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Comparative Egg Production Performance of Domestic Chicken Genotypes Reared in Two Housing Plans and Feeding Regimens

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Abstract

The study was carried out to evaluate the egg production performance of heavy (HBW) and light (LBW) body weight chickens housed in cages and deep litter and fed commercial feed (CF) or locally formulated feed (LF). One hundred and sixty pullets at point of lay (18 weeks of age, 80/genotype) were used for the study. During the growing phase (8-18 weeks), pullets of each genotype were fed either CF or LF growers mash. Thereafter, birds of each genotype and feed type were assigned to either deep litter (10 birds/pen) or battery cage (individual bird cages). Next, birds that received CF and LF growers mash were assigned to CF and LF layers mash, respectively. Water was provided *ad libitum*. Data collected included age at first egg (AFE), body weight at first egg (BWFE), weight of first egg (WFE), egg weight (EW), egg number (AEN), and egg mass (AEM). Comparison between treatments was done using independent samples t – test. Result showed significant ($P < 0.05$) genotypic effects on the measured traits irrespective of feed type, and housing system. Housing significantly ($P < 0.05$) influenced BWFE, AEN, and AEM as well as AFE, BWFE, AEN, and AEM in LBW and HBW birds, respectively while feed type significantly ($P < 0.05$) affected AFE, BWFE, AEN, and AEM and BWFE and AEM among LBW and HBW birds reared in deep litter, respectively. For birds reared in battery cages, feed type significantly ($P < 0.05$) affected BWFE, and AEN in LBW birds but only BWFE for HBW birds. It was concluded that HBW chickens performed better than the LBW chickens in most of the parameters while battery cage and local feed were better than deep litter and commercial feed, respectively in enhancing the performance of both genotypes.

Key word: Genotype, battery cage system, deep litter, commercial ration, local feed, egg production.

Introduction

Poultry production has been recognized as the cheapest source of animal protein in the developing countries (Ajayi, 2010; Rahman *et al.*, 2013). In addition to the yield of meat and eggs, indigenous chickens play both economic (food security) and socio-cultural roles for rural dwellers (Yousif and Eltayeb, 2011). These roles cannot be fulfilled by the conventional (exotic) chickens due to the strict management and high financial inputs needed for their production. It is therefore important to ensure the conservation of indigenous poultry resources since their erosion will bring about a major disruption of biological, food and socio-cultural systems capable of reducing the value of life especially among rural households (FAO, 2009; Groeneveld *et al.*, 2010).

The indigenous chicken of Nigeria occurs as two recognizable body weight genotypes (Ogbu and Omeje, 2011) or ecotypes (Momoh and Nwosu, 2008) namely light and heavy body weight genotypes. Consistent body weight differences between genotypes from hatch to sexual maturity have also been demonstrated (Adebambo, 2005; Momoh and Nwosu, 2008). Similar genotypic classifications and variations in performance traits have also been reported for local chickens of Sudan (Yousif and Eltayeb, 2011), Ethiopia (Hansen *et al.*, 2006; Reta *et al.*, 2009), Zimbabwe (Mupeta *et al.*, 2002) and other countries. These indigenous chickens constitute the raw materials that must be harnessed to develop enduring indigenous chicken production systems. Thus there is a need to continuously evaluate the performance of native chickens under different production, management, economic and social milieu.

The environments to which poultry birds are exposed include the housing system, the feed they consume, the climatic factors and the management systems that affect the performance of the birds (Tadelle, 2003; Yousif and Eltayeb, 2011; Olaniyi *et al.*, 2012). Rearing condition is an important management input in poultry production (Jin and Craig, 1994; Gerzilov *et al.*, 2012; Ojedapo, 2013). Rearing condition affects growth, egg production and qualities as well as health and well being (Yousif and Eltayeb, 2011; Olaniyi *et al.*, 2012; Ojedapo, 2013). In recent times, the increased emphasis on regulation has driven changes on how animals are housed, fed and managed and this will continue; possibly in an accelerated manner with much pressure on reducing cost to increase supply through the use of larger and more integrated facilities (Olaniyi *et al.*, 2012). Rearing of layers in cages is widely accepted over floor rearing to enhance egg production (Ojedapo, 2013), achieve a cleaner and disease free environment as well as small group size (Gerzilov *et al.*, 2012). Cages are still the most economic housing to produce eggs and the best system for disease prevention (Hulzebosch, 2006; Gerzilov *et al.*, 2012) as well as protection of birds from pecking and other social vices. Cages also minimize egg losses and the number of rejects (cracks and soiled eggs). Caged birds had better overall egg production and quality than free-range hens, including FCR, daily egg masses, production of grade A eggs; greater haugh unit ratings; and decreased mortality (Golden *et al.*, 2012). However, such issues as cage fatigue, and lack of social interaction are of welfare importance (Craig and Adams, 1984; Appleby, 2003) necessitating a re-evaluation of economic interests in the light of bird welfare and health concerns. Floor or group rearing of birds will certainly become more forcefully demanded from chicken producers by animal welfarists and consumers of animal products (meat and eggs) in the future (Ojedapo, 2013), hence the need to continuously evaluate the performance of birds in deep litter systems.

Performances in deep litter or group rearing systems will most probably become important economic selection criteria to improve performance in future. Ojedepo (2013) reported significant effects of housing systems on egg quality traits of Nera Black laying hens. Interaction effects of housing system by age of layers on external and internal egg traits were also shown to be better in deep litter operations compared to caged eggs (Ojedepo, 2013). Gerzilov *et al.* (2012) reported that Isa Brown hens reared in enriched cages performed better than those in conventional cages and in barns with slat flooring, manure pit and deep litter. In addition, Al-Rawi and Abou-Ashour (1984) reported that birds on floor pens were superior in number and size of eggs, egg mass and livability compared to caged birds. They consumed higher feed but FCR was not affected.

Knowledge of the nutritional requirement at various stages of production will lead to maximum biological and economic efficiency in the use of feed resources. The high cost of feed input in poultry farming means that aside from health related issues, feed management is the key profit index in poultry production. One way out of the high cost of feed in poultry production is the development of dietary formulations which allow locally available ingredients to be used (Emenalor and Udedibie, 1998; Ravindran, 1995; Achi *et al.,* 2007). The widespread use of commercial rations for feeding of poultry stems from the uncertainty in the nutrient composition of a majority of locally available feed raw materials. Mussaddeq *et al.* (2002) reported that rural poultry reared on traditional feeding systems have poor growth rate as well as low production of eggs. But the use of commercial ration in rural poultry production and for feeding local chickens has not helped the growth of the sector since the practice is unsustainable (Ochetim, 1993; Achi *et al.*, 2007; Reta, 2009) hence the need to explore the use of locally formulated ration to reduce cost of feeding and enable rural people to get maximum output from local birds within their available feed resources (Mussaddeq *et al.,* 2002). With these background, the present study was conducted to evaluate the egg production performance under two housing systems (deep litter and battery cage) and two feeding plans (commercial feed and locally formulated feed) using two indigenous chicken genotypes (light and heavy body weight ecotype).

Materials and Methods

The study was carried out in the Local Chicken Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. One hundred and sixty (160) indigenous pullet chickens at point of lay (18 weeks of age) belonging to two genotypes (80 each of light, LBW and heavy, HBW body weight genotypes) were used for the study. The birds were generated as day old chicks (360, 180/genotype) through random mating involving parents of each genotype. They were raised to 18 weeks of age before they were employed for the study. The classification into light and heavy body weight genotypes (ecotypes) was based on growth performance characteristics as previously reported by Momoh and Nwosu (2008) and Ogbu and Omeje (2011). The birds were brooded from day old to 8 weeks of age according to genotype (sexes combined) during which they were fed *ad libitum* on chicks mash formulated from locally available feed stuffs (19.5% CP, 2700 Kcal ME/kg). Thereafter, pullets belonging to each genotype were randomly divided into two groups and assigned to one of two growers mash namely commercial growers mash and locally formulated growers mash. At 18 weeks of age, the birds belonging to each genotype and feed type were randomly divided into two groups (20 each) and assigned to one of two housing types namely deep litter or battery cage. Birds assigned to battery cage were housed individually while those on deep litter were housed in groups of 10 hens in pens that allowed $750cm^2$/bird. There were two deep litter pens per genotype. Next, the birds that received commercial growers mash were assigned to commercial layers mash while those that were raised on locally formulated growers mash were assigned to locally formulated layers mash. For each treatment, birds were fed 125g/bird/day as previously determined by Ogbu (2012) for Nigerian indigenous chickens. Water was provided fresh and *ad libitum* to the birds. Appropriate prophylactic medications were given from day old as and when due or when necessary to ensure optimal health of the birds. The birds were monitored for annual egg production (52 weeks of lay) from point of lay. Data collected included age at first egg (AFE), body weight at first egg (BWFE), weight of first egg (WFE), egg weight, egg production (egg number, EN), and egg mass (EM). Data were analyzed using the independent samples t – test to compare the effects of genotype, housing type, and feed type on the parameters measured. Significant treatment effects were accepted at $P < 0.05$ probability level.

Results and Discussion

The ingredient composition of the experimental feeds is presented in Table 1 while Table 2 contains the proximate composition of the feeds.

Table 1: Percentage composition of formulate rations

	Percentage composition		
Ingredient	Chick 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 meal	3.0	3.0	3.0
Bone meal	3.0	2.5	3.0
Lysine	0.25	0.25	0.25
Methionine	0.25	-	0.25
Vitamin/mineral premix	0.25	-	0.25
Salt	0.25	0.25	0.25
Oyster shell	-	-	6.0
Total	100	100	100
Calculated composition			
Crude protein	18.0	15.0	16.5
Energy (kcal/kg)	2800	2670	2600

Table 2 shows that the proximate composition of the experimental growers diets differed in energy content (3260 vs 2800 Kcal ME/kg), and fibre content (15.0 vs 7.0%) while the layers mash differed in energy, crude protein, fibre and ash content (3300 vs 2900 Kcal ME/kg, 16.3 vs 18.3%, 14.5 vs 6.0%, and 11.5 vs 15.5%, respectively).

Table 2: Proximate composition of experimental ration

Analysed samples	CP (%)	Energy (kcal/kg)	Fibre (%)	Ether extract (%)	Ash (%)	Moisture (%)
Formulated chick mash	19.5	2700	6.5	3.0	7.5	8.5
Commercial growers mash	17.5	3260	15	1.5	14.5	9.0
Local growers mash	18.0	2800	7.0	2.0	15.0	8.5
Commercial layers mash	16.3	3300	14.5	3.5	11.5	8.5
Local layers mash	18.0	2900	6.0	3.5	15.5	9.5

The comparative egg production performance of light (LBW) and heavy (HBW) body weight chickens revealed higher (P<0.05) BWFE, WFE and AEN for HBW chickens reared in deep litter compared to their LBW counterparts (Table 3). In battery cage, the HBW birds also surpassed their LBW counterparts in all the traits except AFE which was higher in the LBW group at 155.85 ± 0.62 d vs 153.50 ± 0.40 d. The results indicate that whatever the housing system adopted, the HBW birds exhibited superior egg production performance compared to the LBW group.

Table 3: Effect of genotype on egg production parameters of local chickens reared in deep litter or battery cages

	Deep litter		Battery cage	
Trait	LBW	HBW	LBW	HBW
Age at first egg (AFE, day)	156.50 ± 0.70	156.90 ± 1.01	155.85 ± 0.62[a]	153.50 ± 0.40[b]
BWFE (g)	797.89 ± 1.43[a]	876.32 ± 1.20[b]	831.85 ± 2.11[a]	962.91 ± 1.17[b]
Weight of first egg (WFE, g)	26.01 ± 0.37[a]	30.45 ± 0.21[b]	26.79 ± 0.31[a]	30.46 ± 0.33[b]
Annual egg number (AEN, no.)	126.22 ± 2.13[a]	140.06 ± 0.63[b]	127.85 ± 1.95[a]	132.90 ± 2.67[b]
Average egg weight (AEW, g)	38.73 ± 0.47	38.59 ± 0.42	38.54 ± 0.26[a]	39.34 ± 0.29[b]
Annual egg mass (AEM, kg)	4.95 ± 0.05	4.90 ± 0.08	5.28 ± 0.05	5.22 ± 0.12

a, b: means are significantly different at P < 0.05. LBW: Light body weight genotype; HBW: Heavy body weight genotype, BWFE: Body weight at first egg.

These results are consistent with those of Momoh and Nwosu (2008) who reported significant differences in egg production parameters of light and heavy body weight local chicken ecotypes of Nigeria. It has been suggested (Momoh and Nwosu, 2008) that the HBW genotype could be selected and developed for egg production or for dual purpose (meat and egg) for the indigenous poultry sector in Nigeria. Performance differences in production parameters of local chicken genotypes have been reported by a number of other studies (Yousif and Eltayeb, 2011; Rahman *et al.*, 2013). Genotype also significantly (P<0.05) affected egg production performance whatever the ration employed in feeding of the local chickens (Table 4). For birds fed commercial feed, BWFE, WFE, AEN, and AEM were higher for the HBW group than for the LBW groups (915.49 ± 5.13 vs 800.66 ± 1.23g, 30.46 ± 0.31 vs 26.24 ± 0.32g, 136.60 ± 1.80 vs 129.90 ± 2.70 eggs, and 5.19 ± 0.13 vs 4.97 ± 0.06kg, respectively) whereas for those fed local feed only BWFE and WFE were higher for the HBW group (938.55 ± 2.60 vs 840.31 ± 2.34g, and 30.45 ± 0.24 vs 26.58 ± 0.36g, respectively). Annual egg mass (AEM) was higher in LBW birds compared to HBW birds while AFE, AEN, and AEW were similar for both genotypes.

Table 4: Effect of genotype on egg production parameters of local chickens fed commercial or local feed

	Commercial feed		Local feed	
Trait	LBW	HBW	LBW	HBW
Age at first egg (AFE, day)	156.70 ± 0.66	155.40 ± 0.84	155.7 ± 0.66	155.00 ± 0.57
BWFE (g)	800.66 ± 1.23[a]	915.49 ± 5.13[b]	840.31 ± 2.34[a]	938.55 ± 2.6[b]
Weight of first egg (WFE, g)	26.24 ±0.32[a]	30.46 ± 0.31[b]	26.58 ± 0.36[a]	30.45 ± 0.24[b]
Annual egg number (AEN, no.)	129.9 ± 2.70[a]	136.6 ± 1.8[b]	134.5 ± 1.4	136.2 ± 1.4
Average egg weight (AEW, g)	38.88 ± 0.37	39.00 ± 0.37	38.89 ± 0.34	38.83 ± 0.34
Annual egg mass (AEM, kg)	4.97 ± 0.06[a]	5.19 ± 0.13[b]	5.23 ± 0.05[a]	4.93 ± 0.08[b]

a, b: means are significantly different at P < 0.05. LBW: Light body weight genotype; HBW: Heavy body weight genotype, BWFE: Body weight at first egg.

Surprisingly, the HBW birds attained sexual maturity (AFE) earlier than the LBW birds. This is very advantageous in the development of fast growing, and early maturing birds for meat and egg production. Early maturity ensures more eggs per cycle, shortens the generation interval and makes for rapid genetic improvement of the flock. Housing type also significantly (P<0.05) influenced some egg production parameters in both genotypes (Table 5).

Table 5: Effect of housing system on egg production parameters of local chicken genotypes

	LBW		HBW	
Trait	Deep litter	Battery cage	Deep litter	Battery cage
Age at first egg (AFE, day)	156.50 ± 0.70	155.90 ± 0.62	156.90 ± 1.10[a]	153.50 ± 0.58[b]
BWFE (g)	777.89 ± 1.43[a]	831.88 ± 2.11[b]	862.82 ± 2.18[a]	962.91 ± 1.17[b]
Weight of first egg (WFE, g)	26.02 ± 0.37	26.80 ± 0.31	30.45 ± 0.21	30.46 ± 0.33
Annual egg number (AEN, no.)	126.50 ± 2.13[a]	137.85 ± 1.95[b]	132.10 ± 0.63[a]	140.60 ± 2.66[b]
Average egg weight (AEW, g)	38.73 ± 0.46	39.04 ± 0.26	38.59 ± 0.42	39.24 ± 0.29

Annual egg mass (AEM, kg)	4.92 ± 0.05[a]	5.29 ± 0.06[b]	4.90 ± 0.07[a]	5.22 ± 0.12[b]

a, b: means are significantly different at P < 0.05. LBW: Light body weight genotype; HBW: Heavy body weight genotype, BWFE: Body weight at first egg.

Light body weight birds reared in deep litter and battery cage differed significantly (P<0.05) in BWFE, AEN, and AEM (831.88 ± 2.11 vs 777.89 ± 1.43g, 137.85 ± 1.95 vs 126.50 ± 2.13 eggs, and 5.29 ± 0.06 vs 4.92 ± 0.05 kg for battery cage vs deep litter, respectively) but did not differ significantly (P>0.05) in AFE, WFE, and AEW. For the HBW birds, significant differences were observed in AFE, BWFE, AEN, and AEM with birds in battery cage surpassing their counterparts reared in deep litter in all the traits except AFE. The earlier AFE and superior performance of birds housed in battery cages could be attributed to better nutrient utilization due to higher nutrient allocation to egg production, reduced activity, minimal disturbance from pen mates, and reduction in egg loses compared to those reared in deep litter (Holt *et al.*, 2011; Golden *et al.*, 2012). These results indicate that rearing condition (housing type) is an important environmental input in poultry and livestock production (Jin and Craig, 1994; Gerzilov *et al.*, 2012; Stojcic *et al.*, 2012; Ojedapo, 2013). Significant (P<0.05) effect of feed type on AFE, BWFE, AEN, and AEM was observed in LBW birds fed commercial or local feeds and reared in deep litter while only BWFE, and AEM differed significantly in the HBW groups (Table 6).

Table 6: Effect of type of ration on egg production parameters of local chickens reared on deep litter

	LBW		HBW	
Trait	Commercial feed	Local feed	Commercial feed	Local feed
Age at first egg (AFE, day)	157.70 0.65[a]	155.30 ± 0.75[b]	157.10 ± 1.10	156.70 ± 0.92
BWFE (g)	735.51 ± 1.88[a]	820.27 ± 0.97[b]	847.80 ± 2.91[a]	877.83 ± 1.44[b]
Weight of first egg (WFE, g)	25.71 ± 0.35	26.32 ± 0.38	30.56 ± 0.23	30.33 ± 0.19
Annual egg number (AEN, no.)	123.00 ± 2.15[a]	130.0 ± 2.10[b]	140.20 ± 0.66	141.00 ± 0.60
Average egg weight (AEW, g)	38.90 ± 0.49	38.55 ± 0.42	39.03 ± 0.45	38.14 ± 0.38
Annual egg mass (AEM, kg)	4.82 ± 0.03[a]	5.01 ± 0.07[b]	5.10 ± 0.11[a]	4.70 ± 0.06[b]

a, b: means are significantly different at P < 0.05. LBW: Light body weight genotype; HBW: Heavy body weight genotype, BWFE: Body weight at first egg.

For LBW chickens, AFE was higher (P<0.05) in birds fed commercial feed compared to their counterparts fed local feed (157.70 ± 0.65 vs 155.30 ± 0.75 d) whereas BWFE, AEN, and AEM were higher in those fed local feed (820.27 ± 0.97 vs 735.51 ± 1.88g, 130.00 ± 2.10 vs 123.00 ± 2.15 egg, and 5.10 ± 0.07 vs 4.82 ± 0.03 kg, respectively). For the HBW birds, BWFE was also higher in birds fed local feed (877.83 ± 1.44 vs 847.80 ± 2.91g) while those fed commercial feed had higher AEM (5.10 ± 0.11 vs 4.70 ± 0.06kg). These results show significant interaction effect of genotype and feed type under deep litter system and indicate that the local feed was a better feed for both the LBW and HBW chickens. The higher AFE in birds fed commercial feed indicates delayed sexual maturity in those birds probably on account of lower rate of growth. The use of commercial feed caused an increase of 2.4 d in AFE, and a 10.3, 5.4, and 3.8% reduction in BWFE, AEN, and AEM, respectively in LBW birds. Only BWFE was reduced (3.4%) by the use of commercial feed in HBW birds. The lower AFE and higher BWFE, AEN and AEM for birds fed local feed could be associated with the higher crude protein, lower crude fibre, and higher ash content of the local feed compared to the commercial ration (18.0 vs 16.3% and 6.0 vs 14.5%, 15.5 vs 11.5%, respectively) in agreement with Rahman *et al.* (2013) who reported better performance in hilly chickens fed high protein-energy feeds compared to low protein-energy feeds. The very high energy content of the commercial feed (3260 vs 2800 kcal ME/kg and 3300 vs 2900 kcal ME/kg for grower and layers mash, respectively) may have also limited the intake of enough feed to meet the need of the birds for other nutrients such as protein, minerals and vitamins necessary for the efficient utilization of feed and for normal metabolic processes in the body. The high energy and low crude protein contents of the commercial feeds may have therefore caused nutritional imbalance which limited the performance of birds fed the commercial feed. In a similar study on the effect of different plans of feeding on laying performance of cross chickens (Mussaddeq *et al.*, 2002), the energy level of the experimental feeds (including commercial layer mash) was 2750 kcal ME/kg which corresponds more to our values of 2800 and 2900 kcal ME/kg for local grower and layer mash, respectively than to the 3260 and 3300 kcal ME/kg for commercial grower and layers mash, respectively. Ochetim (1993) had reported the crude protein, crude fibre, and energy content of local vs commercial feeds employed in a study of effect of local and commercial feeds on egg production as 18.0 vs 16.2%, 5.8 vs 5.2%, and 3000 vs 2900 kcal ME/kg, respectively for pullet developer, and 17.9 vs 17.8%, 5.6 vs 5.4%, and 2900 vs 2900 kcal ME/kg, respectively for layer feed. These values considerably agree with the nutrient composition of the local grower and layers mash employed in the present study. It does appear therefore, that the energy content of 2800 and 2900 kcal ME/kg for the local grower and layers feeds, respectively as well as their respective crude protein, crude fibre, mineral and vitamin contents were better for growth and egg production in the local chicken genotypes employed in the present study. Table 7 shows that interaction effect of genotype by feed type on laying performance of birds reared in battery cages was significant (P<0.05) for BWFE, and AEN for LBW birds but for BWFE only for HBW birds.

Table 7: Effect of type of ration on egg production parameters of local chickens reared in battery cage

	LBW		HBW	
Trait	Commercial feed	Local feed	Commercial feed	Local feed
Age at first egg (AFE, day)	155.70 ± 0.67	156.10 ± 0.57	153.70 ± 0.58	153.30 ± 0.21
BWFE (g)	786.78 ± 3.01[a]	876.97 ± 1.21[b]	945.78 ± 1.41[a]	980.04 ± 0.92[b]
Weight of first egg (WFE, g)	26.76 ± 0.29	26.83 ± 0.33	30.35 ± 0.38	30.56 ± 0.28
Annual egg number (AEN, no.)	136.70 ± 3.25[a]	139.00 ± 0.65[b]	132.90 ± 3.02	131.30 ± 2.29
Average egg weight (AEW, g)	38.85 ± 0.25	39.22 ± 0.26	38.97 ± 0.28	39.51 ± 0.29
Annual egg mass (AEM, kg)	5.12 ± 0.08	5.45 ± 0.03	5.28 ± 0.15	5.16 ± 0.09

a, b: means are significantly different at P < 0.05. LBW: Light body weight genotype; HBW: Heavy body weight genotype, BWFE: Body weight at first egg.

Again LBW birds fed local feed had higher BWFE, and AEN (876.97 ± 1.21 vs 786.78 ± 3.01g, and 139.00 ± 0.65 vs 136.70 ± 3.25, respectively i.e., 10.3 and 1.7% reduction, respectively). For HBW birds, BWFE was also higher in birds fed local feed (980.04 ± 0.92 vs 945.78 ± 1.41g i.e., 3.5% reduction). Compared to the observed performance of birds reared in deep litter (Table 6). These results show that birds in battery cages were less varied in their performances probably on account of a more uniform and benign micro environment in the battery cage system. Birds reared in deep litter are exposed to a myriad of unequal and stressful environmental effects and influences from pen mates such as cannibalism, and competition for feed, water and space (Gerzilov *et al.*, 2012; Golden *et al.*, 2012). These factors bring about variations in performance of individual birds and this in turn influences the overall performance of a flock (Golden *et al.*, 2012). The comparison between genotypes for egg production parameters under different housing systems and type of feed is presented in Table 8.

Table 8: Effect of genotype on egg production parameters of local chickens fed local or commercial feed and reared on deep litter or battery cages

	Deep litter		Battery cage	
Trait	LBW	HBW	LBW	HBW
Local feed				
Age at first egg (AFE, day)	155.30 ± 0.75	156.70 ± 0.92	156.10 ± 0.57[a]	153.30 ± 0.21[b]
BWFE (g)	820.27 ± 0.97[a]	877.83 ± 1.44[b]	876.97 ± 1.21[a]	980.04 ± 0.92[b]
Weight of first egg (WFE, g)	26.32 ± 0.38[a]	30.33 ± 0.19[b]	26.83 ± 0.33[a]	30.56 ± 0.28[b]
Annual egg number (AEN, no.)	130.0 ± 2.10[a]	141.00 ± 0.60[b]	139.00 ± 0.65[a]	131.30 ± 2.29[b]
Average egg weight (AEW, g)	38.55 ± 0.42	38.14 ± 0.38	39.22 ± 0.26	39.51 ± 0.29
Annual egg mass (AEM, kg)	5.01 ± 0.07[a]	4.70 ± 0.06[b]	5.45 ± 0.03[a]	5.16 ± 0.09[b]
Commercial feed				
Age at first egg (day)	157.70 ± 0.65	157.10 ± 1.10	155.70 ± 0.67[a]	153.70 ± 0.58[b]
BWFE (g)	735.51 ± 1.88[a]	847.80 ± 2.91[b]	786.78 ± 3.01[a]	945.78 ± 1.41[b]
Weight of first egg (WFE, g)	25.71 ± 0.35[a]	30.56 ± 0.23[b]	26.76 ± 0.29[a]	30.35 ± 0.38[b]
Annual egg number (AEN, no.)	123.00 ± 2.15[a]	140.20 ± 0.66[b]	136.70 ± 3.25	132.90 ± 3.02
Average egg weight (AEW, g)	38.90 ± 0.49	39.03 ± 0.45	38.85 ± 0.25	38.97 ± 0.28
Annual egg mass (AEM, kg)	4.82 ± 0.03[a]	5.10 ± 0.07[b]	5.12 ± 0.08	5.28 ± 0.15

a, b: means are significantly different at P < 0.05. LBW: Light body weight genotype; HBW: Heavy body weight genotype, BWFE: Body weight at first egg.

For birds fed local feed, and reared in deep litter, the HBW group had significantly (P<0.05) higher BWFE, WFE, and AEN but lower AEM than the LBW birds (877.83 ± 1.44 vs 820.27 ± 0.97g, 30.33 ± 0.19 vs 26.32 ± 0.38g, 141.00 ± 0.60 vs 130.00 ± 2.10, and 4.70 ± 0.06 vs 5.01 ± 0.07, respectively) while AFE and AEW were similar. A similar trend was observed in birds reared in battery cage except that AFE, and AEN were lower in HBW group than in their LBW counterparts (153.30 ± 0.21 vs 156.10 ± 0.57 d, and 131.30 ± 2.29 vs 137.00 ± 0.65, respectively). These results indicate delayed sexual maturity and depressed egg weight in HBW birds fed local feed and reared in deep litter compared to their counterparts reared in battery cage. For birds fed commercial feed under the deep litter system, BWFE, WFE, AEN, and AEM were significantly (P<0.05) higher in HBW birds compared to LBW birds whereas in battery cage only AFE, BWFE, and WFE differed significantly (P<0.05) between the genotypes (153.70 ± 0.58 vs 155.70 ± 0.67 d, 945.78 ± 1.41 vs 786.78 ± 3.01g, and 30.35 ± 0.38 vs 26.76 ± 0.29g, respectively). Again sexual maturity was delayed in HBW birds in the deep litter system in spite of receiving the same feed type. It does appear therefore that rearing environment has an overriding effect over feed type on performance of birds. Apart from these, the results also affirm our earlier submission that the heavy body weight birds were better in growth and egg production performance irrespective of the housing type and/or feeding plan adopted.

Conclusion

Genotypic variation in egg production performance existed among the indigenous chicken genotypes employed in the study. There were also strong effects of feed type and housing system on the variables measured. Generally, birds fed locally formulated feed performed better than those fed commercial feed in both battery cage and deep litter systems. Furthermore, housing in battery cage caused overall improved performance in both genotypes irrespective of the feed type adopted. It will be worthwhile to further evaluate the economics of local chicken production using the two genotypes under the feeding plans and housing systems investigated in the present study.

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