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EGG PRODUCTION OF TWO NIGERIAN LOCAL CHICKEN ECOTYPES UNDER IMPROVED MANAGEMENT

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ABSTRACT

The Nigerian local chickens were conceptually categorized on the basis of body weight and body size into two groups namely, "heavy" ecotype and "light" ecotype. The ecotypes were evaluated for egg production under improved management conditions using fifty point of lay (POL) pullets of each ecotype placed individually per cell in a two-tier battery cages. Hen-day egg production was monitored for 52 weeks. Other parameters evaluated include egg number, egg weight and egg mass. Egg number, egg weight and egg mass were each divided into part-period (first 3 months of lay), residual period (12 months minus the first 3 months of lay) and total or annual period production. Results showed an average hen-day percentage production of 38.0 and 40.11 for the "heavy" and "light" ecotypes, respectively. Total annual egg number, egg weight and egg mass for the "heavy" ecotype was 135.69 eggs, 40.34 g and 5740.85 g, respectively. The corresponding values for the "light" ecotype were 144.19 eggs, 37.32 g and 5008.21 g. The "heavy" ecotype did not differ ($p > 0.05$) from the "light" ecotype in hen-day production, egg number and egg mass except in egg weight. The "heavy" ecotype produced significantly ($P < 0.05$) heavier eggs than the "light" ecotypes.

Keywords: "Heavy", "Light", Evaluation, Hen-day, Part-period.

INTRODUCTION

The local chickens of Nigeria play major roles not only in rural economies but also in contributing substantially to the Gross National Domestic Product. For instance, about 12.4% of the 192,640 metric tons of egg produced in Nigeria in 1987 came from local hens in rural areas (Sonaiya, 1997). In spite of this potential, the local chickens are abandoned in the hands of resource-poor farmers who rear them under the traditional husbandry system of extensive management.

In Nigeria, there are various ecotypes of the local chicken in the different agro-ecological zones. The different ecotype conceptually can be grouped into two major categories on the basis of body size and body weight as "heavy" ecotype and "light" ecotype. The "heavy" ecotype is

found in the dry Savannahs (Guinea and Sahel Savannah), montane regions and cattle kraals of the Northern Nigeria and weighs between 0.9 and 2.5 kg at maturity. The "light" ecotypes are those chicken types from the Swamp, Rainforest and Derived savannah agro-ecological zones whose mature body weight ranges between 0.68 and 1.5kg. The "light" ecotype had been reported (Nwosu, 1990) to have potential for egg production. The "heavy" ecotype has not been subjected to much scientific investigation as the "light" ecotype although Momoh (2005) reported that the 'heavy ecotype has potential for meat production. Differences in climatic conditions, agricultural production activities and local chicken production systems among the various agro-ecological zones could affect the production levels of local chickens found in the different agro-ecological zones. In addition, geographical separation over time as seen in the different ecological niches may have produced genetic entities. The two ecotypes may therefore differ in many production characteristics. The objective of this study is to compare the egg production characteristics of the "heavy" and "light" ecotypes under improved management conditions.

MATERIALS AND METHODS

Experimental Site

This research was carried out at the local chicken unit of the Poultry Farm of the Department of Animal Science, University of Nigeria Nsukka. Nsukka is located on latitude 05^0 22^1 North and longitude 07^0 24^1 East with annual rainfall ranging from 986 to 2098mm (Inyang, 1978). The natural day length for Nsukka is 12 – 13 hours and average annual maximum and minimum temperature of 29.7^0C and 21^0C, respectively with relative humidity that ranges from 34 to 78% (Monanu, 1975).

Management of Experimental Birds

The base population consisted of 50 "light" ecotype hens with 10 cocks and 50 "heavy" ecotype hens with 10 cocks. They were maintained on the farm as two separate non-pedigreed, unselected and unimproved random mating populations.

The "heavy" ecotype chickens were gathered from rural areas in Obudu, a montane region of South-east Nigeria and its adjoining villages of Vandeikya, Katsina-Ala and Wannune in Benue State in the Guinea Savannah zone. The "light" ecotype chickens were obtained from markets in Oye-orba, Ibagwa-Nkwo, Afor-Obollo, Oye Ayu all in Enugu State in the derived savannah area, Pie Zarama, Yenogoa in the swamp area of Bayelsa State and Obo-Anang in the rainforest area of Akwa Ibom state.

Fifty (50) females each of the "heavy" and "light" ecotype constituted the foundation stock. They were replicated into five deep litter pens per ecotype with each pen containing one cock and 10 hens to meet the standard mating ratio of 1:10. The cock and the hens of each ecotype were allowed to mate freely within the pens.

Hatching eggs were collected twice a day for seven days. This was to ensure that enough eggs were available for natural incubation. The eggs were held in egg crates under room temperature which varied between 19 – 30^oC. At the end of seven days of egg collection, the eggs were incubated naturally using the basic system. The procedure for natural incubation using the bas-

ket system is as described by Momoh *et al*. (2006). Six batches of natural incubation were carried out at weekly intervals between February and March, 2004. Two hundred and fourteen day-old chicks of the "heavy" ecotype and 142 day-old chicks of the "light" ecotype were hatched and used for the study.

On hatching the chicks of each group were transferred to the brooding house and brooded separately on floor pens with wood shavings as litter materials. The brooding period lasted for eight weeks, which represents the starter phase. They were fed chick's mash containing 19.5% crude protein and 3020 kcal/kg ME (Table1) At the end of the eight weeks, the chicks were transferred to an open sided rearing house and reared on deep litter until the 20th week of age during which they were fed grower's mash containing 17.95% crude protein and 2700 kcal/Kg ME (Table1). At 20 weeks, 50 pullets each of "heavy" ecotype and "light" ecotype were randomly chosen and were individually placed in a cell in two-tier battery cages and monitored for egg production until 72 weeks of age. Eggs were collected and recorded twice daily at 10.00h and 17.00h. The hens were fed layers mash containing 17.95% crude protein and 2750 kcal/kg ME for the laying phase.

Table 1 Composition of the formulated experimental diets used for the starter, grower and layer phases.

		Type of feed	
Ingredients (%)	Chick's Mash	Growers' Mash	Layers' Mash
Maize	53.0	44.0	43.0
Wheat offal	13.0	30.0	18.0
Soya bean meal	18.0	10.0	17.0
Palm kernel cake	9.0	10.0	9.0
Fish waste	3.0	2.5	2.5
Bone meal	3.0	3.0	3.5
Oyster shell	-	-	6.0
Salt	0.25	0.25	0.25
Lysine	0.25	0.25	0.25
Methionine	0.25	-	0.25
Pre-mix®	0.25	-	0.25
Total	100.00	100.00	100.0
Calculated composition			
% Crude protein	18.0	15.0	16.50
ME kcal/kg	2800	2670	2600
*Analysed Composition			
% Crude protein	19.50	17.95	17.95
ME kcal/kg	3020	2700	2750
Fibre	6.50	7.0	6.0
Either Extract	3.50	2.0	3.52
% Ash	7.52	15.0	15.50
Moisture	8.50	8.5	9.52

*Analyzed according to A.O.A.C (2000) method

Feed and water were provided *ad libitum* during the brooding (0 – 8 weeks) and rearing (9 – 20 weeks) periods. During the laying period, the hens were fed at 150g per bird per day and this quantity was given once and water was provided *ad libitum*. The birds were vaccinated against New Castle disease at day old, 14 days, 16 weeks and 32 weeks of age. Infectious bursal disease vaccine was administered at 7 and 21 days old. Fowl typhoid vaccine was given at 9 weeks of age while fowl pox vaccine was at 12 weeks old. In addition to vaccinations, good sanitary measures such as daily cleaning of feeding and water troughs as well as the surrounding environment were ensured throughout the test period.

Traits Measured and Statistical Procedure

The following egg traits were measured for each genetic group.

(i) Percent egg production. The annual egg production of the two ecotypes was expressed as hen-day production, egg number, egg weight and egg mass. The annual production of both "heavy" and "light" ecotypes for these parameters was grouped into part-period (PP) (first 3 months of lay) egg number (PPEN), part-period egg weight (PPEWT), part-period egg mass (PPEM), residual (R) (12 months minus the first 3 months of lay) egg number (REN), residual egg weight (REWT), residual egg mass (REM) and total (T) egg number (TEN), total egg weight (TEWT) and total egg mass (TEM).

Comparisons between the two ecotypes in all the parameters measured were done using the t-test.

RESULTS

The hen-day percentage production of the two ecotypes is presented in Table 2. The hen-day percentage production calculated on monthly basis ranged from 33.55% to 46.27% with an overall mean of 38.01± 1.00% for the "heavy" ecotype and from 37.36% to 47.36 % with an overall mean of 40. ± 1.06% for the "light" ecotype. There was no significant (P>0.05) difference in the hen-day percentage production of the "heavy" and "light" ecotypes.

The "heavy" ecotype reached "peak" hen-day production in the 2nd month of lay after which the production declined, but gradually rose to a second "peak" at the 7th month of lay. Another "peak" (the third) was observed at the 11th month of lay. The "light" ecotype had a similar trend in hen-day percentage production but achieved first, second and third "peaks" at the 3rd, 8th and 11th months of lay, respectively.

The annual egg production characteristics are presented in Table 3. The part-period egg number (PPEN) for "heavy" and "light" ecotypes were 36.07 ± 2. 71 and 41. 74 ± 2.76 eggs, respectively. The total egg number (TEN), i.e., annual egg number for the "heavy" ecotype was 135.69 ± 6.09 eggs, while the corresponding value for the "light" ecotype was 144.19 ±6.19 eggs. The PPEN and TEN of the two ecotypes did not differ significantly (P>0.05).

Table 2: Hen-day percentage (HD%) egg production based on annual egg record of Nigerian 'heavy' and 'light' chicken ecotypes in battery cages.

Month of lay	Heavy ecotype			Light ecotype		
	No. of birds	No. of eggs	H.D%	No. of birds	No. of eggs	H.D%
1	50	520	33.55	50	579	37.36
2	50	694	46.27	50	681	45.40
3	50	625	40.32	50	734	47.36
4	50	594	38.32	50	602	38.84
5	50	556	38.34	50	564	38.90
6	50	543	35.03	50	545	35.16
7	49	604	41.09	48	533	37.01
8	49	552	36.34	46	595	41.73
9	48	502	34.86	46	540	39.13
10	47	521	35.76	46	582	40.81
11	47	567	38.92	46	612	42.92
12	47	526	37.31	46	507	36.74
Total/mean	48.9	(6804)	38.01±1.0a	48.2	(7074)	40.11±1.1a

( ) = Figures in parenthesis are total values
a = Means with the same superscript are not significantly different (P>0.05)

Table 3: Annual egg production characteristics of the Nigeria 'heavy and 'light' Chicken ecotypes in battery cages.

Parameter*	No. of obs.	Heavy ecotype	Light ecotype
PPEN	99	36.07±2.71a	41.74±2.76a
REN	99	101.67±4.86a	109.77±4.94a
TEN	99	135.69±6.09a	144.19±6.19a
PPEM(g)	99	1593.22±93.99a	1188.14±92.48b
REM(g)	99	4409.43±168.11a	3892.20±65.41a
TEM(g)	99	5740.85±221.42a	5006.21±17.86a
PPEWT(g)	99	38.62±0.24a	33.76±0.0.24b
REWT(g)	99	40.78±0.30a	38.40±0.29b
TEWT(g)	99	40.34±0.24a	37.32±0.23b

ab = Means within the same row with different superscripts are significantly different (P<0.05).

* PPEN = Part-period (1st 3 months) egg number.
REN = Residual egg number.
TEN = Total (annual) egg number.
PEM = Part-period (1st 3 months egg ma
REM = Residual egg mass.
TEM = Total (annual) egg mass.
PPEWT = Part-period (1st 3 months) average egg weight.
REWT = Residual average egg weight.
TEWT = Total (annual) average egg weight.

The part-period average egg weight (PPEWT) of the two ecotypes was 38.62 ±0.24g and 33.76±0.24g for "heavy" and "light" ecotypes, respectively. The average total eggs weight (TEWT) were 40.34 ± 0.24g and 37.32 ± 0.23g for "heavy" and "light" ecotypes, respectively. Both the PPEWT and (TEWT) were significantly ($P<0.05$) heavier in the "heavy" ecotype than the "light" ecotype. The part-period egg mass (PPEM) was 1593.22 ± 93.99g for the "heavy" ecotype while the "light" ecotype had 1118.14 ± 92.48g. Total egg mass (TEM) was 5740.85 ± 221.42g and 5008.21 ± 217.86g for "heavy" and "light" ecotypes, respectively. The PPEM was significantly higher ($P<0.05$) in the "heavy" ecotype than in the "light" ecotype but the TEM of the "heavy" ecotype did not differ significantly ($P>0.05$) from that of the "light" ecotype.

DISCUSSION

The annual production pattern of the "heavy" and "light" ecotype chickens followed three production cycles as described by Oluyemi and Roberts (1979) and in each laying cycle egg production quickly rose to a peak and declined slowly thereafter to the end of the cycle as described by Fairful (1982) and Gowe and Fairfull (1982). The fact that the two ecotypes though unimproved, demonstrated classical characteristics of egg-type chicken indicates their potentials as layer-type birds. The periods of attainment of first "peak" production in the two ecotypes agreed with Adedokun and Sonaiya (2001) who reported peak production to occur at the 2nd month of lay for chickens from the derived savannah agro-ecological zone and third month of lay for those from the guinea savannah and rainforest agro-ecological zones of Nigeria.

The TEN of about 144 eggs for the "light" ecotype obtained in this study agrees fairly well with the value of 146 eggs reported by Nwosu and Omeje (1985) for the chicken type described here as "light" ecotype under the battery cage system of management. This value together with the 136 eggs obtained for the "heavy" ecotypes is, however, higher than the 124 eggs per hen per year under intensive (Battery cage) management reported by Hill and Modebe (1961) and the 80-112 egg per hen per year (Sonaiya *et al.*,1998) for the Nigerian local chickens.

The average annual egg weight of 40.34 ± 0.24g and 37.32 ± 0.23g obtained for the "heavy" and "light" ecotypes, respectively, are within the range of 36-41g reported by Sonaiya *et al.* (1998) for the Nigerian local chickens. There is a fair agreement between the TEWT of the "heavy" ecotype and the value of 39.0 ± 1.0g reported by Adedokun and Sonaiya (2001) for the chicken ecotype of the derived savannah. The value of 37.32g as TEWT for the "light" ecotype is similar to the 37.1g reported by Adedokun and Sonaiya (2001) for chicken ecotype from the rainforest zone which is described in this study as "light" ecotype.

The similarity of the egg mass of "heavy" and "light" ecotypes is possible because egg mass represents egg number and egg weight. The "light" ecotype recorded higher number of eggs but lower weight

than the "heavy" ecotype while it is the reverse for the "heavy" ecotype. The total egg mass of 5,740 g and 5,010 g obtained in this study for the "heavy" and "light" chicken ecotypes, respectively, are in close agreement with the average of 5,640kg reported by Nwosu (1990) for the Nigerian local chickens of the south-east Nigeria. Egg mass reflects egg off take in metric tons. This implies that the "heavy" and "light" Local chicken ecotypes are capable of producing on annual basis 5,740 g and 5,010 g of eggs, respectively, per hen.

CONCLUSION

The "heavy" ecotype did not differ from the "light" ecotype in annual egg production characteristics except in egg weight. The "heavy" ecotype produced significantly ($P<0.05$) heavier eggs than the "light" ecotype. The egg mass production performance did not differ in "heavy" and "light" ecotypes; however, the later produced higher number of eggs.

The similarity of the "heavy" ecotype with the "light" ecotype in almost all the egg production parameters studied indicates that the "heavy" ecotype also has potential for egg production.

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