PERFORMANCES OF THE INDIGENOUS CHICKENS OF NIGERIA AND THE APOLLO 1. EGG WEIGHT, RATE OF PRODUCTION AND FACTORS AFFECTING THEM

By

Akinokun Osu and Dettmers Almut[1],
Department of Animal Science,
University of Ife, Ile-Ife, Nigeria.

SUMMARY

Data on the Ife Breed of the indigenous chicken and the Apollo, an imported commercial egg strain were analysed for effect of breed, time and generation of hatch, body weight at various ages, and age at sexual maturity on egg weight and rate of egg production to eight months. There were highly significant generation and breed differences, with a mean of 116 eggs for the Ife Breed compared to 106 for the Apollo over two generations. Other factors that significantly affected egg production were body weight and age at sexual maturity, and mature egg weight. Mean pullet year egg weight showed breed and hatch differences and were significantly affected by body weight and age at sexual maturity. Mean egg weight for the Ife Breed was 32.3 compared to 48.7 for the Apollo.

INTRODUCTION

Reports on egg production and egg weight of chickens indicate wide variations between breeds and between strains. Other factors such as time of hatch, climate,

1 of Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

nutrition and disease incidence play highly significant role in total egg production of a breed or strain (Huston et. al. 1959; Hutchinson, 1953; Mueller, 1961 and others). Several reports have been written on egg production of exotic breeds, but few deal with their performance in tropical and sub-tropical areas (Trail, 1963; Hill and Modebe, 1961; Akinokun, 1975). Similarly, there are few published reports on egg production of the indigenous chicken of Nigeria. The following report deals with egg production and egg weight of the Ife Breed of indigenous chicken of Nigeria in comparison with an imported commercial egg strain being selected for improvement under modern management conditions.

MATERIALS AND METHODS

The foundation stock of the indigenous chicken was established from five hatches of fertile eggs collected from villages in South-western Nigeria. Each lot made up of about 500 eggs, was incubated after about five days collection. About 2, 800 eggs were incubated and 1, 300 eggs were hatched. The mean weight of the eggs was 37. 2g and the chicks averaged 26. 5g at day-old. The foundation stock of the Apollo, a commercial hybrid layer was obtained at day-old from Sterlin Poultry products of the United Kingdom.

Chicks were brooded in cages to eight weeks and kept on the floor or grower cages to 18 weeks when they were transferred into laying cages. Chicks were fed *ad libitum*, and given routine innoculations against Newcastle disease, Fowl typhoid and Fowl pox. The components of various types of rations used are shown in Table 1.

Table 1. The Components of Rations Fed to Chicks, Growers and Layers

Ingredients	Percentages or amounts in rations for: Chicks	Growers	Layers
Guinea Corn	60.0	68.0	68.0
Groundnut Cake	24.0	16.0	14.0
Fish Meal	7.0	5.0	5.0
Rice Bran	4.0	4.0	3.0
Stylosanthes	2.0	2.0	4.0
Bone Meal	-	-	-
Dicalcium Phosphate	0.8	2.0	2.5
Advit[1]	1 tin/ton	1 tin/ton	0.5
Salt	0.2	0.5	0.5
Terramycin Crumbles	-	-	0.5
Grit	0.5	0.5	-
Oyster Shell	1.5	2.0	-

1. Advit is a mineral - vitamin - antibiotic supplement which when added at the level indicated supplied the following per kg of feed: 1600 I.U. Vitamin A, 1400 I.U. D_3, 3mg riboflavin, 3 mg pantothenic acid, 8 mg vitamin B_{12}, 10 mg bacitracin, 80 mg manganese, 50 mg zinc, 1.2 mg Iodine, 200 mg Cobalt, 2 mg Copper, 25 mg Iron and 125 mg antioxidant.

Body weights were taken at 4, 12 and 20 weeks. In laying cages, individual egg production was recorded from first egg, and weight of first egg as well as mean egg weight at first, third, fifth and seventh months of production were taken. The foundation stock of both breeds were transferred into the breeder house to produce chicks of the succeeding generation at about four months of egg production, because there was high mortality among the Apollo from point of lay. Thus, the first generation of hens with complete record of production were the second generation of both breeds.

Selection of the second and subsequent generations were based on egg production to 260 days. The index used was a combination of individual hen's egg production and the sire family mean, weighed as follows:

$$I = P + \left\{ \frac{r-t}{1-r} \quad \frac{n}{1 + (n-1)t} \right\} \quad P_f$$

where r is the genetic correlation between members of a family, t is the correlation of phenotypic values between members of families, n is the family size, P represents the individual's egg production and P_f the family mean, Falconer (1960).

Least squares analysis with multiple classifications and regressions (Harvey, 1960) were carried out. Data were analysed for the effect of breed, time of hatch, generation, body weight at 4, 12 and 20 weeks, age at sexual maturity, egg weight at various ages and four month egg production on the dependent variable, egg production to eight months. Similar analysis was carried out on egg production to four months. Another analysis was made to dertermine the effect of breed, time of hatch, weight at various ages, and age at sexual maturity on mean egg weight in the pullet year. The analysis included data on 498 hens that had complete record on all factors and variables, up to eight months in production.

RESULTS AND DISCUSSION

Simple correlations between regression and dependent variables are shown on Table 6.

Breed Effect

There was significant breed effect on egg production to eight months in lay (Table 2). Although the Apollo produced more eggs than the Ife Breed in the first generations, with a difference of 10.5 eggs. There was a smaller significant breed difference of about 2 eggs at 4 months in production. The weight of Apollo eggs was significantly heavier than those of Ife Breed, with a difference of 14g at first egg and 16g at five months in production. The mean egg weights of the two breeds which were 32.3 and 48.7g, showed that the eggs of the Ife Breed of indigenous chicken was about 66 percent of that of the Apollo. The least squares difference (Table 3) in the mean egg weights of the two breeds which was highly significant was 9.4g.

Table 2. Mean Egg Weight and Egg Production of the Apollo and the Indigenous Chickens

Generation	Hatch	Indigenous			Apollo		
		H* B** Mean egg wt.	H* B 4 mths prod.	H* B** 8 mths prod.	H* B** Mean egg wt.	4 mths prod.	H* B** 8 mths prod.
1	1	34.6 ± 1.5	55.8 ±3.2	106.1 ± 7.1	50.1 ± 1.7	58.9 ±3.8	132.8 ± 8.6
	2	33.8 ± 1.8	65.8 ±3.8	110.7 ±8.6	50.1 ±2.0	56.9 ±4.3	115.7 ± 9.8
	3	35.0 ± 1.5	57.9 ±3.2	96.2 ±7.3	48.9 ±1.5	60.5 ±3.2	122.6 ± 7.2
	Mean	34.5 ± 0.9	59.8 ±1.9	104.3 ±4.4	49.7 ±1.0	58.8 ±2.1	123.7 ± 4.8
2	1	30.6 ± 1.3	52.4 ±2.9	101.7 ±6.6	47.1 ±1.2	56.9 ±2.6	96.6 ± 5.8
	2	32.4 ± 1.2	59.6 ±2.5	96.6 ±5.7	50.7 ±1.6	58.5 ±3.4	104.6 ± 7.6
	3	29.9 ± 1.2	70.5 ±2.6	119.6 ±5.8	48.0 ±1.2	59.5 ±2.6	104.8 ± 5.7
	Mean	31.0 ± 0.7	60.8 ±1.5	106.0 ±3.5	48.6 ±0.8	58.3 ±0.6	102.0 ± 3.6

H = Coding for hatch effect

* = Significant at 5 percent

B = Coding for breed effect

** = Significant at 1 percent level of probability.

Egg Production in Indigenous and Apollo 1 Chickens.

Table 3. Least Squares Means and Constants for Egg Production to 4 and 8 months with their Standard Errors

	Egg Production	
	to 4 Months	to 8 Months
L. S. Mean	59.48	110.92
Generation		
First	- 0.76 ± 0.48[a] [1]	4.55 ± 1.2[a]
Second	0.76 ± 0.48[b]	- 4.55 ± 0.9[b]
Breed		
Ife Breed	0.91 ± 0.66[a]	5.28 ± 1.1[a]
Apollo	- 0.91 ± 0.7[b]	- 5.28 ± 0.9[b]
Body Weight at		
4 wks	- 0.01 ± 0.02**	-0.003 ± 0.02
12 wks	0.02 ± 0.01**	0.01 ± 0.01
20 wks	0.002 ± 0.00*	0.004 ± 0.0*
Age sex mat.	0.21 ± 0.03*	0.14 ± 0.04**
Egg Weight		
First egg	0.01 ± 0.00	0.06 ± 0.00
1st Mo.	0.14 ± 0.1	0.11 ± 0.2
3rd Mo.	0.09 ± 0.0	- 0.14 ± 0.00
5th Mo.	- -	0.21 ± 0.17
7th Mo.	- -	- 0.35 ± 0.15**
Egg Prod. to 4 Mo.	- -	1.39 ± 0.06**

1. Constants in the same column within the same subclass with no common superscript are significantly different at 0.05 level of probability.

* Significant at 0.05 ** Significant at 0.01 levels of probability.

Previous reports indicate that exotic breeds of chicken laid more and heavier eggs than the indigenous ones. The average egg production ot eight exotic breeds and crosses in the first eight months of production at Fashola in Nigeria (Akinokun, 1975) was 129, varying from 118 to 136 per hen, compared to an average of 106 eggs hen-housed, in eight months of production for the Apollo. The least squares mean egg production of the Ife Breed was 116 at eight months. This was lower than those observed for exotic breeds at Fashola, but substantially higher than has been reported for the indigenous stock (Hill and Modebe, 1961). Apart from the effect of the local environment, observed low egg production of the Apollo would be accounted for by the fact that the first and second generations in the study were respectively the F_2 and F_3 of a commercial hybrid whose rate of production would be expected to regress considerably compared to the F_1. Also, having been obtained from only one hatch, the Apollo foundation stock used may not be representative of the performance of the hybrid, particularly with respect to the foundation stock.

Generation Effect.

There was a significant difference in egg production between the first and second generation, as shown on Table 2. The difference was about 1.5 eggs at four months and 9.1 eggs at eight months in production. The observed improvement was a reflection of the increase in egg production of the Ife Breed in the second generation. Egg weight showed no generation effect, but there was a significant hatch effect.

Egg Production in Indigenous and Apollo 1 Chickens.

The least squares constants show that the first three hatches corresponding to the first generation did not differ from the last three hatches which correspond to the second generation, but there were significant differences between hatches within each generation.

Estimate of sire component of variance from sib analysis on the first generation early egg production (Table 5) showed that there was some amount of genetic

Table 5. Sib Analysis of Variance on Egg Production of the Apollo and the Indigenous chickens in the First Generation

Source of Variation	Apollo		Indigenous	
	df	ms	df	ms
Sires	20	944.49	19	604.78
Progenies/Sires	341	947.81	303	442.75

variance among the indigenous stock, but little or none among the Apollo. Further information on subsequent generations will be needed to adequately determine the levels of genetic variance and establish a trend in response to selection.

Hatch x Breed Interaction.

There was no significant hatch x breed interaction for egg production when the two generations were taken together (Table 4), but there was significant

Table 4. Analysis of Variance on the Effect of Breed and Time of Hatch on Rate of Egg Production within Generations.

Source of Variation.	First Generation				Second Generation			
	4 Mo.		8 Mo.		4 Mo.		8 Mo.	
	df	ms	df	ms	df	ms	df	ms
Breed	1	6138.2**	1	31095.3**	1	470.0	1	8514.5**
Hatch	2	893.6	2	2154.7	2	1713.4**	2	7670.3**
B x H Interaction	2	7085.4**	2	827.5	2	1727.9**	2	2590.8*
Error	638	698.4	156	1028.6	291	259.0	291	754.6

interaction within generations. This was a form of genotype x environment interaction and suggests that the breeds performed differently in various environmental situations. This indicates that chicken performance could depend substantially on short term environmental variations in terms of weather and management associated with individual hatches.

Effect of body weight and age at sexual maturity.

Body weight of hens at 4, 12 and 20 weeks significantly affected egg production to four months, but only 20-week body weight had significant effect on egg production to eight months. The regression and simple correlation (Table 6) show that the relationship between body weight at 20 weeks and egg production was positive.

Table 6. Simple Correlations Among Regression Variables and the Dependent Variables.

	4 week wt.	12 week wt.	20 week wt.	ASM	wt. 1st egg	Egg wt. 1st Mo.	Egg wt. 3rd Mo.	Egg wt. 5th Mo.	Egg wt. 7th Mo.	Prod. 4 Mo.	Prod. 8 Mo.	Prod. 4-8 Mo.
4 wk. body wt.	1.0											
2 wk. body wt.	0.13	1.0										
20 wk. body wt.	-0.0	0.04	1.0									
A S M.	0.14	-0.02	-0.04	1.0								
Wt. 1st Egg	0.13	0.02	0.18	0.13	1.0							
Egg 1st Mo.	0.12	0.03	0.16	0.11	0.64	1.0						
Egg 3rd Mo.	0.13	0.07	0.15	0.19	0.65	0.69	1.0					
Egg 5th Mo.	0.14	0.05	0.16	0.17	0.62	0.64	0.80	1.0				
Egg 7th Mo.	0.27	0.06	0.13	0.16	0.58	0.55	0.70	0.68	1.0			
Prod. to 4 Mo.	-0.07	0.09	0.00	0.16	-0.01	0.02	-0.05	-0.01	-0.01	1.0		
Prod. to 8 Mo	-0.04	0.08	0.04	0.11	-0.02	0.01	-0.07	-0.09	-0.08	0.72	1.0	
Prod. to 4-8 Mo.	-0.0	0.05	0.05	-0.04	-0.02	-0.01	-0.06	-0.05	-0.03	0.27	0.87	1.0

Since 20-week body weight is several weeks before mature weight is attained, such a relationship would be transient. What happens to early body weight and mature body weight as a correlated response to selection for egg production after many generations will be of interest.

The effect of age at time of sexual maturity was significant for early rate of egg production, and highly significant for rate of egg production to eight months, as well as mean egg weight in the pullet year. Regressions and simple correlation coefficients indicate that hens which matured late produced more and heavier eggs. Body weight at 20 weeks also showed significant positive relationship with mean egg weight.

Early Egg Production.

Egg production in the first four months significantly affected 8-month egg production as well as 4-8 months egg production. This agrees with the report by Saadeh et. al. (1968) of high genetic correlation between early and later rate of lay, and suggests that selection on egg production to 4 months will be effective in improving total pullet year egg production.

REFERENCES

AKINOKUN, OSU (1975). The problem of the improvement of poultry production in Nigeria. Niger. Agric. J. 11: 61-71.

CRAIG, J. V., BISWAS, D. K. and SAADEH, H. K. (1969). Genetic variation and correlated responses in chickens selected for part year rate of egg production. Poultry Sci. 48 : 1288-1296.

DICKERSON, G. E. (1965). Experimental evaluation of selection theory in poultry. Genetics Today Vol. 3.

HILL, D.H. and MODEBE, A. N. A. (1961). Poultry production at the University College, Ibadan, 1950-58. Tech. Bull. No. 2 Faculty of Agriculture.

HUSTON, T. M., JOINER, W. P. and CARMON, J. L. (1957). Breed differences in egg production of domestic fowl held at high environmental temperatures. Poultry Sci. 36 : 1247-1254.

HUTCHINSON, J. C. D. (1953). Effect of hot climate on egg weight. Poultry Sci. 32 : 692.

MODEBE, A. N. A. and HILL, D. H. (1960). Fertility hatchability and egg production of poultry at University College, Ibadan. World's Poultry Sci. J. 16: 47.

MUELLER, W. J. (1961). The effect of constant and fluctuating environmental temperature on the biological performance of the laying hen. Poultry Sci. 40 : 1562.

NORDSKOG, A. W. and FESTING, M. (1962). Selection and correlated responses in the fowl. Twelfth World's Poultry Congress pp. 25-29.

SAADEH, H. K., CRAIG, J. V., SMITH, L. T. and WEARDEN, S. (1968). Effectiveness of alternative breeding systems for increasing rate of egg production in chickens. Poultry Sci. 47 : 1057-1072.

TRAIL, J. C. M. (1963). A comparison between five breeds of commercial poultry in Uganda III. Egg Production Tropical Agric. 40 : 237.