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Egg Production of Isa Brown and Bovan Nera Laying Hens as Affected by Body Weight During One Year Laying Cycle

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A B S T R A C T

Body weight of domestic chickens differs between strains, and has significant effect on their performance. In layers, it determines age at sexual maturity, percent peak production and total egg production. The aim of this study was to evaluate the genetic differences in egg production as affected by body weights at various ages of brown (Isa Brown) and black (Bovan Nera) feathered commercial layer strains. The birds were of the same age, and reared on deep litter system under similar housing, nutrition and management conditions. Data on egg production were collected on daily basis for a period of 52 weeks, while body weights were measured at regular intervals from commencement of egg production to end of lay. The results revealed that body weight has significant effect on egg production, and that both increased until 54 weeks of age. In addition, it was indicated in this study that percent egg production fluctuates with body weight in laying birds. Isa Brown appeared more sensitive to stress factors than Bovan Nera as the former recorded 70% drop in egg production when there was disease challenge on the farm compared to the latter's 64%. This implies that strain varies in their response to any stress factor, and that whatever affects body weight of layers will invariably impact negatively on their performance. In both strains, the weight that favored highest percent (peak) egg production ranged from 1840-1900g. The results indicate that percent egg production across strains increased with weight of the birds and declined when there was weight loss due to disease infection. Brown feathered birds suffered greater loss in term of egg production during the infectious period than their black feathered mates. Phenotypic correlation results showed that there were positive and significant relationships between body weight and egg production.

Key words: Egg, weight, strain, feather, birds

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INTRODUCTION

Egg production is an important quantitative trait normally measured to assess the genetic potentials of any breed or strain of domestic fowls. There are differences among strains in the expression of this reproductive trait, and it is also affected by nutrition, body weight, health status, temperature and management. Body weight of laying birds has direct and positive effect on their laying capacity between and within breeds raised in the same or different rearing environment. Body weight is moderately heritable and also affected by the environment. Robinson and Sheridan (1982) and Summer and Leeson (1983) documented that body size of laying birds has effect on egg size and feed intake. Previous workers had reported significant positive genetic correlation between body weight and egg weight of birds (Duncan and Mench, 2000; Santos *et al*., 2000; Webster, 2000). In Pakistan, Haq *et al*. (2011) observed significant differences in body weight and egg production of Fayoumi and Dokki hens at various ages. The authors also found positive correlation between body weight and egg weight in the two breeds. It is imperative to have the understanding of the relationship between weight of laying birds and production traits in order to monitor and control their weight during growing and laying stages so as to be able to obtain maximum egg numbers from the birds before going into natural molting or culled as a result of old age. In a previously published data, Ayorinde and Oke (1995) reported that there was no significant difference in egg production traits between heavy and low body weight birds. In a recent study, Udeh (2007) observed that rearing birds on weight basis has no comparative advantage since high and light body weight group of birds reared in the same environment recorded similar results in hen-day egg production between different breeds. Within-breed however, the author found that heavier birds of brown plumage were feed efficient than their light weight mates. The findings of the worker were at variance with previously published reports (Render and McDaniel, 1984; Ayorinde *et al*. 1988; Ayorinde and Oke, 1995). The researchers asserted that low body weight birds were superior to high body weight

in egg production. In guinea fowl, Oke *et al*. (2004) reported that body weight has positive effect on egg number, egg weight, yolk weight and albumen weight. The workers also found positive phenotypic correlation between body weight and egg number. Excessive weight of laying birds as a result of fat deposition has always been a problem in laying flock leading to prolapse, drop in egg production and high mortality. In the same vein, birds that are under-sized or small in size during laying due to underfeeding, disease or poor management will not be able to produce optimally because there is strong association between body weight and production traits in hens (Ayorinde *et al*., 1988; Asuquo, 1994). In contrast, Harms *et al*. (1982) reported negative correlation between body weight and egg number. In view of contrasting reports on the influence of laying birds' weight on egg production, this study was conceived and carried out to assess the effect of body weight on egg production of brown and black plumage hens. The study will reveal the weight range that positively influenced production, and the phenotypic correlation between body weight and egg production at various ages.

MATERIALS AND METHODS

Study location

The study was carried out at the Animal Breeding Unit, Teaching and Research Farm, Ekiti State University, Ado-Ekiti for a period of 52 weeks from September, 2008 -August, 2008. Ado-Ekiti is situated along latitude $7^0 31^1$ and $7^0 49^1$ North of the Equator and longitude $5^0 71^1$ and $5^0 27^1$East of the Greenwich meridian. The city falls under Derived Savannah zone. The city enjoys two separate seasonal periods namely, Rainy (May-October) and Dry (November-April) seasons.

Management and experimental birds

The two strains raised were Isa Brown (IB) and Bovan Nera (BN). One hundred (100) day-old chicks of each strain were purchased from local hatcheries and reared under the same housing and management conditions. Each strain was housed in standard, well constructed open-sided but separate pens (deep litter) from day-old till the commencement of laying. Cleanliness and other sanitary measures such as removal of caked or wet litters were carried out at regular intervals. The birds were vaccinated against Newcastle, Fowl pox and other viral diseases, while antibiotics were administered occasionally to prevent bacterial infection. They were dewormed and given vitamins at regular intervals. At 5% production, layers mash was introduced and given *ad libitum* containing 2650 Kcal/MEkg and 16.5% CP fortified with micronutrients. Fresh, clean water was given *ad libitum*. Debeaking was carried out at the commencement of egg production in order to reduce the incidence of egg cannibalism and pecking. All the experimental birds were housed on the floor and were subjected to the same treatments. Their production cycle covered both dry and wet seasons, and were carefully monitored so as to obtain an unbiased data. The data collected lasted 52 weeks of production (24^{th} week - 76^{th} weeks). Body weights were taken at monthly intervals after starving the birds overnight. Daily records of eggs produced and feeds consumed from 24^{th} week till the end of the experiment, that is, 76^{th} week were registered and used for this study.

Statistical analysis

Data collected were subjected to T-test using SAS (2001) computer package.

The appropriate statistical model used was:

$Y_{ijk} = \mu + G_i + B_j + $ ijk

Y_{ijk} = observation of the k^{th} population, of the j^{th} body weight and i^{th} genotype

μ= common mean

G_i= fixed effect of i^{th} genotype (i=2)

H_j= fixed effect of j^{th} body weight (j=11)

ijk= random error normally and independently distributed with zero mean and common variance.

RESULTS

Egg production (pooled data) of two strains of commercial layers as affected by body weight between 24 and 76 weeks of age were studied and presented in Table 1. It was found that mean values for body weight of hens

Table 1: Production Performance of two strains of commercial layers (pooled data) at different ages

Age (weeks)	Traits	
	Body weight (g)	Egg production (%)
24	1672±0.15	69.43
32	1868±0.15	91.57
36	1846±0.17	84.07
41	1872±0.18	86.72
46	1870±0.19	82.71
50	1944±0.16	86.00
54	1941±0.18	87.29
58	1852±0.19	28.36
63	1857±0.16	71.79
69	1877±0.17	72.14
76	1891±0.23	61.86

Table 2: Least square means showing the effect of body weight on egg production of the two commercial layer strains

Ages (weeks)	Strains	Traits	
		Body weight (g)	Egg production (%)
24	BN	1650±0.03	74.71[a]
	IB	1700±0.02	64.14[b]
32	BN	1870±0.03	90.14[b]
	IB	1870±0.03	93.00[a]
36	BN	1810±0.03	81.43[b]
	IB	1870±0.03	86.71[a]
41	BN	1880±0.03	86.29[b]
	IB	1870±0.03	87.14[a]
46	BN	1940±0.03[a]	85.71[a]
	IB	1800±0.03[b]	79.71[b]
50	BN	1940±0.03	86.57[a]
	IB	1950±0.02	85.43[b]
54	BN	1990±0.04	85.43[b]
	IB	1890±0.03	89.14[a]
58	BN	1890±0.05	30.43[a]
	IB	1810±0.03	26.29[b]
63	BN	1880±0.03	74.29[a]
	IB	1830±0.03	69.29[b]
69	BN	1870±0.03	68.57[b]
	IB	1880±0.03	75.71[a]
76	BN	1870±0.04	63.86[a]
	IB	1910±0.05	59.86[b]

BN: Bovan Nera (black); IB: Isa Brown (brown)

Table 3: Phenotypic Correlations between body weight and egg production for various ages (pooled data)

Trait	Age (weeks)										
	24	32	36	41	46	50	54	58	63	69	76
Egg production	-.175	-0.008	0.211	-0.017	0.392**	-0.050	-0.276	0.230	0.149	0.025	-0.095

**P<0.01

increased from 24th to 50th week of age and decreased gradually thereafter. Egg production followed the same trend as body weight. Percent egg production reached its peak (91.57%) at 32th week of age when the birds were still growing bones and muscle. A sudden and drastic drop in egg production was witnessed between 54th and 58th week due to respiratory disease problem that attacked the flock though no mortality was recorded.

The mean values for body weight and percent egg production for the two strains were as shown in Table 2. Body weight of the two strains was not significantly (P>0.05) different at various ages except at week 46. At this time, that is, 46th week, Bovan Nera had superior (P<0.01) and higher body weight than Isa Brown and equally recorded higher percent hen-day egg production. However, egg production differed (P<0.01) significantly between strains at various ages during the observed period. The mature body weight when the highest hen-day egg production was recorded for both strains was 1840-1900g, and this happened at 32nd week of age. There were, however, fluctuations in body weight across strains from when the birds peaked (90-93%) at 32nd week to the time they were culled at 76th week.

In this study (Table 3), body weight has significant (P<0.01, r=0.392)) positive phenotypic correlation with egg production only at 42-46 weeks of age. Below and above this range, there was no significant (P>0.05) correlation between the two traits.

DISCUSSION

Both brown and black feathered birds increased in body weight until a particular period when age set in leading to gradual decline. This consistent increase in body weight also affected the total number of eggs produced during the time. However, when the birds lost some weights due to disease infection, egg production also fell drastically. This study further reinforced the assertion made by Oke *et al*. (2004) that hen-day egg production depends on the body weight of laying birds to a certain age in the absence of any disease or stress factor. Therefore, it can be said that any factor that improves physiological development of the bird will doubtlessly enhance and promote better performance. It was also noted that egg production was restored to pre-infection period the moment the birds were medicated with drug of choice, and were back to normal production.

Generally, body weight has significant effect on hen-day egg production between strains at various age subdivisions. All the birds made initial body weight gains and increased egg production. The effect of these fluctuations in body weight was seen on the egg numbers which also went up and down depending on the degree of decrease in weight values. The consistent fluctuations in body weight observed in this study could be attributed to increasing demand for nutrients from physiological reserve to meet the demand for egg production (Ayorinde *et al*., 1988). Strain-basis data showed that Isa Brown had superior (93%) egg production at peak production compared to Bovan Nera (90%). Their body weight (1870g) at peak production was similar, that is, no significant difference between them. The notable and significant findings of this study was recorded when the two strains were infected with respiratory disease between 55-58 weeks of age. The negative effect of this infection showed that Isa Brown and Bovan Nera lost 80g and 100g, respectively in body weight. When translated to percentages, the former had 4.23% weight loss, while the latter recorded 5.03% weight loss during the 4-week infectious period. This implies that Bovan Nera suffered more in terms of weight loss than Isa Brown during the disease condition though no mortality was recorded for the two strains. The respiratory problem caused sudden and sharp drop in egg production across strains. With regards to egg production pattern during the infectious period, Isa Brown appeared worse hit than Bovan Nera as the former had 70% drop in egg production compared to Bovan Nera which recorded 64%. This further demonstrates the fact that egg production at whatever age depends on body weight of hens, and that whatever affects the latter will have concomitant effect on the former. The study also reveals that strains differ in their response or reaction to stress factors such as inadequate feeding (quantity and quality), poor management, disease challenge and unfavorable weather conditions. After medication and recovery from ill-health, the two strains were not able to produce as much as they did before the disease attack. This was due to the fact that their weights had been negatively affected by the disease problem.

With regard to correlation between body weight and egg production, this study found a positive significant phenotypic correlation between the two traits. The result implies that body weight has positive influence on egg production. The result partially agrees with the observation of Oke *et al*. (2004), but contradicts the findings of Harms *et al*. (1982) who reported a negative correlation between body weight and egg number.

Conclusions

- Body weight of laying birds across strains increased from commencement of laying to a certain age and then declines gradually under normal conditions.
- Percent egg production across strains increased with weight of the birds and declined when there was weight loss due to disease infection during the course of the study.
- Brown feathered birds suffered greater loss in term of egg production during the infectious period than their black feathered mates.
- The two strains recorded highest percent egg production at 32nd week of age and at the same body weight (1870g).

- Phenotypic correlation result shows that there exists positive correlation between body weight and egg production.

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