ISSN 1682-8356
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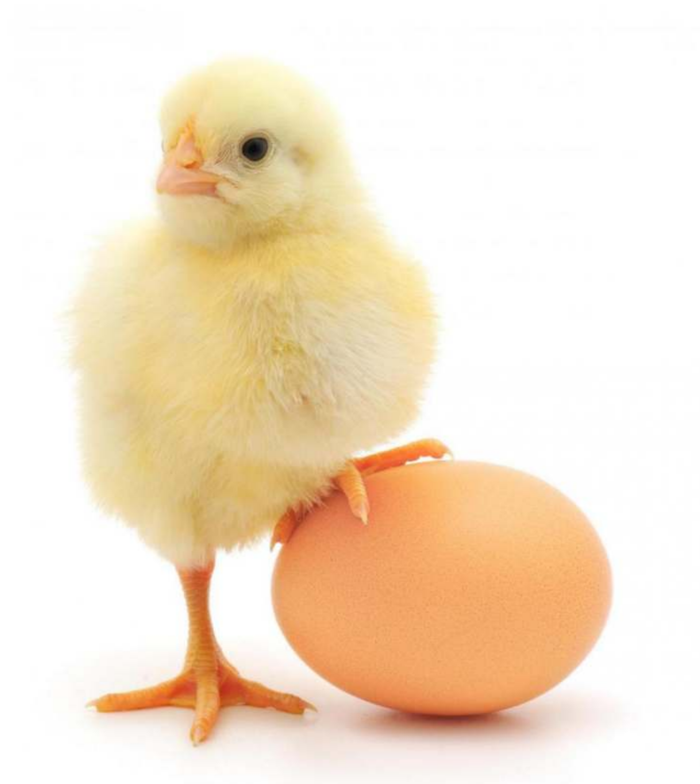

INTERNATIONAL JOURNAL OF POULTRY SCIENCE

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International Journal of Poultry Science 10 (3): 221-224, 2011
ISSN 1682-8356

Growth and Short Term Egg Production of Two Exotic (Layer Type) and the Local Chickens Compared with Their F_1 Inbred Progenies

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Abstract: The objective of this study was to compare the growth and short term egg production of two exotic and the local chicken with those of their F_1 inbred progenies in order to determine the effect of one generation of full sib mating on these traits. The two exotic chickens were H and N Brown Nick (strain 1) and Black Olympia (strain 2) while the local chicken was strain 3. The experimental birds were raised in deep litter pens from day old to 40 weeks of age. The coefficient of inbreeding of the three strains were as follows: strain 1 (10.80%), strain 2 (9.00%) and strain 3 (11.80%). Body weight, weight gain, age at first egg, age at peak egg production, egg weight, hen day rate and feed per dozen eggs were significantly ($p<0.01$) depressed in the two exotic (strains 1 and 2) but not in the local chicken except age at peak egg production. The parent consumed significantly ($p<0.01$) more feed to first egg compared with the inbred progeny of strain 1. The reverse was the case in strain 2. Total feed to first egg was similar in both generations of strain 3. The inbred progeny generation of the two exotic strains recorded more mortality compared with the parents. Both generations of strain 3 did not record any mortality during the laying period. It was concluded that generating replacement stock through inbreeding should be avoided in the exotic chicken but not in the local type.

Key words: Body weight, egg production, exotic chicken, inbreeding depression, local chicken, weight gain

INTRODUCTION

Inbreeding is the mating of genetically related individuals (Falconer and Mackey, 1996). It is used by breeders for the production of genetically uniform strains of chicken and for the development of inbred lines for subsequent crossing to utilize heterosis (Ibe *et al.*, 1983). As observed by Falconer and Mackey (1996), inbreeding can increase the difference between the lines and as such increase heterosis. Experimental evidences have shown that inbreeding has detrimental effects on economic traits in poultry leading to decline in growth rate, egg production, fertility and hatchability (El-Fiky *et al.*, 1996; Sharma *et al.*, 1996; Brah *et al.*, 1997; Kutter and Nitter, 1997). Szwacczkowski *et al.* (2004) reported slight inbreeding depression for body weight, egg weight, weight at first egg and percentage of fertile eggs when applying quadratic partial regression analysis. Although, it is an established fact that inbreeding results in reduction in fitness traits in farm animals, a phenomenon known as inbreeding depression, the magnitude of the decrease varies with the degree of heterozygosity among parental strains (Ayyagari *et al.*, 1982). In other words, different strains of chicken respond differently to the same level of inbreeding depending on their heterozygosity. At the rural and urban areas in Nigeria, small scale poultry producers use mild inbreeding to generate their replacement stocks. Most of these farmers do not keep records and may not know the consequences of mild inbreeding on the performance of their birds. The local chicken mate indiscrimately among themselves in the scavenging system. The objective of this study was to compare the performance of F_1 inbred progenies with the parents of the local and two exotic (layer type) chickens in order to determine the effect of one generation of fullsib mating on growth and egg production.

MATERIALS AND METHODS

The experimental birds comprised two exotic layer strains namely H and N Brown Nick (strain 1), Black Olympia (strain 2) and the local chicks (strain 3). The number of birds used were 150 pullets and 15 cockerels for each exotic strain and 150 unsexed local chicks. The birds were established at day old and raised on deep litter pens to 40 weeks of age at the Poultry Breeding and Research Unit, Department of Animals science, Enugu State University of Science and Technology, Enugu. At three weeks of age four lines were established from the exotic strains based on plumage colour and body weight while two lines were created from the local chicken based on body weight only. The H and N Brown Nick pullets were separated into Light Brown (LB) and Dark Brown (DB) in colour while Black Olympia pullets were divided into Pure Black (PBL) and Golden Black (GB) colours. Individuals within the four groups were further separated on the basis of body weight into Light Body Weight (LBW) and High Body

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Weight (HBW). Within a group, individual bird weighing 150 g and less were classified as LBW while those weighing more than 170 g were classified as HBW. Individuals weighing 151-169 g were not used because they were very few. Within the local strain, individual bird weighing 70 g or less were separated as LBW while those weighing more than 70 g were categorized as HBW. At 28 weeks of age, two cocks were used in mating 20 hens from each line. Fertile eggs were collected, numbered according to line and hatched in a locally fabricated hand turner incubator with a capacity of 250 eggs. Four of such incubators were used at a time. F_1 inbred chicks were produced and raised as the parents. Bodyweight and egg production data from the parents were compared with those of the F_1 inbred progenies using t test (Steel and Torrie, 1980). The coefficient of inbreeding for each strain was calculated using the following formula by Gavora *et al.* (1979):

$$Fx = \tfrac{1}{2}\left(\frac{1}{N_m A_m} + \frac{1}{N_f A_f}\right)$$

Where:

Fx = Coefficient of inbreeding
N_m = Number of males in each breeding group
N_f = Number of females in each breeding group
A_m = Age of male when they were used for mating
A_f = Age of female when they wee mated

RESULTS AND DISCUSSION

The coefficient of inbreeding which is used as an indicator of the degree of inbreeding in the inbred strains are presented in Table 1. The local chicken (strain 3) had the highest inbreeding coefficient of 11.80%. This was closely followed by strain 1 (10.50%). Strain 2 recorded the lowest value of 9.00%. The higher coefficient of inbreeding obtained in strain 3 compared with the others may indicate that the local chickens were more homozygous than the two exotic strains. Table 2 presents the within strain comparison in body weight and weight gain between the parents and the inbred progeny generations of the three strains. The two exotic parents (strains 1 and 2) were superior to their respective inbred progenies in body weight and weight gain at 4, 12 and 20 weeks of age. This was not so in the local chicken (strain 3) where the two generations were similar in body weight and weight gain at 4, 12 and 20 weeks of age respectively. The apparent inferiority of the inbred progenies compared with the parents of the two exotic strains in body weight and weight gain could be attributed to inbreeding depression which is known to affect fitness characters (Keller and Walter, 2002). Table 3 compares the parents and inbred progeny generations of the three strains in short term egg production traits. The inbred progeny generations of strains 1 and 2 came to lay about 10 days and 31 days later than their respective parents. This delay might have been caused by the retardation of the process of growth following inbreeding. The retardation delayed the attainment of the required body size necessary for laying. The two generations of strain 3 came to lay almost the same time (about 155 days). Total feed to first egg (g/bird) was higher in the parents than the inbred progenies of strain 1 with a difference of 1402.40 g which was highly significant ($p<0.01$). This may be associated with the higher metabolic size of the parent which called for more feed intake for maintenance purpose (Brenoe, 1996). The reverse was the case in stain 2 where the inbred progenies consumed significantly ($p<0.01$) more feed then the parents with a difference of 1727.61 g of feed to first egg. This is in agreement with the opinion of (Falconer and Mackey, 1996) and (Wiener, 1994) that inbreeding may enhance characters such as feed intake which are not directly connected with the fitness of the animal. It may also be attributed to other management problems at this period such as non uniformity in the time of feeding or high environmental temperature which were not in favour of the parent strains (Bougon *et al.*, 1998). In strain 3, there was no significant ($p<0.05$) difference between the two generations in the quantity of feed consumed to first egg. The overall cost to 20 weeks showed that it was cheaper to raise the inbred progeny strains than the parents. The difference was due to the initial cost of purchasing the day old parent chicks. The parent strains reached peak egg production earlier than their inbred progenies (Table 3). This was more pronounced in strain 1 where the parents reached peak egg production about 64 days earlier than the progeny strain. The weight of first egg and the weight of egg at 40 weeks were significantly ($p<0.01$) heavier in the parents compared with the inbred progeny generation of strain 1 with a difference of 3.71 g ad 4.88 g respectively. In strain 2, whereas the inbred progenies were significantly ($p<0.01$) heavier than the parents for weight of first egg with a difference of 7.20 g, the trend was reversed for egg weight at 40 weeks with a difference of 4.04 g. This trend may be attributed to the late maturing of the progeny strain which came to lay about 31 days later than the parent. The delayed onset of lay had positive effect on weight of first egg (Adenowo *et al.*, 1995). The hen day rate of lay was significantly ($p<0.01$) higher in the parents than the inbred progenies of strains 1 and 2. This may also be attributed to inbreeding depression. Previous studies have shown that inbreeding depression was higher in egg number compared with other egg production traits (Foster and Kilpatrick, 1987; Ablanalp 1990). The parents were more efficient in feed utilization compared with the inbred progenies of strains 1 and 2. This could be attributed to the lower body size and poor egg production of the inbred progenies. The two generations of the local

Table 1: Within line and between strain data on the coefficients of inbreeding for three parents strains

Strains	Lines	No. of females	No. of males	Fx	Strain mean
1	LB (HBW)	15	3	0.086	
	LB (LBW)	16	3	0.085	
	DB (HBW)	12	2	0.125	
	DB (LBW)	14	2	0.123	0.105±0.01
2	PBL (HBW)	16	3	0.085	
	PBL (LBW)	15	3	0.086	
	GB (HBW)	18	4	0.066	
	GB (LBW	13	2	0.124	0.09±0.01
3	LC (HBW)	24	5	0.107	
	LC (LBW)	20	4	0.129	0.11±0.01

Fx = Coefficient of inbreeding, LB = Light Brown, DB = Dark Brown, PBL = Pure Black, GB = Golden Black, LC = Local Chicken, HBW = High Body Weight, LBW = Light Body Weight

Table 2: Within strain comparison in body weight and weight gain between parent (P0) and inbred progeny (P1) generations of two exotic (strains 1 and 2) and the local chicken (strain 3) from 4-20 weeks of age

	Strain 1			Strain 2			Strain 3		
Body weight (g)	P0	P1	P0-P1	P0	P1	P0-P1	P0	P1	P0-P1
Week 4	211.58^b	173.05^a	38.53**	250.54^b	177.29^a	73.25**	126.14^a	125.51^a	0.79^{NS}
	(5.24)	(2.49)		(4.88)	(2.83)		(2.35)	(1.35)	
Week 12	959.04^b	656.82^a	302.22**	1059.28^b	722.85^a	336.43**	449.07^a	435.94^a	13.13^{NS}
	(10.49)	(11.95)		(7.84)	(10.47)		(16.56)	(4.03)	
Week 20	1451.54^b	1185.54^b	266.42**	1568.74^b	1333.45^a	235.29**	771.11^a	765.94^a	5.17^{NS}
	(10.34)	(10.34)		(16.00)	(24.79)		(19.88)	(8.94)	
Weight gain (g)	747.46^b	483.77^a	263.69**	808.74^b	545.56^a	263.18**	322.93^a	310.43^a	12.50^{NS}
4-12 weeks	(4.25)	(2.65)		(3.30)	(2.24)		(3.35)	(2.32)	
12-20 weeks	492.50^a	528.30^b	-35.80**	509.46^b	610.60^a	-101.14**	322.04^a	330.00^a	-7.96^{NS}
	(3.15)	(4.32)		(3.66)	(6.04)		(5.20)	(2.24)	

For all row figures within each stain a<b (p<0.01). NS = Not Significant (p>0.05), Standard errors are in parenthesis

Table 3: Comparative mean values for short term egg production traits of the two exotic (strain 1 and 2) and the local chicken (strain 3) parents (P0) and their inbred progenies (P1)

	Strain 1			Strain 2			Strain 3		
Traits	P0	P1	P0-P1	P0	P1	P0-P1	P0	P1	P0-P1
Age at first egg (days)	166.48^a	177.03^b	-10.55**	153.93^a	184.79^b	-30.86**	154.00^a	155.35^a	-1.35^{NS}
	(2.56)	(2.18)		(3.10)	(2.70)		(0.43)	(0.42)	
Age at peak egg production (days)	196.00^a	260.25^b	-64.25**	207.00^b	241.67^b	-34.67**	226.00^a	258.00^b	-32.00**
	(4.72)	(9.22)		(6.27)	(4.37)		(4.50)	(2.25)	
Total feed to first egg (g/bird)	12230.66^b	10828.26^a	1402.40*	10315.40^a	12043.01^b	-1727.61**	7566.88^a	7557.89^a	8.99^{NS}
	(41.15)	(53.03)		(55.50)	(45.47)		(21.59)	(25.84)	
+Overall cost to 20 weeks (N/bird)	831.00	720.00	111.00	774.77	755.82	18.95	625.56	593.66	30.00
Weight of first egg (g)	49.41^b	45.70^a	3.71**	41.76^a	48.96^b	-7.20**	33.98^a	34.19^a	-0.21^{NS}
	(0.70)	(1.00)		(0.81)	(0.80)		(0.24)	(0.36)	
Egg weight at 40 weeks (g)	59.81^b	54.93^a	4.88**	58.26^b	54.22^a	4.04**	41.34^a	40.51^a	0.83^{NS}
	(0.46)	(1.07)		(0.52)	(0.68)		(0.67)	(0.63)	
Hen day rate (%)	66.83^b	32.48^a	34.35**	62.82^b	36.19^a	26.63**	26.47^a	28.16^a	-1.69^{NS}
	(2.57)	(1.92)		(2.03)	(2.40)		(2.01)	(1.43)	
Feed per dozen eggs	3.23^a	5.90^b	-2.67**	2.81^a	6.53^b	-3.71**	6.66^a	5.26^a	1.40^{NS}
	(0.26)	(0.41)		(0.10)	(0.45)		(0.50)	(0.35)	
+Laying mortality (%)	0	3.59	-3.59	1.32	1.59	-0.27	0	0	0

+Data not tested statistically. For all row figures within each stain a<b (p<0.01). NS = Not Significant (p>0.05), Standard errors are in parenthesis

chickens(strain 3) were similar in hen day rate, egg weight as well as feed per dozen eggs indicating that the genes responsible for egg production traits have become homozygous in them. This homozygosity must have been fixed by many generations of like mating by the local chicken in the extensive system. In line with increased mortality with inbreeding reported by Ibe *et al.* (1983), the inbred progenies recorded more mortality than the parents of strains 1 and 2. Both generations of strain 3 did not record any mortality during the laying period.

Conclusion and Recommendations: The present study supports the general conclusion reached by earlier researchers that mild inbreeding retards growth and egg production in the chicken. Therefore full sib mating should be avoided by poultry farmers unless it is intended to generate inbred lines for crossbreeding purposes. However, one generation of full sib mating can be done in the local chicken without much deleterious effect on egg production.

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