Enab *et al.* 1992a, Sherif *et al.* 1993, Abou El-Ghar 1994, Zatter 1994, Enab 1996, Gomaa 1997, Harfoush 1997, Abdou *et al.* 1998, El-Sakka 1999, Enab *et al.* 2000, Abou El-Ghar *et al.* 2003, El-Hadad 2003, Abou-Elewa 2004, Ben Naser 2007 and El-Weshahy 2010). Regarding the reviewed literature, we didn't find any lower values of BW_{SM} in Norfa females than these showed in our research. The low BW_{SM} results in the present study comparing with the reviewed literature may be due to the low performance of the birds used (first generation) for reproduce the current birds, also, may be correlated with some constraints during the management period (i.e. environmental and health challenges faced by the studied flock).

On the other hand, results concluded by other investigators on some other local strains showed that, BW_{SM} ranged in average between 1008.3 - 1462.5 g for Sinai fowl (Soltan 1991, Soltan *et al.* 2009 and El-Gazar 2012) and ranged between 1048.4 – 1203.0 g for Fayoumi hens (El-Wardany 1987, Enab 1991, El-Wardany *et al.* 1992, Sherif *et al.* 1993 and Zatter 1994) in the reviewed literature.

1.3. Body weight at maturity (BW_M):

Results showed in Table (2) indicated that, the average of BW_M recorded in the studied flock of Norfa layers equal to 1073.71 ± 121.69 g for second generation number two. The current results are close to those reported by some previous works on the same strain (Norfa), especially, for light body weight lines and selected lines for egg number (El-Wardany 1987, El-Wardany *et al.* 1992, Abou El-Ghar 1994 and El-Salamony 1996) with average of BW_M ranged between 1007.8 to 1096.0 g. Slightly higher values were recorded (1117.8 – 1192 g) by some researchers for different types of Norfa lines (Enab 1991, Enab *et al.* 1992a, Enab *et al.* 1992b, Ben Naser 2007, Abou-Elewa 2010 and El-Weshahy 2010). In addition, higher values of body weight at maturity were obtained with average ranged from 1204.0 to 1549.0 g (Sherif 1991, Abdou and Enab 1994, Abou El-Ghar 1994, Nawar 1995, Abdou 1996, El-Salamony 1996, Harfoush 1997, El-Sakka 1999, Enab *et al.* 2000, Enab 2001, Abou El-Ghar 2003, El-Hadad 2003, Abou-Elewa 2004, Abou El-Ghar and Abdou 2004, Ben Naser 2007 and El-Weshahy 2010). Regarding the reviewed literature, we didn't find any lower values of BW_M in Norfa females than these reported in our research. The low BW_M results in the present study comparing with the reviewed literature may be due to the low performance of the birds used (first generation) for reproduce the current birds, also, may be correlated with some constraints during the management period (i.e. environmental and health challenges faced by the studied flock). Ben Naser (2007) also reported poor performance in Norfa layers due to shortage of feed resources.

Furthermore, results found by other scientific reports on some other local strains showed that, BW_M ranged in average between 1371.78 - 1400 g for Sinai fowl (Soltan *et al.* 1985 and El-Gazar 2012), and ranged between 1147.0 – 1217.9 g for Fayoumi hens (El-Wardany 1987, Enab 1991, El-Wardany *et al.* 1992 and Enab *et al.* 1992a) in the reviewed papers.

1.4. Egg weight at sexual maturity (EW_{SM}):

The mean of EW_{SM} was 32.0 ± 3.26 g in the current experiment as shown in Table (2)

Comparing with early studies conducted on Norfa strain, the value obtained by the present study was the lowest one. Some investigators reported different estimates of the EW_{SM} average ranged from 32.7 to 44.2 g (Enab 1991, Sherif 1991, Abou El-Ghar 1994, Nawar 1995, El-Salamony 1996, Enab 1996, Gomaa 1997, Harfoush 1997, El-Sakka 1999, Abou El-Ghar 2003, El-Hadad 2003, Abou El-Ghar and Abdou 2004, Ben Naser 2007, Abou-Elewa 2010 and El-Weshahy 2010). The low EW_{SM} value in the current experiment should be correlated to the low BW_{SM} recorded, since it has been reported that, EW_{SM} positively correlated with body weight at sexual maturity.

1.5. Egg weight at maturity (EW_M):

Egg weight is considered as an important trait in laying hens. Average of EW_M in the current research shown in Table (2) for Norfa hens, it was 45.62 ± 4.24 g. The same trend was indicated by some previous studies with mean values partially closed to these estimates of this trait in Norfa layers ranged between 44.2 – 46.4 g (Enab *el al.* 1992b, El-Salamony 1996, Gomaa 1997, Abdou *et al.* 1998, Enab *et al.* 2000, Ben Naser 2007 and Abou-Elewa 2010). According to reviewed scientific work on Norfa, the lowest mean values of EW_M were recorded by El-Sakka (1999) during the first generation of his work (38.9 and 39.1 for selected and control lines, respectively). Moreover, some lower values than current study were found by Enab (1991), Sherif (1991), Abou El-Ghar (1994) and Abdou (1996). In the opposite trend, higher means of EW_M than those estimated in the current study were indicated by some early investigators and ranged from 47.2 to 55.4 g (Nawar 1995, Harfoush 1997, El-Sakka 1999 for the second generation, Enab 2001, Abou El-Ghar 2003, El-Hadad 2003 and Abou-Elewa 2004).

This wide range of variation in egg weight at maturity in Norfa layers could be returned to the different breeding plans that birds subjected to (i.e. different selection objectives, selection for egg number, egg weight, heavy body weight, light body weight ….. etc.), additionally, environment plays an important role affecting this trait plus the interaction between the genotype and environment.

1.6. Egg number in the first 90 days of laying (EN_{90d}):

Egg number is the most important economic trait in addition to body and egg weight in layers flocks. Results in Table (2) show that, the average of egg production during the first 90 days after onset was 39.0 ± 6.12 eggs. current results are completely agreed with those obtained by Enab *et al.* (2000), who reported that, during the 1st generation of selection, two selected lines of Norfa strain (i.e. egg number and egg weight) laid 39.0 and 38.0 eggs at the first 90 days. Slightly lower estimates than the current research early recorded by Ben Naser (2007) in Norfa pullets selected for heavy body weights after two generations of selection (38.63 eggs) also comparing with control line (36.9 eggs). Lower values (in the range of 27.5 – 36.9 eggs) than current results were indicated by Abou El-Ghar (1994) during 2nd generation of his experiment, and by Abou-Elewa (2010) after one generation of selection for immune response in Norfa layers (36.2 and 36.9 for selected and control lines resp.).

On the other side, higher estimates than current values of EN_{90d} were proposed by many investigators, and the averages of their means ranged between 40.1 – 70.6 eggs (El-Wardany 1987, Enab 1991, Shebl *et al.* 1991, Enab *et al.* 1992c, El-Salamony 1996, Enab 1996, Harfoush 1997, El-Sakka 1999, Enab *et al.* 2000, El-Hadad 2003, Abou El-Ghar and Abdou 2004). Continuously, selected line for light body weights after two generations recorded 42.1 eggs during the first 90 days of laying (Ben Naser 2007). Abou-Elewa (2010) showed that the overall average of (EN_{90d}) in the base population in Norfa layers was 59.65 eggs. Finally, El-Weshahy, (2010) found that, the averages of EN_{90} were 70.6, 49.4 and 50.8 eggs in three lines (EN, BW and control) in the third generation after using independent culling levels method of

selection for improving Norfa hens for egg production traits.

This wide range of variation in egg production at first 90 days of laying in Norfa layers could be returned to the different breeding plans that birds subjected to (i.e. different selection objectives, selection for egg number, egg weight, heavy body weight, light body weight ….. etc.), additionally, environment plays an important role affecting this trait plus the interaction between the genotype and environment.

1.7. Egg number at 42-wk of age (EN42wk):

Egg number till maturity or annual egg number is a function of cumulative effects of many other economic traits in laying chickens. Data in Table (2) represent the averages of the studied traits, EN_{42wk} in the current search found to be equal to 48.02 ± 10.5 eggs. The mean values of this trait were indicated by many researchers at literature reviewed, from these experiments, it is clear that, current results are partially in harmony with those previously estimated by Abou-Elewa 2004 (54.16 eggs) in Norfa layers.

Higher values than those represented in current research were reported by some workers for EN_{42wk} and ranged between 57.0 and 110.9 eggs (Enab 1991, Enab *et al.* 1992b, Abdou and Enab 1994, Harfoush 1997, El-Sakka 1999, Enab *et al* 2000, El-Hadad 2003, Ben Naser 2007, Abou-Elewa 2010 and El-Weshahy, 2010). In Addition, no lower values than those found in the current research were found in reviewed literature.

It can be concluded that, current estimates are the lowest values of this trait according to studied literature. This may be due to the late sexual maturity and small value of EN_{90d} egg production and the effect of some environmental factors. Norfa pullets were exposed to a stress condition during 1st generation, whereas due to shortage of financing these pullets exposed to a partial shortage in feed quantity. Therefore, the Pullets of Norfa strain in these study could not express their real total genetic potential and that cause the obvious decreasing of the averages of most egg production traits during this generation. In the second generation this shortage was avoided.

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دراسات على بعض الصفات الإنتاجية فى دجاج النورفا

أحمد عبد الوهاب عنب ، محمد السيد سلطان ، فاروق حسن عبده و هند النعمانى النعمانى

قسم إنتاج الدواجن – كلية الزراعة – جامعة المنوفية

الملخص العربى

التجربة الحالية أجريت فى مزرعة أبحاث الدواجن بكلية الزراعة جامعة المنوفية بشبين الكوم فى الفترة من ٢٠١٢ حتى ٢٠١٤ ولمدة جيلين بهدف دراسة الأدآء الإنتاجى لدجاج النورفا كسلالة مصرية محلية لإنتاج البيض. استخدم فى الدراسة عدد ٥٢٨ طائر (٣٩٦ أنثى + ١٣٢ ذكر) ، وتم استخدام التلقيح الصناعى فى التزاوج بنسبة جنسية ١ ذكر : ٣ إناث مع تجنب تزاوج الأقارب. عند الفقس تم ترقيم الكتاكيت وتنسيبها . غذيت الكتاكيت على عليقة بادئة تحتوى ١٨,٠٥ % بروتين خام حتى عمر ٨ أسابيع ، ثم على عليقة نامى (١٤,٠١ % بروتين خام) من الأسبوع التاسع وحتى الأسبوع السادس عشر ، وبعد ذلك غذيت البدارى فى فترة الإنتاج على عليقة ناهى تحتوى على ١٧,٤٦ % بروتين خام . تم فصل الذكور عن الإناث عند عمر ٨ أسابيع فى عنبر الحضانة الإناث نقلت فى عمر ١٦ أسبوع إلى عنابر الدجاج البياض . استخدم برنامج الإضاءة step down–step up خلال فترات حضانة ورعاية وإنتاج الطيور .

تم تسجيل صفات العمر عند البلوغ الجنسى ، وزن الجسم عند البلوغ الجنسى ، وزن الجسم الناضج ، وزن البيضة عند البلوغ الجنسى ، وزن البيضة عند النضج الجسمى ، إنتاج البيض خلال الـ ٩٠ يوم الأولى من الإنتاج وإنتاج البيض حتى عمر ٤٢ أسبوع فى سجلات فردية لكل دجاجة .

وكانت أهم النتائج المتحصل عليها تتلخص فيما يلى :

1- الجيل الأول : كان العمر عند البلوغ الجنسى متأخر (١٩٣,١٥ يوم) ، وكانت متوسطات أوزان البيض المدروسة جيدة (٣٧,٩٩ و ٤٦,١١ جم عند البلوغ الجنسى وعند النضج الجسمى على الترتيب) . كان متوسط إنتاج البيض منخفض (٢٨,٣٤ بيضة فى الـ ٩٠ يوم الاولى من الإنتاج و ٣٣,٤٨ بيضة حتى عمر ٤٢ أسبوع) . كانت أوزان الدجاجات خفيفة بمتوسط ٩٧٩,٧٠ جم عند النضج الجنسى ومتوسط ١٠٧٨,٤٢ جم عند النضج الجسمى .

2- فى الجيل الثانى : كان متوسط العمر عند البلوغ الجنسى ١٧٩,٣٠ يوم ، ومتوسط الوزن عند البلوغ الجنسى يعادل ٩١٩,٢٥ جم ، بينما كان متوسط الوزن عند النضج الجسمى يعادل ١٠٧٣,٧١ جم . متوسط وزن البيضة عند البلوغ الجنسى كان ٣٢,٠ جم وارتفعت هذه القيمة إلى ٤٥,٦٢ جم عند النضج الجسمى الكامل . كانت متوسطات إنتاج البيض خلال الـ ٩٠ يوم الأولى من الإنتاج وحتى ٤٢ أسبوع من العمر تساوى ٣٩,٠ بيضة و ٤٨,٠٢ بيضة على الترتيب .