Comparative performance, egg quality characteristics and economy of production of exotic and Yoruba ecotype strains of domestic fowl

Afolabi K.D. *, R. Olajide and A.O. Akinsoyinu
Department of Animal Science
University of Ibadan, Ibadan, Nigeria.
**corresponding author: kaydaf1@yahoo.com*

ABSTRACT

Thirty hens from each of 28 weeks old Nigerian local hens and 20 weeks old Nerablack (NB) hens were fed diet containing 2609 kcal ME/ kg and 18.17% crude protein ad libitum for 12 weeks. Their performance, egg quality parameters, and economy of production were evaluated and compared. The NB hens had a significantly (P < 0.05) higher values for feed intake (124. 58g/bird/ 12 weeks), body weight gain (0. 18kg/bird/ 12weeks) hen day production (78.09%), albumen weight (64.24%) and height (4. 72mm), and yolk index (0.33) than those (60. 36g/bird/ 12 weeks, 0.08kg/bird/ 12 weeks, 50.00%, 33.64g, 68.58, 0.32mm, 50.93%, 3.47mm, and 0.20 respectively) of the local hen. Local hen had a significantly (P<0.05) higher feed conversion ratio (3.59), egg shape index (0.73), and yolk weight (38.59%) than the NB hens. Shell thickness and yolk colour score were not affected by strain difference. Egg production from Nigeria local hen is profitable but had higher cost of feed per kg egg produced and lower gross margin than NB hens.

Key words: Performance, egg quality, exotic, Yoruba ecotype, Domestic fowl

Introduction

Increasing the consumption of poultry meat and eggs are considered to be the fastest feasible and economic means of reversing the shortage of animal proteins in the diets of people in developing countries. This is because poultry is characterized by the high rate of reproduction and the best efficiency of nutrient transformation into high quality protein (Strawberg, 1990).

Exotic chickens reared in Nigeria were hybrids, bred overseas by different breeding companies. Continuous multiplication of these hybrids with time will lead to loss of vigour, manifestation of abnormalities in term of diseases and deficiency symptoms; and consequently reduction in production. Stephenson *et al* (1953) had observed a decline of 0.45 percent in egg production for each one percent increase in inbreeding Kulenkamp *et al* (1973) reported that five generations of full sib mating of Japanese quail reduced the population from 17 to six lines and that fertility, hatchability, egg production, body and egg weights were depressed by inbreeding.

The Nigerian local fowl with variable plumage colours, live weights of 400 - 1380g (for hens) and 690 - 1840 (for cocks) are traditionally reared on free range system of management. The Nigerian indigenous or local chicken number at 103 million (RIMS, 1993) out numbered other livestock species in Nigeria. Adequate development in terms of management, nutrition and breeding plans will undoubtedly improve contribution of local fowl to animal protein production and reduce the huge foreign exchange incurred on importation of exotic stocks (Adebambo, 2005, Ude and Omeje, 2005) and suffice to the fact that they are well adopted to the tropical environment besides their high cultural value. Rearing birds in cages had been said to be advantageous by Duncan (2001) because of increasing hygiene, small group size, ease of management, absence of litter problems, better working conditions and a much low cost of production.

There is the need to evaluate the potentials of the Yoruba ecotype of the Nigerian local chicken in order to compensate for protein shortfall and imbalance which may occur as a result of poverty and malnutrition in rural areas, depressed economy, emergencies like war, natural disaster; and the increasing cost of procuring and rearing exotic breeds.

This study therefore aimed at determining and comparing the performance, egg quality parameters and the economy of production of Nigerian local hens and Nera black breed of exotic hens kept in cages under

tropical environment.

Materials and methods

The parent stock of Yoruba ecotype strain of the local chicken were purchased from Ibadan and Ogbomoso markets in Oyo State of Nigeria. Local cocks and hens were sustained on commercial layers mash, bred and allowed to lay fertile eggs which were collected on a daily basis, fumigated and taken to the hatchery on the 7th day of collection. The hatched chicks were later sexed and raised to point of lay.

Local hens of 28 weeks old and Nera black of 20 weeks of age were used for the study which lasted 12 weeks. Thirty hens from each of the breeds were randomly divided into three replicates of ten birds each in which two hens were housed per stair step cage cubicle at the Zartech Unit of the Teaching and Research farm of the University of Ibadan, Ibadan, Nigeria.

All birds from the two strains were fed the same diet containing 2609kcal ME/kg and 18.17% crude protein. Composition of experimental diets is shown in Table 1 beflow. Feed and water were provided ad *libitum*. Prophylactic doses of multivitamins, antibiotics and piperazin were also administered.

Table 1: Composition of Experimental Diet

Ingredients	% composition
Maize (white)	47.30
Soybean meal (SBM)	3.26
Groundnut cake (GNC)	15.25
Palm kernel cake)PKC)	11.75
Fish meal (72%)	2.00
Wheat offal	9.70
Bone meal	3.00
Oyster shell	7.00
Salt (Nacl)	0.30
*Prenix (layers)	0.25
Methionine	0.10
Lysine	0.09
Total	100.00
Metabolizable energy (kcal/kg)	2609.26
Crude protein (%)	18.17
#Determined analysis	
Crude protein (%)	18.21
Crude fibre (%)	4.28
Ether Extract (%)	3.98
Ash (%)	7.26
Nitrogen free extract (% NFE)	66.28

* Supplied por kg diet: Vit.A, $4x10^6$ I.U; Vit D_3, $8x10^5$I.U; Tocopherols, $4x10^3$I.U; Vit k_3, 800mg, folacin, 200mg; Thiamine, 600mg; Riboflavin, 1,800mg, Niacin, 600mg; Calcium panthothenate, 2g; Pyridoxine, 600mg, Cyonocobalamin, 4mg; Blotin, 8mg, Manganese, 30g; zinc, 20g, Iron, 8g, choline chloride, 80g, copper, 2g; Iodine, 480mg; cobalt, 80mg; selenium, 40mg, BHT, 25g; and Anti-caking agent, 6g.

Data Collection

Initial body weights of hens were measured and thereafter feed intake was determined on daily basis by subtracting the weight (g) of the left over feed from the weight of the feed initially offered. Eggs were collected three times a day at the 7th, 12th and 17th hours and their respective weights were recorded.

Percentage hen day production (HDP) is the total number of eggs laid expressed as a percentage of the product of total number of hens and days. Body weight gain, final body weight, feed conversion ratio (FCR) and economy of production (i.e. cost of feed per egg produced, cost of feed per kg egg, cost of feed intake, the gross margin, and the relative cost of eggs produced) were calculated from the data obtained. Ten fresh eggs were collected weekly from each of the replicates for determining external and internal egg qualities. The length and breadth of each egg were measured with a Vernier Caliper. Each fresh egg was broken out and the albumen was carefully separated from the yolk using an aluminum yolk separator and the height of the albumen was measured with a pair of broom stick and a ruler. Weights of albumen, yolk and shell were measured with a sensitive top load electric balance. Egg shells were air dried and their thickness was measured using a micrometer screw gauge. Means of shell thickness were obtained from broad, middle and narrow sides. The yolk colour was rated and scored using Roche yolk colour fan (Roche, 1974).

Shell surface area or circumference was calculated by employing the formula:

$$\text{Sell surface area} = W^{0.677 \times 4.07}$$

where w = egg weight in grams

Egg shape index is the ratio of the egg breadth to its length while yolk index is the ratio of yolk height to its width or diameter. Haugh's unit was calculated using the formula of Haugh (1937).

$$\text{Haugh's unit} = 100\log (H + 7.57 - 1.7 W^{0.37})$$

where H = albumen height in mm, and w = egg weight in grams.

Means of each parameter was determined per replicate.

Statistical analysis: Data obtained on each parameter per replicate of the two chicken strains were subjected to statistical analysis of variance using the General Linear Models (GLM) procedure of SAS (1999).

Results and Discussion

The performance characteristics of exotic and local hen are shown in Table 2. The initial live weight of NB hen (1.37kg) was significantly ($P< 0.05$) higher than that of the local hen (1.0kg). Adebambo (2005) had reported a live weight of 940.5±70.10g for local hen at point of lay. The body weight observed in NB hens was similar to 1.36±0.01kg and 1.48kg reported by Adebambo (2005) and Fasuyi, *et al* (2005) respectively. The NB hens had a significantly ($P< 0.05$) higher values than local hens in terms of feed intake (124.5kg versus 60.36g) and body weight gain (6.18kg versus 0.08kg). Oluyemi *et al* (1982) reported a feed consumption of 71.11g/bird/day by local hens fed on diet containing 2850kcal ME/kg and 18% crude protein.

Hen day production (HDP) of 78.09% was observed in NB breed which was significantly ($P< 0.05$) higher than 50% HDP obtained in the local breed. The HDP observed in NB hens in this study was higher than 57.94% reported by Adebambo (2005) and lower than 87.88% reported by Oluyemi (2004) when NB hens were fed diet containing 2600kcal ME/kg and 17.5% crude protein. However, the HDP observed in the local strain is comparable *to* 53.8 - 63.33% reported by Afolabi *et al* (2007), 54.82% reported by Adebambo (2005), 41.42% reported by Nwosu and Omeje, (1985), and between 29.54 and 54.79% reported by Oluyemi *et al;* (1982). Mohammed *et al;* (2005) had reported 38.57 *to* 48.57% HDP *for* Sudanese indigenous chicken types.

The significant ($P < 0.05$) difference and superiority of NB hens *for* body weight, feed intake, body weight gain, HDP and efficiency of feed utilization is a reflection of their different genetic background. The NB hens are better converter of feed *to* egg than local hens by having a FCR of 2.8 which was significantly ($P <0.05$) lower than 3.59 obtained in Yoruba ecotype of the Nigerian local hens.

Table 2: Performance characteristics of exotic and local hens

Parameters	Exotic hen	Local hen	SEM	CV
Initial body weight (kg)	1.37[a]	1.01[b]	0.06	9.95
Mean daily feed intake (g/bird/12 weeks)	124.58[a]	60.36[b]	1.19	2.58
Body weight gain (kg/bird/12 weeks)	0.18[a]	0.08[b]	0.02	23.71
Hen day production (%)	78.09[a]	50.00[b]	0.96	2.99
Final body weight (kg)	1.55[a]	1.09[b]	0.07	10.54
Feed conversion ratio (kg feed/kg egg)	2.38[b]	3.59[a]	0.02	1.32
Efficiency of feed utilization (kg egg/kg feed)	0.42	0.28	0.02	1.33
Metabolizable Energy intake (kcal/bird/day)	325.06[a]	157.49[b]	1.20	2.58

ab * Mean values along the same row with different superscripts are significantly (P<0.05) different.
SEM = Standard error of mean. CV = Coefficient of Variation.

The egg quality traits of the exotic and local has is shown in Table 3. Strain difference significantly ($P < 0.05$) affected all egg quality traits measured *except* the % shell (w /w) and yolk colour score (Table 3). Egg weight in NB hens, 57.51g was significantly ($P < 0.05$) higher or heavier than 33.64g observed in local chicken eggs. The egg weights were in conformity with the reports of Adebambo (2005), Udeh and Omeje (2005), Fasuyi *et al;* (2005), Olori and Sonaiya (1992) and Nwosu and Omeje (1985). Considerable differences in egg weight of layer strains have been reported by Suk and Park (2001).

A significantly ($P < 0.05$) higher values of egg weight (57.5%), shell surface area (72.55), Haugh's unit (94.85), shell thickness (0.34mm), albumen weight (64.24%), albumen height (4.72mm) and yolk index (0.33) were observed in NB compared to the values (33.64g, 50.47, 68.58, 0.32mm, 50.93%, 3.47mm and 0.20 respectively) observed in local hens (Table3). Since egg weight is directly related to shell surface area and Haugh's unit, the NB hens therefore had a significantly ($P < 0.05$) higher values for these traits than the local breed. The inverse relationship between the proportion of albumen and yolk weights made the percentage yolk (w/w) of local eggs, 38.59% to be significantly ($P< 0.05$) higher than 26.49% observed in NB eggs. Rose (1997) asserted that heavier eggs have proportionately less yolk and more albumen. Yeasmin and Howlider (1998) also observed that eggs of dwarf indigenous hens of Bangladesh contained larger yolks than that of normal counterparts, and Richard (1976) had suggested that the release of more lipid by the mature dwarf hens to eggs may be responsible for their larger yolk size in comparison to the normal ones. The higher albumen height expressed in eggs of NB hens suggests its higher Haugh's unit and market value.

The higher egg shape index expressed in local eggs is a function of the smaller difference between its length and width when compared to eggs from NB hens which is an exotic breed. Strain of layer as a result of the different genetic make up is known to affect egg quality (Essien *et al;* 1996). However there were no significant ($P>0.05$) differences in percentage shell weight and yolk colour score of the two strains.

The same yolk colour score observed in eggs from the two strains was as a result of the similar treatment in terms of diet and medication they were both exposed to.

Table 3: Egg quality traits of exotic and local hens

Parameters	Exotic hen	Local hen	SEM	CV
Egg weight (g)	57.51[a]	33.64[b]	0.25	1.11
Shell surface area	72.55[a]	50.47[b]	0.22	0.71
Egg shape index	0.68[b]	0.73[a]	0.01	1.64
Haugh's unit	94.85[a]	68.58[b]	0.73	1.80
Shell thickness (mm)	0.34[a]	0.32[b]	0.01	3.50
Shell weight (%)	9.27	10.28	0.31	6.38
Albumen weight (%)	64.24[a]	50.93[b]	0.33	1.16
Albumen Height (mm)	4.72[a]	3.47[b]	0.08	3.70
Yolk Weight	26.49[b]	38.59[a]	0.57	3.53
Yolk Index	0.33[a]	0.20[b]	0.01	10.83
Yolk colour score	1.00	1.00	0.00	0.00

*ab Mans values along at same row with different superscripts are significantly ($P<0.05$) different.

The economy of egg production by exotic and local hens is shown in Table 4. A sum of ₦388.84 was expended on feed per hen in NB breed which laid an average of 65.60egg/bird/12 weeks, which was higher than ₦188.10 cost of feed consumed by the local hen that laid 42.00 eggs/bird in 12 weeks. Cost of feed per egg produced and returns from sales of egg produced per bird in twelve weeks in local hen (₦4.48k and ₦630 respectively) were lower than what obtained (₦5.92 and ₦984 respectively) in NB hens.

NB strain gave a better performance than the Yoruba ecotype of Nigeria local breed in terms of its lower FCR (2.38) and cost of feed per kg egg produced (₦88.67) with a corresponding higher HDP (78.09%) and gross margin of ₦595.76 when compared with those of local hens. However, the local hens which were more adapted to the local (tropical) climate had a lower feed cost per egg produced (₦4.48) with a gross margin of ₦441.90. Rearing of local chicken in battery cages as layers is therefore profitable and can be the way out of poverty and malnutrition in rural areas during emergencies and wars, and to supplement egg production from the exotic breeds in order to sustain productivity when its hybrid vigour is depreciating.

Table 4: Economy of egg Production from exotic and local hens

Parameters	Exotic hen	Local hen
Daily feed intake (g/bird/12 weeks)	124.58	60.36
#Cost of feed intake (N/bird/12 weeks)	388.24	188.10
Egg production (No/bird/12 weeks)	65.60	42.00
Cost of feed per egg produced (N/egg)	5.92	4.48
Cost of feed per kg egg produced (N/kg egg)	88.67	133.19
*Returns from the sales of eggs produced (₦)	984.00	630.00
Relative sales or return from egg produced	1.00	0.64
Gross margin (N* - #)	595.76	441.90

Cost of feed per kg at ₦37.10k.
* Egg price at ₦15 per egg or ₦450 per tray

Conclusion

- The imported NB hens performed better than the local hens.
- Egg production from local hens in cages is profitable and can supplement or increase the national egg production, alleviate poverty and malnutrition and sustain its cultural needs and value among Nigerians.

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