EFFECTS OF RESTRICTED FEEDING AT THE CHICK AND GROWING PHASES ON LAYING PERFORMANCE AND EGG QUALITY PARAMETERS OF ISA BROWN CHICKENS

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Abstracts

Two hundred and seventy (270) pullet chicks were reared in a group for one week. At day 8, the chicks were randomly allotted into 3 treatments such that each treatment had three replicates of 30 chicks each. The chicks in experimental group R_0 were fed ad-libitum, R_1 were fed six days weekly while R_2 received full feeding for five days weekly. After the first 8 weeks, the three groups of birds used in the first experiment were each sub divided into three groups of ad libitum (r_0), one-day feed restriction (r_1) and two days feed restriction (r_2), resulting finally in nine experimental groups. Laying performance, internal and external qualities of eggs were determined. There were no significant difference ($p>0.05$) in the weights of first egg, egg weight and shell thickness across the treatments. However, R_0r_0 birds has the highest ($p<0.05$) value for henday (68.33%) and percentage yolk weight (23.56%) while R_2r_1 and R_2r_0 birds had the least ($p<0.05$) values; 53.41% and 21.26%, recorded for above parameters respectively. The albumen percentage is however significantly ($p<0.05$) higher in R_2r_0 birds than R_0r_0 birds. It could be concluded that starter-restricted Isa Brown layers (R_2) had poor laying performance and egg quality with the exception of the albumen percentage. Mild starter-restriction (R_1) is recommended as it gave effects similar to ad libitum feeding.

Keywords: feed restriction, laying performance, egg quality

Introduction

Poultry products has been recognized as the cheapest source of animal protein in the developing countries (Ajayi, 2010). Egg production is of great economic importance and the success of this enterprise hinges on the total number of eggs produced from management inputs (Ojepapo *et al*., 2009). The qualities of egg which include egg weight, shell thickness, and shell index are very important due to their economic importance in the egg production industry (Savegnago *et al*., 2011; Blanco *et al.*, 2014). The high cost of feed inputs in poultry farming means that feed management is the key profit index in poultry production (Achi *et al.*, 2007). Feed, according to Sanni and Ogundipe (2003) constitutes a major cost input in egg production enterprise. Any savings in feed consumption will increase the profit margin. Feed restriction is one major way of ensuring efficient utilization of feed and feed cost reduction.

Different methods of feed restriction programmes are applied in practice. These include: reduced nutrient intake by means of diet dilution (Camacho-Fernandez *et al.*, 2002), appetite suppressant (Oyawoye and Krueger, 1990), limiting the time of feed access as in skip-a-day feeding (Khajali *et al*., 2007), meal feeding (Susbilla *et al.*, 2003) and limiting the quantity of feed offered to the birds daily (Ocak and Sivri, 2008). This research is designed to determine the effect of restricted feeding at the chick and growing phases on laying performance and egg quality parameters of Isa Brown chickens.

Material and methods

The research was carried out in the Poultry Unit, Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta, Ogun State. Two hundred and seventy (270) pullet chicks were purchased from a reputable hatchery. At day 8, the chicks were randomly allotted into 3 treatment groups such that each treatment had 3 replicates of 30 chicks each in dimensions of 2.5m x 3m. The chicks in experimental group R_0 were fed *ad-libitum* at chick phase and served as control. Groups R_1 and R_2 were restricted one-day and two-day per week respectively. After the first 8 weeks, the three groups of birds used in the first experiment were each sub divided into three groups of *ad libitum* (r_0), one-day,(r_1) and two days (r_2) weekly feed restriction, resulting finally in nine experimental groups. The birds were fed with chicks mash, grower mash and layers mash at chick, growing and laying phases respectively. At 20 weeks, the number of pullets per replicate was

reallocated in the battery cage to have equal number of eight birds per replicate. The production of egg and egg weights of all egg were measured daily and calculated periodically (every 30 days) from 20 to 68weeks of age. Haugh unit scores were calculated by the procedure of Haugh (1937) in the formula; $HU = 100\log(H + 7.5W^{0.37})$, Where H = Albumen height in mm; W = Egg weight in grams. Hen day egg production was the average of daily egg production of the 3 replicates (8 birds per replicate). Percentage albumen weight and Yolk weight were calculated as the percentage of the albumen weight and yolk weight to the egg weight respectively. Shell thickness: The thickness of individual air-dried shells was measured to the nearest 0.01mm using micrometer screw gauge. Albumen height: The eggs were gently broken and the maximum albumen height was measured with tripod micrometer. Egg shape Index (ESI) calculated using the formula ESI = $\text{Width of egg (mm)}/\text{Length of egg (mm)}$

Statistical Analysis

Data collected were subjected to analyses of variance for a Completely Randomised Design in 3x3 factorial arrangements of treatments. Duncan Multiple Range test was utilized to separate significant means (SAS Version, 2012).

Result

The effects of main restriction and sub-restriction on the laying performance and egg quality parameters are shown in Table 2. In the main restriction, there was significant difference ($p<0.05$) in the body weight at lay (BWL). Birds maintained on R_1 have the highest value (1419.75 g) of BWL which was not significantly different ($p>0.05$) from R_0 birds but significantly different ($p<0.05$) from birds in R_2. In the main restriction, R_0 birds have the highest values of henday and yolk weight percentage while R_2 birds have the least values of henday, albumin height, yolk weight, and Haugh unit. The interaction of main feed restriction and sub-restriction is presented in Table 3. The result showed that the age at first lay of birds maintained on R_0r_0 was earlier than other treatments, while birds in R_0r_2 has the highest (140 days) age at first lay. The birds maintained R_0r_1 has the highest body weight (1483.89g) at first lay while the least (1240.19g) was recorded in R_2r_0 birds. There was no significant ($p>0.05$) difference in the weight of first egg across the treatments. However, R_0r_1 birds has the highest egg weight value (43.67g) while R_1r_2 has the least value (38.77g). Layers on R_0r_0 has the highest value (68.33%) of hen day which was not significantly different ($p>0.05$) from other treatments except R_2r_1 birds with the least value (53.41). The highest values of egg length were recorded in R_1r_0 birds. R_2r_0 birds had the significantly ($p<0.05$) highest values of albumen percentage.

Discussion

The average age at first lay of Isa brown in this study ranges between 127.33 days and 140days. The birds on *ad libitum* feeding both at chick and growing phases (R_0r_0) came to lay earlier than all other groups. All restriction groups were delayed at least by 3 days or more when compared to the *ad-libitum* group. The range of age at first lay in this study is earlier than the observed age at lay by Roll *et al.*, (2008) who reported an onset of lay for Isa brown hens at 21 weeks. Lala *et al*., (2016) reported an age at first lay of 153 days (21.86 weeks) for same strain of birds. The difference might be due to methods of rearing which is an important factor in poultry production (Ojedapo, 2013). The body weight at sexual maturity was significantly higher in *ad-libitum* and one day restriction groups (with the exception R_0r_0 group) than the two days restriction groups. Sandoral and Gernat (1996) found 3-5 days delay in sexual maturity age and partially an increase in body weight due to fee restriction.

Restricted feeding effects were significantly found on the henday, albumen percentage, albumen height, yolk percentage and Haugh unit. The *ad libitum* (R_0) and mildly restricted (R_1) performed better in all parameters mentioned above than the severely restricted birds (R_2), with the exception of albumen percentage. This result may be due to severity and length of feed restriction programme for birds (Mahmood *et al.*, 2007). The performance of the bird group on more severe restriction (R_2) programme performed low compared with birds on *ad libitum* feeding and one day restriction programme. The lower values of egg length were recorded in R_0r_0 and R_1r_2 birds. The remaining groups recorded higher and similar values.

In conclusion, age at first lay may be delay and body weight at sexual maturity reduced due to severe starter restricted feeding. However, henday and most egg qualities parameters are negatively affected due to severe feed restriction.

Table 2: Main effects of main restriction and sub-restriction on Egg production records and egg quality traits of Isa Brown layers

	Main restriction				Sub-restriction			
	R_0	R_1	R_2	SEM	r_0	r_1	r_2	SEM
Age first lay (days)	135.67	133.78	133.11	1.15	131.33	136.78	134.44	1.15
Body weight at 1st lay (g)	1398.94 [a]	1419.75 [a]	1285.23 [b]	20.68	1318.5	1398.63	1386.79	20.68
Weight of 1st egg (g)	42.54	41.05	41.74	0.66	42.12	43.03	40.18	0.66
Henday (%)	63.56 [a]	60.86 [ab]	55.07 [b]	1.44	60.52	60.99	57.97	1.44
Egg Weight(g)	64.44	64.36	64.99	0.39	64.72	64.71	64.36	0.39
Egg length (mm)	57.8	57.68	58.2	0.19	57.98	58.01	57.7	0.19
Egg width (mm)	35.37	34.82	35.12	1.56	35.03	35.38	34.9	1.56
Shell (%)	10.09	10.1	9.96	0.06	10	10.11	10.03	0.06
Shell thickness(mm)	0.51	0.5	0.51	0.00	0.5	0.51	0.51	0.00
Egg shape Index	0.61	0.61	0.6	0.03	0.6	0.61	0.6	0.03
Yolk Weight %	23.15 [a]	22.18 [b]	21.64 [b]	0.20	22.21	22.42	22.34	0.20
Albumin %	66.76 [b]	67.72 [ab]	68.4 [a]	0.21	67.79	67.47	67.63	0.21
Albumen height (mm)	9.3 [ab]	9.54 [a]	9.08 [b]	0.08	9.21	9.34	9.37	0.08
Haugh Unit	95.62 [ab]	96.77 [a]	94.28 [b]	0.41	95.1	95.66	95.9	0.41

Table 3: **Interaction of main restriction and sub-restriction on egg production records and egg quality traits of layers**

Main restriction	R_0			R_1			R_2			
Sub-restriction	r_0	r_1	r_2	r_0	r_1	r_2	r_0	r_1	r_2	SEM
Age at first lay (days)	127.33 ^{b}	139.67 ^{a}	140 ^{a}	134.67 ^{ab}	134 ^{ab}	132.67 ^{ab}	132 ^{ab}	136.67 ^{ab}	130.67 ^{ab}	1.15
Body weight at 1st lay (g)	1273.75 ^{b}	1483.89 ^{a}	1439.17 ^{a}	1441.56 ^{a}	1430.51 ^{a}	1387.19 ^{ab}	1240.19 ^{b}	1281.48 ^{b}	1334.02 ^{ab}	20.68
Weight of 1st egg (g)	41.46	43.67	42.5	42.13	42.23	38.77	42.75	43.2	39.26	0.66
Henday (%)	68.33 ^{a}	65.94 ^{ab}	56.4 ^{ab}	57.97 ^{ab}	63.63 ^{ab}	60.97 ^{ab}	55.26 ^{ab}	53.41 ^{b}	56.54 ^{ab}	1.44
Egg Weight(g)	0.61	0.61	0.61	0.6	0.62	0.6	0.6	0.6	0.61	0.03
Egg length (mm)	63.01	65.2	65.11	65.71	64.64	62.72	65.45	64.28	65.26	0.39
Egg width (mm)	56.84 ^{b}	58.22 ^{ab}	58.35 ^{ab}	58.77 ^{a}	57.49 ^{ab}	56.79 ^{b}	58.32 ^{ab}	58.31 ^{ab}	57.97 ^{ab}	0.19
Shell %	34.89	35.65	35.57	35.1	35.44	33.92	35.09	35.04	35.22	1.56
Shell thickness(mm)	6.44	6.48	6.55	6.47	6.61	6.37	6.47	6.51	6.42	0.04
Egg shape Index	10.22	9.96	10.08	9.89	10.23	10.18	9.89	10.15	9.85	0.06
Yolk Weight %	0.5	0.51	0.5	0.5	0.5	0.51	0.51	0.52	0.5	0.00
Albumin %	23.56 ^{a}	22.73 ^{abc}	23.15 ^{ab}	21.82 ^{abc}	22.4 ^{abc}	22.32 ^{abc}	21.26 ^{c}	22.13 ^{abc}	21.53 ^{bc}	0.20
Albumen height (mm)	66.22 ^{c}	67.31 ^{abc}	66.77 ^{bc}	68.29 ^{ab}	67.37 ^{abc}	67.5 ^{abc}	68.85 ^{a}	67.73 ^{abc}	68.62 ^{ab}	0.21
Body weight at 1st lay (g)	8.87	9.55	9.47	9.66	9.56	9.41	9.09	8.91	9.23	0.08
Haugh Unit	93.89	96.66	96.3	97.11	96.78	96.43	94.3	93.55	94.99	0.41

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