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Nigerian Indigenous vs Exotic Hens: the Correlation Factor in Body Weight and Laying Performance *(Pp. 405-413)*

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Abstract

Genetic interrelationship within and between strains was assessed using pure Nigerian normal feathered local, pure exotic and their crossbred hens for age and body weight at first lay, egg weight and egg internal quality traits. 100 layers comprising 20 Black Nera, 20 White Leghorn, 20 Normal feathered local chicken, 20 White Leghorn x Local cross and 20 Black Nera x Local crosses were randomly selected from a breeding stock of about 500 *chickens. Pearson correlation analysis revealed a positive relationship between age and body weight at first egg in all the pure exotic strains. A low but negative relationship between age at first egg and egg weight was observed in White Leghorn, local and their crosses. The r values were generally low and not significant except in Black Nera (r = 0.515). however, a strong, significant and positive relationship was observed between body weight at first egg and egg weight in the local hen (r = 0.765). These results suggest that selection for increased body weight in the local chicken will result in increase in egg size and egg internal quality traits. These values were relatively higher in the crossbred and pure local chicken compared to their pure exotic counterparts.*

Keywords: Body weight, egg weight, egg quality, traits.

Introduction

The Nigerian indigenous chicken is one of the major sources of protein to the Nigerian people (Ogbonna *et al*., 2002). The importation of exotic breeds because of factors such as fast reproduction cycle, low unit cost, bigger eggs and higher body weight has being at the detriment of the local chicken. It is a fact that the potentials of the local chicken has not been fully exploited since there are still growing reports about existing or potential levels of productivity in the breed managed under extensive system (Mathur *et al.,* 1989). The genetic interrelationships between economic traits in chicken have being assessed by many authors (Chineke, 2001; Adenowo *et al*., 1995 and Monsi, 1992). The influence of body weight and egg weight on egg internal quality traits cannot be over emphasized as they significantly determine the performance and the economic value of the hen. Various works have been done on the relationship between body weight and egg internal quality traits (Chineke, 2001; Adenowo *et al*., 1995; Ayorinde *et al*., 1994; Monsi, 1992). However, the relationship between age and body weight at first lay, egg weight and egg internal quality traits needs to be further investigated both within and between strains.

Materials and Method

Experimental location and management

The research was carried out at the Poultry Breeding Unit of the University of Agriculture Teaching and Research Farm, Alabata road, Abeokuta, Nigeria. ($7^0$10'N and $3^0$2'E). The area lies in the South West part of Nigeria and has a prevailing tropical climate with a mean annual rainfall of about 1037mm. The mean ambient temperature ranges from 28^0C in December to

36^0C in February with a yearly average of 34^0C. The Relative Humidity ranges from 60% in January to 94% in August with a yearly average of about 82%. The vegetation represents an interphase between the tropical rainforest and derived savannah. One hundred (100) layers comprising 20 Black Nera, 20 White Leghorn, 20 Normal feathered local chicken, 20 White Leghorn x Local cross and 20 Black Nera x Local crosses were randomly selected from a breeding stock of about 500 chickens were used to assess age and body weight at first lay, egg weight and egg internal quality traits.

Data Collection and Statistical Analysis

Records for age and body weight at first egg, weekly average body and egg weights were collected. The weights of the birds were taken at weekly intervals and eggs were collected daily for 20 weeks during which the number and weight of the eggs were noted. Eggs were collected from the selected at the beginning and twenty weeks of lay for quality analysis. The eggs were broken, the content poured into a standard separator. The albumen and the yolk were separated and weight was taken using CS200 Electronic scale. The shell weight was also taken and the shell thickness determined by a micrometer screw gauge. The height of the albumen was measured off the chalazae at a point mid-way between the inner and outer circumferences of the thick white with a P6085 Spherometer (tripod micrometer) having an accuracy of 0.01mm. Also, Haugh unit was calculated from the egg weight and albumen height for individual egg using the formular:

$HU = 100\log (H + 7.5 - 1.7w^{0.37})$ where:

H = Height of thick albumen in mm and

W = weight of egg in grams

Shell Percent (%) was expressed as a percentage of the egg weight and recorded as percent shell for individual egg sample while yolk colour was determined with the Hoffmann-La-Roche yolk colour fan. The yolk colour was determined at the time of measuring albumin height. It was performed using the yolk colour fan having different score for different colours ranging from pale yellow (score 1) to deep orange (score 15).

Albumen pH was determined using a digital Jen way® 3015 pH meter with solution of pH 4, 7, 9, with sensitivity of pH 0.01 at room temperature.

Data generated as a result of variations due to strain, age and body weight at first egg and egg weight were subjected to correlation analysis using Pearson correlation Module according to SAS (2003) procedures.

Results and Discussion

Table 1 shows the Pearson correlation between age at first egg, body weight at first egg and egg weight of pure and crossbred chicken considered for this study. The Pearson correlation analysis revealed a positive relationship between age and body weight at first egg in all the pure exotic strains. However, negative relationship was observed in White Leghorn x Local cross (r = - 0.144) and pure local (r = - 0.174). The highest value of (r = 0.454) was observed in White leghorn with the lowest in Giri x Local (r = - 0.144). A negative relationship was also observed both in pure exotic, crossbred and local chicken between age at first egg and egg weight. The r values were generally low and not significant except in Black Nera (r = 0.515). Differences in age at sexual maturity are subject to genetic variation. However it is not clear whether age at first egg is inherited independently of body size. The variation in the body weight at first egg is also as a result of the differences in their ages at first egg. Sowunmi *et al.* (1998) reported that the body weight at first egg depends to a large extent upon age. Those that mature when relatively young weigh less than those that do not begin laying until they are somewhat older. A strong, significant and positive relationship was observed between body weight at first egg and egg weight (r = 0.765). These values were relatively higher in the crossbred and pure local chicken compared to their pure exotic counterparts. This positive correlated value is in line with that of Chineke (2001). Render *et al.* (1984) observed that the correlation between body weight and egg production might be positive or negative. Nordskog (1960) asserted that negative association could be due to fat deposition in large bodied hen. This according to Singh (1990) is because birds with small body sizes lay smaller sized eggs. The number of genes affecting egg production is unknown but apparently large (Flock, 1994).

Considerable differences in egg weight of layer strains have been reported (Suk and Park, 2001 and Merat *et al*., 1994). Higher r values for the relationship between body weight at first egg and egg weight in the crossbreds could be attributed to heterosis or hybrid vigour (Oluyemi *et al*., 1978). Variation observed could also be as a result of different body weight at maturity of the various strains considered as Charles and Tucker (1993) found that layers of light strain consumed comparable little feed as opposed to heavy strains which consumed more feed.

Table 2 shows the Pearson correlation between body weight, egg weight and egg internal quality traits. The Pearson correlation analysis revealed a positive relationship between egg weight and albumen weight (r = 0.925), albumen height (r = 0.574), yolk weight (r = 0.633), yolk colour (r = 0.623), shell weight (r = 0.785), shell thickness (r = 0.118) and Haugh unit (r = 0.306) except for albumen pH (r = -0.129) and shell percent (r = -0.305). This relationship is high and significant (p<0.05) except for albumen pH and shell thickness. Also, a positive relationship was observed between body weight and egg internal quality traits except for shell thickness (r = - 0.110) and shell percent (r = - 0.305). These positive correlated values are in line with that of Chineke (2001). Render *et al*. (1984) observed that the correlation between body weight and egg production might be positive or negative (Harms *et al*., 1982). Nordskog (1960) asserted that negative association could be due to fat deposition in large bodied hen. Moreso, a significant positive relationship was seen between egg weight and other egg internal quality traits except for shell percent.

Variation existing between egg internal quality parameters as seen in the results is in line with Asuquo *et al*. (1992). Albumen and egg weights were strongly correlated. This indicates that albumen is the main bulk of the egg weight and that much of the variations in egg weight can be accounted for by albumen weight (Benoff and Renden, 1983). Results for albumen weight further suggest that selection for increased egg size will result in concomitant increase in albumen weight. In agreement with the findings of Ayorinde *et al*. (1994), body weight was positively correlated with yolk weight, shell weight and albumen weight but negatively correlated with shell thickness and shell percent. The low values observed are in agreement with the reports of Charles and Tucker (1993) who reported correlated values varying between 0.026 and 0.84. Also, the negative correlation between body weight and shell thickness implies that eggshell becomes thinner with increased body weight. This according to Singh (1990) is because birds with small body sizes lay smaller sized eggs and that irrespective of egg size the amount of shell is the same. This implies that larger eggs have thinner shells.

In conclusion, this study has revealed a stronger relationship between body weight at first egg and egg weight in the crossbreds and pure indigenous local chicken compared to pure exotic laying hens. The other observations in this study will also help in the improvement of economic egg production traits in chicken.

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Table 1: Correlation between age at first egg, body weight at first egg and egg weight in exotic pure and crossbred chicken

Strain		Age at first egg	Body weight at first egg	Egg weight
White Leghorn	Age at first egg	1		
	Body weight at first egg	0.454	1	
	Egg weight	-0.136	-0.299	1
Giri raja	Age at first egg	1		
	Body weight at first egg	0.269	1	
	Egg weight	0.205	0.193	1
Black Nera	Age at first egg	1		
	Body weight at first egg	0.204	1	
	Egg weight	0.515	0.518	1
White leghorn x local	Age at first egg	1		
	Body weight at first egg	-0.144	1	
	Egg weight	-0.165	-0.579	1
Giri raja x Local	Age at first egg	1		
	Body weight at first egg	0.121	1	
	Egg weight	0.273	0.423	1
Local	Age at first egg	1		
	Body weight at first egg	-0.174	1	
	Egg weight	-0.216	0.765**	1

**. Correlation is significant at the 0.01 level (2 - tailed) *. Correlation is significant at the 0.05 level (2 - tailed)

Table 2: Correlation coefficients (r) between body weight, egg weight and egg internal quality parameters in pure exotic, indigenous and crossbred pullets.

	Body weight	Egg weight	Albumen weight	Albumen height	Albumen pH	Yolk weight	Yolk Colour	Shell Weight	Shell Thickness	Shell %	Haugh Unit
Body weight	1.000										
Egg weight	0.481**	1.000									
Albumen weight	0.364**	0.925**	1.000								
Albumen height	0.161	0.575**	0.551**	1.000							
Albumen pH	0.037	-0.129	-0.120	-0.150	1.000						
Yolk weight	0.496**	0.633**	0.301*	0.288*	-0.106	1.000					
Yolk Colour	0.360**	0.623**	0.526**	0.533**	0.009	0.443**	1.000				
Shell Weight	0.312*	0.785**	0.697**	0.593**	-0.005	0.450**	0.697**	1.000			
Shell Thickness	-0.034	0.118	0.036	0.280*	0.023	0.088	0.322*	0.573**	1.000		
Shell %	-0.305*	-0.364**	-.379**	0.012	0.186	-0.304*	0.102	0.285*	0.636**	1.000	
Haugh Unit	0.021	0.306*	0.300*	0.951**	-0.115	0.116	0.398**	0.404**	0.290*	0.143	1.000