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COMPARATIVE PERFORMANCE OF COMMERCIAL STRAINS OF LAYER CHICKENS REARED IN SEMI ARID TROPICS AND FED DIETS SUPPLEMENTED WITH VITAMIN C

Sabo, M. N.[1]*, Hameed, H.[1], Garba, M. G.[1], Runka, J. Y.[1], Usman, H. B.[1] and Tukur, R.[2]

[1]*Department of Animal Science, Federal University Dutsin-ma, Nigeria.*
[2]*Department of Geography and Regional Planning, Federal University Dutsin-ma, Nigeria.*
Corresponding Author: Email:mustynalado@gmail.com; Phone number: +2348061524895

ABSTRACT

This study was conducted to determine the performance of Lohmann Brown Classic (LBC) and Nera Black (NB) strains of layer chicken fed diet supplemented with vitamin C. One hundred and twenty (120) 28 weeks old laying hens (Sixty for each strain) were assigned to four treatments in a completely randomized design and a 2 x 2 factorial arrangement made up of two strains (LBC and NB) and Vitamin C supplementation (0 and 0.25g/kg feed). Each treatment was replicated thrice with ten birds per replicate. Hen day egg production, egg weight, feed intake, feed conversion ratio, feed cost and weight change were measured and computed. Data obtained were analyzed using the general linear models (GLM) procedure. The results of the study showed that final body weight (kg/bird) of LBC (1.84kg/bird) and NB (1.80kg/bird) were similar. The average weight change of LBC (3.40%) was higher ($P<0.05$) than that of NB (0.34%). The daily feed intake (g/bird) of LBC (157.45) was higher ($P<0.05$) than that of NB (144.00). Feed conversion ratio (g feed/dozen eggs), egg weight and feed cost/crate (₦) were similar ($P>0.05$) for the two strains. The LBC strain laid more ($P<0.05$) eggs (88.17) than the NB strain (78.55). Vitamin C supplementation did not affect ($P>0.05$) all the performance indices evaluated in the study except for feed cost/crate. Feed cost/crate (₦) of the hens fed with vitamin C (836.90) was higher than those fed without vitamin C (660.34). Both LBC and NB strains performed almost similarly.

Keywords: Semiarid, Strains, Vitamin C, Feed intake, Chicken,

INTRODUCTION

Although the need for more eggs and poultry meat is obvious and the availability of these products can go a long way to meet the protein needs of several populations in Nigeria, there are several constraints to the future development of the poultry industry. The first and foremost is the availability of capital. Secondly, the availability of adequate supplies of grain and protein supplements necessary for the formulation of poultry feeds and the need to develop the various supporting industries necessary for commercial poultry production.

The global climate change is increasingly impacting poultry production by high ambient temperatures, especially where poultry are reared in open sided houses in developing countries (Wang *et al.*, 2018). High temperature, especially when coupled with high humidity, imposes severe stress on birds and leads to reduced performance (Daghir, 2008). Fortunately, during the past three decades, there has been a great deal of development in housing and housing practices for hot climates, and most modern poultry houses have been properly insulated (Daghir, 2008). Genetics significant control the response to heat stress in poultry (Wang *et al.*, 2018). Most of the major international poultry breeders are located in temperate countries (Canada, France, Germany, the Netherlands, the UK and the USA). Nevertheless, much of the world's poultry production takes place under more extreme temperature conditions (Gowe and Fairfull, 2008). Oyeagu *et al.*, (2015) observed that strain did not affect performance parameters of Nera Black and Shaver Brown layer chicken strains except for hen day egg production and feed intake.

Poultry have the ability to synthesize ascorbic acid, or vitamin C in their body; hence, no recommended requirement is established by the National Research Council (NRC, 1994; Shojadoost, *et al*., 2021). It is generally assumed that the endogenous synthesis is adequate to meet biological demands in poultry (Amaefule *et al.*, 2004). During certain conditions Vitamin C supplementation provides benefit to layers such as egg production performance, egg size, yolk quality etc. Ascorbic acid can also be added to poultry feed to maintain egg production and egg shell quality during heat stress (Leeson and Summers, 2005). It has also been reported to improve liveability and performance of poultry (Abidin and Khatoon, 2013). Common stress factors in modern poultry production in the tropic include high ambient temperatures (AT) and relative humidity (RH), which often occurs concurrently with other stress factors especially during the hot-dry season (Bulent and Niyazi, 2018). Studies on supplemental feeding of Vitamin C to bird in Nigeria are of interest to consumers who are willing to consume low cholesterol eggs and to poultry farmers who are willing to improve the efficiency of egg production (Amaefule *et al.*, 2004). The objectives of the present study were to investigate the effects of vitamin C in diets of NB and LBC layers on their performance.

MATERIALS AND METHODS

The research was conducted at the Poultry Unit of the Livestock Teaching and Research Farm, Department of Animal Science, Federal University Dutsin-ma, Katsina State, Nigeria. It lies on longitude 07°29ˈ56ˈˈE and 07°30ˈ04ˈˈE and latitude 12°27ˈ10''N and 12°27ˈ16''N at an altitude of 605m above sea level with an average temperature of 33°C. The climate of the area is semiarid classified as tropical wet and dry climate (Tukur *et al.*, 2013).

Experimental animals and management

A total of 120 twenty-eight weeks old layer chicken comprising of sixty per strain were used in the study. The birds were reared in a deep litter. Feed and water were supplied *ad libitum.* The study lasted for 8 weeks. The birds were fed layer mash. All other routine management practices were strictly adhered to.

Experimental design, data analysis and data collection

Experimental design

The experiment was carried out using a 2 × 2 (two strains x two levels of Vitamin C) factorial arrangement in a completely randomized design with two strains (brown and black) and two vitamin C supplementation levels (0g/kg and 0.25g/kg feed). The birds were allocated to four treatments with each treatment having three replicates and 10 birds per replicate. All birds were fed maize based layer diet (Table 1).

Measurements

Feed intake and live weight gain

The birds were weighed to the nearest gram in the early morning before receiving any feed and water at weekly intervals during the experimental period. Total feed intake, weekly feed intake, initial body weight and final body weight were measured. Weight change was determined as indicated in the formula below:

$$\text{Weight change (\%)} = \frac{\text{Final body weight} - \text{Initial body weight}}{\text{Initial body weight}} \times 100$$

Egg production and egg weight

Egg production and egg weight were recorded daily and pooled weekly to calculate hen day production (HDP) using the formula below:

$$\text{Hen day production (\%)} = \frac{\text{No. of eggs laid a day} \times 100}{\text{No. of birds available that day}}$$

$$\text{Feed conversion ratio} = \frac{\text{Feed intake (g)}}{\text{Number of dozen eggs produced}} \times 100$$

Weekly hen day egg production, feed conversion ratio (FCR) and feed cost/crate were determined.

Table 1: Composition (%) of Experimental Diet

Ingredient	Quantity
Maize	60.20
Soyabean meal	15.00
Groundnut cake	6.00
Wheat offal	5.00
Bonemeal	3.50
Limestone	9.50
Salt	0.25
Methionine	0.20
Lysine	0.10
Premix	0.25
Total	100.00
Calculated analysis	
ME (kcal/kg)	2671.70
Crude protein (%)	16.00
Crude fibre (%)	3.10
Ether extract (%)	3.02
Calcium (%)	4.70
Phosphorus (%)	0.89
Methionine (%)	0.52
Lysine (%)	0.93

Data analysis

Data obtained were analyzed using the general linear models (GLM) procedure of SAS software (SAS, 1994). Initial weight was used a covariate in the analysis using analysis of covariance ANCOVA procedures. Where the analysis was significant, Duncan's multiple range test was used to separate treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Effect of strain on performance layer chicken

Table 2 shows the effect of strains on the layers' performance. It shows that the initial weight was higher (P<0.05) in NB (1.78kg/bird) than LBC (1.49kg/bird). Final body weight (kg/bird) of LBC (1.84kg/bird) and NB (1.80kg/bird) were similar. The average weight change of LBC (3.40%) was higher (P<0.05) than that of NB (0.34%). The daily feed intake (g/bird) of LBC (157.45) was higher (P<0.05) than that of NB (144.00). Feed conversion ratio (g feed/dozen eggs), egg weight and feed cost/crate (₦) were similar (P>0.05) for the two strains. The LBC strain laid more (P<0.05) eggs (88.17) than the NB strain (78.55).

Table 2: Effect of strain on the performance of the two layer chicken strains

Parameters	LBC	NB	SEM
Initial weight (kg/bird)	1.49^{b}	1.78^{a}	0.04
Final weight (kg/bird)	1.84	1.80	0.1
Average Weight change (%)	3.40^{a}	0.34^{b}	0.64
Daily feed intake (g/bird)	157.45^{a}	144.00^{b}	4.09
Egg weight (g)	58.57	57.27	0.62
Hen day production (%)	88.17^{a}	78.55^{b}	2.72
Feed conversion ratio (g feed/dozen eggs)	2147.86	2213.02	81.50
Feed cost / crate (₦)	740.31	756.93	29.15

$^{a, b, c}$; Mean values in a row with different letter superscripts are significantly (P<0.05) different. SEM= Standard Error of Mean

The initial weight of NB was statistically (P<0.05) higher than that of LBC. This was similarly reported by Imouokhome and Ojogho (2012) when they compared Bovans Nera with other commercial strains. The difference in body amongst the strains used for this study may likely due their genetic make-up as genotype has significant effect on body weight (Imouokhome and Ojogho, 2012). However, the final weight of both strains was similar showed that the LBC strain has the ability for compensatory growth. The higher feed intake of the LBC compared NB agreed with the findings of Valemtim *et al.* (2019) who observed higher intake in the brown strain compared to the black strain laying chickens in their study. The higher feed intake may also be related to the compensatory growth observed. On the contrary, Oyeagu *et al.* (2015) reported higher feed intake in Nera black strain compared to Shaver brown strain. Egg quality parameters were not affected by strain. Egg weight of was similar for both strains. This may be due to the similar age of the birds and their similar final body weight as age and weight of laying hens are the major determinants of egg size (Valemtim *et al.,* 2019). Body weight and egg weight are correlated (Leeson and Summers, 2005). Hen day production (%) was significantly (P<0.05) influenced by strain with LBC laying more eggs than NB. This is consistent with the findings of Olawumi and Adeoti (2009) who reported that higher hen day production for Isa Brown chickens compared to Bovan Nera. Oyeagu *et al.* (2015) also observed different hen day production with Nera black strain producing more eggs than Shaver brown strain. Feed cost/crate (₦) was statistically similar between the two strains. NB had higher numerical values than LBC. This agrees with findings of Oyeagu *et al.* (2015) who also reported cost per dozen eggs between black and brown layer chicken strains.

Effect of vitamin C on performance layer chicken

Table 3 shows the effect of vitamin C on the performance of layers. Vitamin C supplementation did not affect (P>0.05) all the performance indices evaluated in the study except for feed cost/crate. Feed cost/crate (₦) of the hens fed with vitamin C (836.90) was higher than those fed without vitamin C (660.34). Daily feed intake (g/bird) was not significantly (P>0.05) different between the intake of feed between layers fed diets supplemented with vitamin C or without vitamin C.

Table 3: Effect of Vitamin C on the Layers Performance

Parameters	Without vitamin C	with vitamin C	SEM
Initial weight (kg/bird)	1.61	1.66	0.04
Final weight (kg/bird)	1.80	1.84	0.1
Average Weight change (%)	2.00	2.00	0.64
Daily feed intake (g/bird)	145.34	156.07	4.09
Egg weight (g)	58.43	57.41	0.62
Hen day production (%)	79.79	86.93	2.71
Feed conversion ratio/dozen (g feed/dozen eggs)	2201.14	2156.74	81.50
Feed cost / crate (₦)	660.34^{b}	836.90^{a}	29.15

$^{a, b, c}$; Mean values in a row with different letter superscripts are significantly (P<0.05) different. SEM= Standard Error of Mean.

The similarity in performance of layer fed with or without vitamin C is in conformity with the findings of Ali *et al.* (2010) and Amaefule *et al.*, (2004) who observed that vitamin supplementation did not improve laying hen performance. This may be due to the fact that the animals were not under thermal or other forms of stress. Stressful conditions were reported to increase requirement for vitamin C and therefore supplementation may alleviate adverse effects and probably improve performance (Ali *et al.*, 2010; Amaefule *et al.*, 2004; Shojadoost, *et al*., 2021). The feed cost/crate (₦) of the layers given vitamin C supplement was statistically higher (P<0.05). This may be due to the higher cost of feed resulting from vitamin C supplementation.

Effect of strain on weekly egg production

Table 4 shows the effect of strain on weekly egg production. It was noted that the egg production was significantly (P<0.05) higher in LBC strain only in the 28th week. The rest of the weeks recorded similar performance (P>0.05). It was noted that the egg production was significantly (P<0.05) higher in LBC strain only in the 28th week. This agrees with the observation of Obike *et al.* (2011) who reported that hen day production was different between strains they studied.

Table 4: Effect of strain on weekly hen day egg production (%)

Age	LBC	NB	SEM
28th Week	86.37[a]	74.18[b]	2.74
29th Week	90.70	82.51	2.94
30th Week	92.89	84.50	3.04
31st Week	91.80	82.46	3.37
32nd Week	87.06	76.01	4.41
33rd Week	84.27	77.20	5.24
34th Week	84.18	73.08	4.76
35th Week	88.09	78.47	4.39

[a, b, c]; Mean values in a row with different letter superscripts are significantly (P<0.05) different. SEM= Standard Error of Mean.

Effect of strain on weekly feed intake

Table 5 shows the effect of strain on weekly feed intake. There feed intake values in week 3, 6 and 7 were significantly (P<0.05) higher among the LBC strain than the NB strain. Feed intake in other weeks was statistically similar (P>0.05).

The feed intake values in weeks 30, 33 and 34 were significantly (P<0.05) higher among the LBC strain than the NB strain. This may be as explained earlier that the LBC strain has the ability for compensatory growth which may be related to higher feed intake.

Table 5: Effect of strain on weekly feed intake (kg/bird)

Age	LBC	NB	SEM
28th Week	0.20	0.19	0.008
29th Week	0.13	0.12	0.005
30th Week	0.16[a]	0.13[b]	0.004
31st Week	0.14	0.13	0.006
32nd Week	0.14	0.13	0.004
33rd Week	0.15[a]	0.14[b]	0.004
34th Week	0.15[a]	0.14[b]	0.004

[a, b, c]; Mean values in a row with different letter superscripts are significantly (P<0.05) different. SEM= Standard Error of Mean.

Effect of vitamin C on weekly egg production

Table 6 shows effect of vitamin C on weekly egg production. It was observed that the egg production statistically (P<0.05) higher in hens fed diets supplemented with vitamin C in the 30th and 34th week. The rest of the weeks showed no significant (P>0.05) difference. Egg production was higher in hens fed diets supplemented with vitamin C in the third and seventh week only.

Table 6: Effect of vitamin C on hen day egg production (%)

Age	Without vitamin C	With vitamin C	SEM
28th Week	80.63	79.92	2.75
29th Week	85.82	87.40	2.94
30th Week	83.04^{b}	94.35^{a}	3.05
31st Week	86.26	88.00	3.37
32nd Week	77.82	85.24	4.41
33rd Week	77.65	83.81	5.24
34th Week	70.16^{b}	87.09^{a}	4.76
35th Week	76.88	90.00	4.39

$^{a, b, c}$; Mean values in a row with different letter superscripts are significantly (P<0.05) different. SEM= Standard Error of Mean.

Effect of vitamin C on weekly feed intake

Table 7 shows the effect of vitamin C on weekly feed intake. The feed intake in week 3 was significantly (P<0.05) higher for birds fed diet supplemented with vitamin C. There were no significant (P>0.05) differences in feed intake in other weeks.

The feed intake in week 3 was significantly higher among the birds supplemented with vitamin C. Meanwhile there were no significant (P>0.05) differences in feed intake in other weeks. These findings were similar to those of Ali *et al.* (2010) and Amaefule *et al.*, (2004) as highlighted above.

Table 7: Effect of vitamin C on weekly feed intake (kg/bird)

Weeks	Without vitamin C	With vitamin C	SEM
28th Week	0.19	0.20	0.008
29th Week	0.13	0.14	0.005
30th Week	0.14^{b}	0.15^{a}	0.004
31st Week	0.13	0.14	0.006
32nd Week	0.14	0.14	0.004
33rd Week	0.14	0.15	0.004
34th Week	0.14	0.15	0.004

$^{a, b, c}$; Mean values in a row with different letter superscripts are significantly (P<0.05) different. SEM= Standard Error of Mean.

CONCLUSION AND RECOMMENDATION

From the results of this study, it can be concluded that both LBC and NB strain performed almost similarly. Both strains showed viability during the test period. Vitamin C supplementation was not beneficial to laying hens if they are under normal conditions.

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