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RELATIONSHIP BETWEEN EGG WEIGHT, HATCH WEIGHT AND SUBSEQUENT BODY WEIGHT IN FULANI ECOTYPE CHICKEN.

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ABSTRACT

Three hundred (300) Fulani Ecotype (FE) chicken eggs collected from free ranged Fulani Ecotype chicken were used to study the effect of egg weight on hatch weight and subsequent body weight. Eggs were grouped into two according to their weight (small and medium) and incubated. Body weight of the chicks was measured from the day of hatch to 12 weeks of age on weekly basis. Mean of the body weight gain from day old to 12 weeks of age in FE chicks obtained from small and medium egg size in this study were 306.73g and 311.36g, respectively. There was no significant correlations between egg weight, hatch weight and subsequent body weight in FE chicks obtained from small egg size, while a significantly ($P<0.01$) high and positively correlated relationship existed between hatch weight and egg weight of chicks obtained from medium egg size. Positive and significant inter-correlation (0.51 to 0.98) existed between body weight of FE chicks obtained from small and medium egg size. Linear regression equations showed a significant coefficient of determination for hatch weight, body weight at 2, 4, and 6 weeks using both small and medium egg weight values. The results of this findings indicated that both small and medium Fulani Ecotype eggs are settable. However, medium eggs produce larger chicks than the small eggs.

KEY WORDS: Egg weight, Hatch weight, Body weight, Correlation and Regression

INTRODUCTION

It is necessary to give considerable attention to animal protein source so as to arrest problems of inadequate protein intake especially in developing countries. The best thing is to encourage production of indigenous chicken, because they are readily available, easy to manage with least cost of production, and are well adapted to the tropical environmental conditions.

Indigenous chickens are a pool of heterogeneous individuals which differ in adult body size, weight and plumage, they are known for their adaptation superiority in terms of their resistance to endemic disease and harsh environmental condition (Nwakpu *et al*.,1999). Their production system is mostly based on scavenging feed resources, they are genetically unimproved and remain predominant in African villages despite the introduction of exotics and cross bred types (Kaiser, 1990). Indigenous chickens are economically important to Nigerian populace (Olawumi *et al*., 2008), because their rearing demand use of very little resources and brings financially reward in a short while. FAO (2008) recognizes these facts and view rural poultry as an important tool for poverty alleviation in Africa. Study on indigenous chicken is necessary for proper understanding of how to boost their production under the prevailing conditions and their possible inputs for the development of commercial chicken type.

Fulani Ecotype chickens are one of the indigenous chickens found in Nigeria. Their origin is uncertain, but they are peculiar to the nomadic Fulani tribe and they are best preserved because of the cultural lifestyle of the Fulani (Ogundipe, 1990; Tiamiyu, 1999; Fayeye *et al*., 2005). Fulani Ecotype chickens are known for their superiority in economic traits when compare with other local chickens raised outside the kraals (Atteh, 1990; Alaba, 1990; Olawumi *et al*.,2008). Egg weight is one of the chief determinant factors required for satisfactory hatching of chickens while day old chicks weight is used as an indicator for chicks development (Meijerhof, 2005). Atteh (2004) stated that smaller egg size leads to smaller hatched chicks, and tends to hatch earlier than the standard eggs while extra large egg size tends to hatch later. The author suggested selection of moderately size eggs for poultry breeders. Determination of relationship that exist between egg weight , hatch weight and subsequent body weight in Fulani Ecotype chicken is essential because it will help breeders to select appropriate egg size to be incubated during an improvement programme designed for the Fulani Ecotype chicken.

Materials and Method

Location of the study Area

This experiment was carried out in the Animal Production Pavillion of the Animal Production Department, Faculty of Agriculture, University of Ilorin, Ilorin Kwara state Nigeria. The climate of the study area is typical Guinea Savannah. It is dominated by a rainy season which spans for about five months (March – October) and a dry season between the months of

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November and early March. The annual rainfall is between 1100mm – 1260mm with an average of 1180mm (Odjugo, 2009, while annual mean temperatures range from 30°C – 35° C.

Collection of Eggs, Incubation and hatching, and Management of Experimental Chicks

Three hundred (300) Fulani Ecotype chicken eggs were collected from free range adult Fulani Ecotype hen owned by Fulani tribe in two different Fulani Kraals located at Mooro and Ilorin East local government of Kwara state. The eggs were labeled for identification and weighed singly with the aid of a sensitive electronic weighing balance (600g capacity). The eggs were grouped into two (Small and Medium size) by findings the means of all the eggs weighed, those eggs that their weight fall below the means were regarded as small size eggs, while those eggs that their eggs fall within and above the means were regarded as medium size eggs. Labeled eggs were set in a force drought incubator at Biotechnology Laboratory, Faculty of Agriculture, University of Ilorin. The incubator temperature and the relative humidity were maintained at 37.7ºC and 55 to 60% respectively, for the eggs set as recommended by Atteh (2004). Turning of eggs were done manually 5 times daily for the period of 18 days as recommended by Abiola (1999). On the day of hatch, the chicks were picked and identified with the number on their eggs casing, wing banded and weighed using the electronic sensitive scale. The chicks were brooded and reared for a period of 12 weeks. Weighing of the chicks was done on weekly basis. They were fed recommended diet for chicks with crude protein of 21% and Metabolizable Energy (ME) content of 2800 kcal/kg from day old to 8 weeks of age, and 16% crude protein with ME of 2500kcal/kg from 8 to 12 weeks of age (NRC, 1994). All necessary vaccination and medication were done accordingly as recommended by Atteh (2004).

Statistical Analysis

The phenotypic correlations were obtained from the expression:

$$rP = \frac{Cov(PxPy)}{\sqrt{Vx}\sqrt{Vy}}$$

rP = Phenotypic correlation

Cov (PxPy) = Phenotypic co variance of traits x and y

Vx = phenotypic variance of trait x

Vy = Phenotypic variance of trait y (Falconer, 1989)

Simple linear regression equations using Egg weight and the various body weight measurements were also generated using the method of Gomez and Gomez (1984). Regression equations were obtained using the equation:

i) $Y = a + bx$

Where:

Y = Body weight, the dependent variable.

a = Constant in the regression equation.

b = Regression coefficient.

x = Egg weight.

The statistical package (SAS, version 9), with General Linear Model procedure and the Pearson correlation coefficient software was used for the analysis (SAS, 2003).

RESULTS AND DISCUSSION

75% of the egg weight, while hatched weight of chicks

15.30, 20.02, 9.10 and 2.14% bigger compare to chicks hatched from small egg size at weeks 0, 2, 4, 6, 8, 10 and 12, respectively. The total weight gain from 0 – 12 weeks of age in chicks from medium eggs was 4.63g numerically higher than total weight gain in chicks obtained from small egg size (306.73g). The results corroborate the findings of Ayorinde and Oke, (1995) where it was stated that variation in body weight within a flock can be attributed to genetic variation and environmental factors that impinge on individual.

Results obtained for chicks hatched from small egg sizes, showed no significant correlations between egg weight and hatch weight (Table 2). Positive and significant ($P<0.05$) correlation (0.52) existed between hatch weight and body weight at week 2, while positive and significant ($P<0.01$) inter correlations (0.51 to 0.96) were present between body weight of the Fulani Ecotype chicks acquired from small egg sizes from weeks 2 to 12. However, body weight at 10 weeks was not significantly ($P>0.05$) correlated with body weight at 12 weeks in this group of chicks as shown in Table 2.

Significant and positive correlations existed between medium sized Fulani Ecotype eggs and hatch weight (Table 3). Hatch weight and body weight at 2 weeks of age were positively and significantly ($P<0.05$) correlated with a moderate value of 0.54. Positive and significant inter correlations ($P<0.05$) that ranged from 0.58 to 0.98 existed between body weight of Fulani Ecotype chicks hatched from medium egg sizes from weeks 2 to 12. This corresponds with the findings of Pinchasov (1991) where initial high correlation that declined with age was reported between hatch weight and egg weight in an exotic chicken. Wilson (1991) also reported that the influence of egg weight remain until marketing stage when each gram advantage translate into a 2 -13 g improvement in body weight at six weeks of age. Narkhede *et al.* (1981) earlier reported a positive correlation ($r=0.831$) of weight of the new hatch chick with egg weight. Positive correlation of hatched chick weight has also been reported by Farooq *et al*. (2001).

Significant ($P<0.05$) coefficient of determination (0.50 to 0.60) value obtained at weeks 0, 2, 4 and 6 form the results of the linear regression equations showed that, hatch weight and body weight of the Fulani Ecotype chicks at weeks 2, 4 and 6 could be predicted from small egg size. Egg weight of medium size can be use to predict hatch weight and body weight at weeks 2 and 4 from linear regression equation (Table 4). From the small egg weight, coefficient of determination at weeks 8, 10 and 12 were lower and not significant, therefore it cannot be use to predict body weight of Fulani Ecotype chicks at those ages, while body weight of the chicks at weeks 6, 8 10 and 12 cannot be predicted from the medium egg weight.

Significant correlation between medium egg size and hatch weight obtained in this study corresponds with the findings of Abiola *et al*.(2008)) where a close correlation was reported between egg weight and hatch weight in domestic birds. The trends of correlations between egg weight and chicks' body weight advancement in age of exotics chicken. Low correlation between egg weight and 12 weeks body weight in this study did not agree with the findings of Wilson (1991), where high correlation was reported between egg weight and final body weight. This may be due to the fact the Fulani Ecotype chicken used in this study have not reach their final point of body development.

Significant phenotypic inter-correlation of body weight at different ages observed here indicates that a subset of weight measurements at early age may serve as selectable markers for future performance (weight at later age) in Fulani Ecotype chicken improvement schemes. The inter-correlation relationship among the body weight can be applied speedily in breeding and selection programme as suggested by Monsi (1992). Significant linear regression equations between egg weight, hatch weight and body weight at 2 weeks of age and non significant equations obtained at 8 weeks corresponds with the report of Ipinyomi *et al*. (2010) where significantly high coefficient of determination was obtained for linear regression equation used in predicting hatch weight and body weight at 2 weeks and non significant equations obtained for 8 weeks body weight from local chicken egg. However, the significant equations obtained for Fulani Ecotype eggs in predicting body weight at 4 and 6 weeks contradicts the findings of Ipinyomi *et al*. (2010), where non significant prediction equations were reported for local chicken at those ages.

CONCLUSIONS AND RECOMMENDATION

The results of these findings indicate that both small and medium Fulani Ecotype chicken eggs should be set, because both egg sizes led to the production of Fulani chicks of relative weight. However, the study indicated that the proportion of egg weight that contributed to chick weight is higher in smaller eggs relative to medium eggs, nevertheless in term of absolute weight of chicks, medium eggs produce larger chicks than small eggs. The weight advantage of chicks produced by medium (relative to small) eggs persists from hatch to 12 weeks of age, and is highest at 8 weeks of age. Therefore, medium Fulani Ecotype chicken eggs are best set for production of chicks with relatively bigger body weight. Within the group of chicks hatched from small eggs hatch weight is a poor predictor of long term performance as measured by weight at 8 - 12 weeks. The same is true of chicks hatched from medium eggs.

Egg weight is moderately reliable as a predictor of hatch weight and body weight at 2 and 4 weeks in eggs of both classes, and a moderate predictor of body weight at 6 weeks in small sized eggs. The data also showed that egg weight can serve as a moderately reliably marker (predictor) of early performance in selection programmes for poultry improvement and may be matched with other predictors of later performance in the construction of selection indexes for poultry improvement.

Further studies will examine the comparative

Table 1: Mean of weekly body weight of chicks hatched from Small and Medium sized Fulani Ecotype eggs.

		SMALL			MEDIUM
AGE (wks)	N	Bodyweight(g)±SD (**ES≤37.32g±2.57)**	AGE (wks)	N	Body weight (g)± SD (**ES ≥ 44.31±2.53)**
0	45	27.80±2.57	0	48	30.51±3.34
1	44	31.72±6.92	1	47	35.83±8.34
2	44	53.57±10.75	2	47	59.17±12.17
3	43	77.37±21.23	3	45	88.17±21.96
4	42	105.02±28.28	4	45	119.29±27.98
5	41	125.37±39.01	5	43	148.84±56.93
6	41	159.51±51.26	6	43	188.33±56.74
7	41	181.85±57.13	7	43	213.27±58.51
8	34	199.69±75.61	8	38	249.69±89.83
9	32	230.74±63.22	9	36	256.64±68.83
10	32	265.83±75.15	10	36	292.47±78.72
11	32	305.65±90.66	11	35	312.15±87.55
12	32	334.53±100.64	12	35	341.87±98.02

0 weeks = hatched weight; N = Number of chicks on weekly basis; SD = Standard Deviation ES = Egg size.

Table 2: Correlations between small egg size, hatch weight and body weight at weeks 2, 4, 6, 8, 10 and 12 in Fulani Ecotype chicken.

	Egg wt	0	2	4	6	8	10	12
Egg wt	1							
0	0.22	1						
2	0.01	0.52*	1					
4	0.20	0.32	0.82**	1				
6	0.10	0.43	0.69**	0.81**	1			
8	0.14	0.30	0.52*	0.66**	0.66**	1		
10	0.10	0.20	0.55*	0.65**	0.65**	0.96**	1	
12	0.12	0.20	0.51*	0.61*	0.61*	0.94**	0.46	1

**Correlation significant at P<0.01, * Correlation significant at P<0.05

Table 3: Correlations between Medium egg size, hatch weight and body weight at weeks 2, 4, 6, 8, 10 and 12 in Fulani Ecotype chicken.

	Egg wt	**0**	**2**	**4**	**6**	**8**	**10**	**12**
Egg wt	1							
0	0.60*	1						
2	0.18	0.54*	1					
4	0.13	0.28	0.87**	1				
6	0.14	0.19	0.76**	0.90**	1			
8	0.12	0.30	0.58*	0.72**	0.98**	1		
10	0.17	0.20	0.36	0.49	0.59*	0.78**	1	
12	0.22	0.20	0.31	0.44	0.57*	0.73**	0.88**	1

**Correlation significant at P<0.01, * Correlation significant at P<0.05

Table 4: Linear regression equation for estimating body weight (Y) from egg weight (X) in Fulani Ecotype chicken.

Age (weeks)	Regression Equation Y= a+bX (Small Egg)	R^2	Age (weeks)	Regression Equation Y= a+bX (Medium Egg)	R^2
0	Y = 17.42 +0.28X	0.58 *	0	Y= 6.86 +0.53X	0.60 *
2	Y = 40.81+ 0.31X	0.60 *	2	Y= 11.70+1.04X	0.50 *
4	Y= 11.60 +2.33X	0.50 *	4	Y=23.35+1.99X	0.50 *
6	Y=85.33+1.63X	0.50 *	6	Y=-27.74+4.43X	0.40 **NS**
8	Y=-70.21 +5.92X	0.40 **NS**	8	Y=-74.96+6.17X	0.38 **NS**
10	Y=-17.85 +5.56X	0.35 **NS**	10	Y=-221.70+9.96X	0.30 **NS**
12	Y=-74.51+8.11X	0.22 **NS**	12	Y=-413+14.95X	0.22 **NS**

R^2 = Coefficient of determination, * Significant at P <0.05, NS = Not Significant.

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