Performance, Egg and Serum Biochemical Constituents of Four Commercial Pullet Strains in Nigeria

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ABSTRACT

The aim of this research was to evaluate the performance and biochemical constituents of egg and blood of four commercial pullet strains in Nigeria with specific reference to Isa Brown, Bovan Nera, Goldline Nera and Dominant Black. Pullet chicks of foreign origin whose parents were raised in Nigeria were used for this study. A total of 300 pullet chicks were used, comprising seventy-five (75) Bovans Nera, Seventy-five (75) Bovans Goldline, Seventy-five (75) Dominant Black and Seventy-five (75) Isa Brown from day old. The birds in each treatment were randomly grouped into three replicates per treatment. Replication was done to equalize the mean initial live weight. Analyzed result showed that Isa Brown and Dominant Black values were significantly ($P<0.05$) higher than that of Bovans Goldline, Bovans Nera for the pre-production performance characteristics of the strains of birds, however, the final live weight was highest ($P<0.05$) in Bovans Nera, (1272.00g) while that of the rest three strains were similar ($P>0.05$) (1245.67 g – 1248.33 g). Bovans Nera had the best live weight at 18 weeks, Bovans Nera and Bovans Goldline recorded the best FCE at 18 weeks, these may be an advantage to producers of point of lay, Mortality to point of lay was lowest in Dominant Black, Egg production to 30 weeks of age was best in Isa Brown and Dominant Black, Shell thickness and Egg shape index which is very important in egg sales and transportation is also best in Isa Brown, Cholesterol was lowest in Isa Brown. The study revealed differences in performance production characteristics and egg and serum biochemical indices, hence the best strain regards to the indices is Isa Brown, then Bovans Nera, Dominant Black and Bovans Goldline respectively.

Keywords: Genotype, Bovan Nera, Goldline Nera, Dominant black, Isa Brown.

INTRODUCTION

In a developing country such as Nigeria, there is a general awareness of the "Protein gap "in the human diet. This gap denotes the inadequacy of animal protein consumed by the average Nigerian. The average person consumes 45.4g against 53.8g which the World Health Organization (WHO) recommended (FAO/IFAD, UNICEF, WFP and WHO, 2019). This can be largely and rapidly bridged by the intensive production of domestic fowl. Many countries have adopted the domestic fowl as a means of economic empowerment due to the quick returns on capital investment arising from the short generation interval of the birds which makes it attractive to entrepreneurs (FAO, 2003b). Demand for meat and meat products is increasing daily due to the increased need for animal protein by the populace. Meat is a good source of protein which is required for growth, body tissue development, replacement of worn-out tissues, blood production, and body system maintenance and as a component of the immune system of the body (Aletor, 1983; Ahmad *et al,,* 2018). The availability of animal protein sources such as fish, meat, milk and poultry is limited by the high cost of animal production, Feed accounts for about 70% of the cost of production cost of monogastric animals (Aletor, 2000).

The supply of good quality chicks to producers as a measure towards improving the poultry sector has been emphasized (Fatuga, 1977; Geidam *et al,,* 2007). Also, Okon and Ekpenyong (1997) pointed out that there has been a lack of good quality hatchable eggs and highly productive indigenous parent stock and these have contributed to the inadequacy of day-old chicks supplied. Due to the proliferation of local franchise hatcheries in the country, there has been an increased supply of day-old chicks imported from different breeders companies

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abroad who breed different exotic breeds of chicken, like Isa Brown, Bovans Nera, Bovans Goldline, Dominant Blue, Dominant Black, Harco, Shaver Star Cross etc (Asuquo *et al,*, 1992; Emmanuel-Ohagenyi and Simeon, 2023). Unfortunately, there is a lack of adequate information on the choice of stock by producers in Nigeria on the qualities of the birds (Oluyemi, 1998; Akintunde, 2015). Egg production is the major index to measure the performance of commercial layers, it accounts for about 90% of the income in egg production, and other characteristics include egg size, egg quality, body weight, the efficiency of feed utilization and mortality (Hesham and Tamer, 2012).

There are two major approaches to the improvement problem. i.e. genetic improvement and environmental improvement. Genetic improvement has been greater for egg layers than any class of livestock except broilers. This resulted from improvement in four components of production, this includes, age at first egg, peak performance, sustained rate of lay and livability. The environmental factors affecting performance include nutrition, temperature, relative humidity, ventilation, stocking rate, pathogens, pollutants, stress, light and diseases (Oluyemi and Robert, 2000). The two important criteria of pullet quality are uniformity within and proper body weight at a specific age (Richard and Jackqueline, 2008). The aim of this research was to evaluate the performance and biochemical constituents of egg and blood of four commercial pullet strains in Nigeria with specific reference to Isa Brown, Bovan Nera, Goldline Nera and Dominant Black.

MATERIALS AND METHODS

Experimental Location

This study was conducted at the Teaching and Research Farm, College of Agricultural Sciences, Olabisi Onabanjo University, Yewa Campus, Ayetoro. The site is in Yewa North Local Government, a derived savanna zone, of Ogun state, Nigeria.

Experimental Animals

Pullet chicks of foreign origin whose parents were raised in Nigeria were used for this study. A total of 300 pullet chicks were used, comprising seventy-five (75) Bovans Nera, Seventy-five (75) Bovans Goldline, Seventy-five (75) Dominant Black and Seventy-five (75) Isa Brown from day old.

The strains and their origin are as follows:

(i) Bovans Nera and Goldline - Netherlands,

(ii) Isa Brown- France

(iii) Dominant black – Czech Republic.

Experimental birds and management

The birds were housed in the Teaching and Research farm. The pen was thoroughly cleaned and disinfected with disinfectant, and wood shavings were used as litter material. Feeders and drinkers were provided and charcoal pots and lanterns served as heat and light sources respectively. The open sides of the house were covered with polythene to conserve heat during the brooding phase.

Commercial feed was used throughout the trial and this consisted of chicks mash, growers mash and layers mash. The proximate composition of the feeds was determined (A.0.A.C., 2023).

All routine health management practices of vaccination, medication and deworming were observed and feed and water were offered ad libitum.

During the brooding phase which lasted for four weeks, the birds were grouped into four treatments, each breed representing a treatment, but after week four, the birds in each treatment were randomly grouped into three replicates per treatment. Replication was done to equalize the mean initial live weight. The replicates were

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

randomly assigned to pen as A1, A2, A3 for Isa Brown, B1, B2, B3 for Bovans Nera, C1, C2, C3 for Bovans Goldline and D1, D2, D3 for Dominant Black.

Data Collection

The data collected/computed during the experiment were:

(i) Average weekly growth rate

The growth rate was determined as the difference in body weight taken before each of the weeks.

(ii) Weekly feed intake

Feed intake was determined weekly as the difference between feed offered for the week i.e. Total feed consumed per week/no of birds.

(iii) Feed conversion ratio

Computed as feed intake (g) per body weight gain (g) and feed intake (kg) per kg egg layer.

(iv) Mortality

Mortality was computed in three phases i.e. brooding phase, growing phase and laying phase.

(v) Age at first egg, Age at 5% production, Egg production record (hen day production %)

(vi) Egg weight per strain (weekly) using sensitive scale

(vii) Egg shape index

The egg width and egg length were measured with a vernier calliper. The unit of measurement was a millimetre.

Shell thickness

A micrometre screw gauge was used and the average of these was taken as the shell thickness.

Chemical Analysis

Diets AOAC, (2023)

Proximate analysis of experimental diets was done in the laboratory (Table 3)

Diet	CP	EE	CF	ASH	MC	DM	CA	P
Chicks	21.02	9.75	8.41	4.21	12.61	87.40	0.68	0.71
Growers	16.56	7.91	6.42	3.67	11.88	88.06	0.48	0.58
Layers	17 05	8.60	5.25	3.73	11.87	88.12	2.75	0.84

CP Crude protein, EE ether extract, CF= crude fibre, MC= moisture content, DM= dry matter, CA= calcium, P= phosphorus.

Eggs And Serum Biochemical Parameters

At weeks 24 and 30, blood samples (5ml) were taken into plastic tubes containing anti-coagulant ethylene diamine tetra-acetic (EDTA) for the determination of haematological parameters. Serum protein was determined using the Biuret method (Reinhold, 1995). Albumen fat was estimated by [Bayoumi et al (1986)] fatty acid

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(Pearson, 1980). Total cholesterol in eggs (Embert, 1974). Calcium and Phosphorus, Preer and Rosen, (1977).

Statistical Analysis

The data obtained were subjected to analysis of Variance using the general linear model (GLM) procedure (S.A.S, 2000). Significant means were separated using the Duncan Multiple Range Test.

RESULTS AND DISCUSSION

Pre-production performance characteristics of the strains of birds

There was significant (P<0.05) difference for the mean initial live weight among the strains of birds. Isa Brown and Dominant Black values were significantly (P<0.05) higher than that of Bovans Goldline, Bovans Nera.

Table: Performance characteristics of different strains of birds (0-18 weeks)

	Isa Brown	Bovans Nera	Bovans Goldline	Dominant Black	SEM
Initial live wt/bird/(g)	55.00^{a}	54.67^{ab}	54.33^{b}	55.00^{a}	0.18
Final wt/bird/(g)	1302.67^{b}	1326.67^{a}	1300.00^{b}	1303.33^{b}	2.53
Weight gain/bird/(g)	1247.67^{b}	1272.00^{a}	1245.67^{b}	1248.33^{b}	2.53
Feed intake/bird/(g)	39,037^{b}	39,047^{b}	38,405^{c}	40,250^{a}	0.38
FCE	0.31^{b}	0.30^{c}	0.30^{c}	0.32^{a}	0.06
Mortality (%)	2.67	2.67	6.67	1.33	

a,b,c Means along the same row followed by different superscripts are significant (P<0.05) SEM

The final live weight was highest (P<0.05) in Bovans Nera, the final live weight for the other three strains are however similar P<0.05). These results for live weight gain followed the same trend as that of the final live weight since the birds were subjected to the same management conditions, the result on live weight agrees with Siegel (1978); Crawford (1990) and Xiang *et al*., (2023) that genetic factors are involved in growth/live weight changes.

Bovans Nera had the highest (P<0.05) weight gain (1272.00g) while that of the rest three strains were similar (P>0.05) (1245.67 g – 1248.33 g). The differences that occurred between the strains on live weight (g) and live weight gain (g) could be due to the effect of genetic differences and adaptability to environmental conditions (Oluyemi and Roberts 1979, 2000; Myles and Tanja, 2006). The mean feed intake between the strains was significantly (P<0.05) different, the highest feed intake was recorded by Dominant Black (402.50g), while the Bovans Goldline recorded the lowest (384.05g) feed intake. Feed intake was comparable (P<0.05) between Isa Brown and Bovans Nera and values were intermediate of the other two strains. The differences in the quantity of feed consumed can be attributed to different factors. Feed intake could also be influenced by body weight or size as stated by Rose (1997) and Junjie *et al,* (2024). Birds eats a daily amount of feed that is equivalent to approximately 5% of their body weight. The most efficient means of determining the optimum utilization of the feed of the strains is the feed conversion which was lowest (P<0.05) in Dominant Black. Feed conversion was equally lower (P<0.05) in Isa Brown than in Bovan Nera and Bovans Goldline which had comparable values. Chambers (1990) and Yan *et al.,* (2024) reported that chicken that differs in productivity will have different nutrient feed efficiency and feed conversion ratio and that there is genetic basis with breed and strain differing in nutrient requirements. Fast-growing chickens convert feed into body weight more efficiently than their slow-growing counterparts and many of the same genes that cause fast growth, also make for more efficient gain (Oluyemi and Roberts 2000). Baxter *et al.,* (2021) reported that fast-growing chickens make more efficient gains than slow-growing chickens because they use a small percentage of their feed intake for maintenance and have a more efficient metabolic system which allows for a better utilization of feed. All these could result in variations of feed efficiency among the strains. The last indices of the performance characteristics still In the table is

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

mortality, The mortality recorded between weeks 0 and 18 showed a significant difference (P<0.05) with Dominant Black being more resistant and hardy to diseases with the least mortality (1.33%) the intermediate groups were Isa Brown and Bovans Nera but the least tolerant was Bovans Goldline since they were all subjected to the same input (feeding, health management and environment etc) The post mortem shows signs of Newcastle disease and traces of intestinal Coccidiosis. The percentage mortality recorded for the strains falls short of the range of 10% at 21 weeks recommended by Oluyemi *et al.,* (1997).

Production Performance

The mean production performance indices of four different strains of laying hen (19 – 30 weeks) are presented in the table below.

Mean Production Characteristics of Different Strains of Birds (19-30 Weeks)

Parameters	Isa Brown	Bovans Nera	Bovans Goldline	Dominant Black	SEM
Initial live wt/bird/(g)	1302.67^{b}	1326.67^{a}	1300.00^{b}	1300.33^{b}	2.53
Final wt/bird/(g)	1450.00^{a}	1448.33^{a}	1432.33^{b}	1449.33^{a}	1.55
Weight gain/bird(g)	147.33^{a}	121.67^{c}	132.33^{b}	146.00^{a}	3.75
Feed intake(g)	76719^{b}	77,545^{a}	76245^{c}	77597^{a}	0.67
FCE	3.06^{b}	3.14^{a}	3.15^{a}	3.13^{a}	0.08
Age at 1st egg(day)	138^{b}	135^{c}	139^{ab}	140^{a}	3.20
Age at 5% hen day (day)	152^{a}	144^{b}	152^{a}	141^{b}	3.00
Hen day Prd/ bird/week	74.68^{a}	73.64^{ab}	72.29^{b}	74.80^{a}	0.96
Total egg	4,689	4,624	4,539	4,697	-
Total feed intake(g)	16,232.90	16,333.90	16,062.35	16,556.66	-
Egg wt (g)	53.43^{a}	53.39^{a}	53.29^{ab}	52.82^{b}	0.62
Shell thickness (mm)	0.547^{a}	0.542^{ab}	0.544^{ab}	0.541^{b}	0.04
Egg shape index	0.771^{a}	0.765^{b}	0.768^{b}	0.768^{b}	0.01
Mortality (%)	0.00^{b}	1.45^{a}	0.00^{b}	0.00^{b}	0.00

a,b,c Means along the same row followed by different superscripts are significant (P<0.05) SEM = standard error of means.

The live production performance as presented in the table showed that the final live weight was comparable for Isa Brown, Dominant Black and Bovans Nera and values were significantly (P<0.05) higher than that of Bovans Goldline. However, there were significant differences in body weight gain between the strains (P<0.05). The differences that occurred between the strains on live weight (g) and live weight gain (g) could be due to the effect of genetic differences and adaptability to environmental conditions as stated in performance characteristics above.

This perhaps explains the trend observed in the live weight of the strains and agreed with Rose (1997) and Olawumi *et al,* (2012) who reported that feed intake could also be influenced by body weight or size, that poultry eats a daily amount of feed that is equivalent to approximately 5% of their body weight. Feed conversion efficiency was slightly higher across the strains, statistically, measurable differences (P<0.05) were observed. The trend observed in feed efficiency was only different in Isa Brown compared with other strains and they compared favorable. This could be due to possible genetic similarity among these strains, this corroborates the report of Crawford (1990b) that most of these modern strains have similar genetic make-up. Araujo *et al,* (2015) obtained a range of 2.69-2.97 for feed conversion for egg production measured as feed intake/egg mass

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VI June 2025

production.

Bovans Nera had its first egg at 135 days of an egg; Isa Brown had its first egg at 138 days of age while Bovans Goldline and Dominant Black had theirs at 139 and 140 days respectively. These results contradict what is obtained in the literature. Ayorinde *et al*., 1988 and Jesuyon (2009) reported a point of lay at 151 days and 161 days of age for heavy-weight and light-bodied birds respectively, Essien (1994) obtained 159 days for age at first egg while Oluyemi and Roberts (2000) reported range of 20 – 24 weeks (140 -168 days).

The ages at 5% hen day production were significantly different ($P<0.05$) Isa Brown and Bovans Goldline's age at 5% hen day production was at 152 days while Dominant Black and Bovans Nera reached 5% hen production at 141 and 144 respectively.

Dominant Black and Bovans Nera recorded the highest values in terms of final live weight gain, feed intake and feed conversion efficiency when compared to Isa Brown and Bovans Goldline and this contributed to the strains reaching 5% hen production earlier, this corroborates Crawford (1990) which stated that with appropriate environmental conditions (nutrition, light, ambient temperature, water, free from diseases).

Strain differences tend to affect the average hen-day production as significant differences exist between them ($P<0.05$) with Isa Brown and Dominant Black recording the highest value when compared to Bovans Nera and Bovans Goldline respectively.

The highest gain value was recorded by Isa Brown and Dominant Black over the Bovans Goldline and Bovans Nera this agreed with Oluyemi and Robert, (2000) that differences that occurred between the strains on live weight (g) and live weight gain (g) could be due to effect of genetic differences and adaptability to environmental conditions.

Total egg produced during the productive period follows the same trend as Hen day production while total feed intake is also aligned with feed intake (g) consumed during the productive period.

No significant ($P>0.05$) were found when comparing the strains during the laying period Oluyemi and Robert (2000) reported that the average egg weight of tropical domestic fowl is about 58g with a range of about 40g-70g Olayiwola (1988) obtained average egg weight of about 54g. The egg weight recorded in this research agreed with the range reported by Oluyemi *et al.,* (2000).

The shell thickness was significantly ($P<0.05$) influenced by different strains. However, the thickness among all strains (0-547 – 0.541) which was recorded is still of higher value compared to what is being reported by Oluyemi and Roberts (2000) who reported eggshell thickness to be 0.33mm and Asuquo *et al* (1992) who reported 0.30mm. This is an indication of the possible improvement of these traits in commercial layers through breeding selection and other molecular biotechnological techniques over the years. The shell thickness and other indices of the egg monitored are especially useful in egg hatchability according to Yamak *et al,* (2015).

In terms of egg shape index, there were significant ($P<0.05$) differences as the ratio of egg width and egg length was compared competitively. The egg shape index value was highest in Isa Brown and the other three strains are however similar. The slight variation in the egg shape index could be due to stress according to Hughes and Black (1976) who reported that using Shaver 288 pullet which lays white eggs observed that hen distributed during a particular stage of egg formation may lay on an egg of characteristically abnormally shape.

Mortality was significantly influenced during this period as Bovans Nera recorded i.45% mortality and none were recorded by other strains.

Egg And Serum Biochemical Indices

The mean egg indices as represented in the table show that Albumen fat (mg/100g) was highest ($P<0.05$) in Isa Black while Dominant Black was least ($P<0.05$) behind Bovans Goldline and Bovans Nera which has the value (2.84 and 2.81 respectively) However Congjiao *et al*, (2019) reported no significant between strains for albumen protein, solid, pH or yolk solid in egg with significantly different weights. This contradicts the research work

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which highlights significant differences (P<0.05) between the strains. Concerning the yolk fat, the trend observed was Dominant Black (3.84) > Bovans Nera (3.70) > Bovans Goldline (3.25) > Isa Brown (3.10). Akbar *et al,* (1983); Hill *et al,.* (1990) and Khatun *et al*, (2016) reported that selected eggs of commercial strain weighed more and contained a higher percentage of albumen, albumen solids and albumen protein. However, this variation among strains has often been related to variations in egg size.

Table 3: Mean Egg and Serum Biochemical Indices of different Strains of Birds

	Isa Brown	Bovans Nera	Bovans Goldline	Dominant Black	SEM
EGG INDICES					
Albumen fat (mg/100g)	2.94^{a}	2.81^{c}	2.84^{b}	2.51^{d}	0.03
Yolk fat (mg/100g)	3.10^{d}	3.70^{b}	3.25^{c}	3.84^{a}	0.02
Cholesterol (mg/100g)	12.01^{d}	14.22^{a}	13.41^{b}	12.82^{c}	0.02
Fatty acid (mg/100g)	0.142^{b}	0.139^{c}	0.146^{a}	0.147^{a}	0.02
Calcium (mg/100)	58.74^{b}	61.51^{a}	56.95^{d}	57.94^{c}	0.05
Phosphorus (mg/100g)	75.94^{b}	83.67^{a}	71.60^{c}	70.47^{d}	0.06
SERUM INDICES					
Serum calcium (mg/100g)	42.67^{d}	44.77^{c}	47.61^{a}	47.21^{b}	0.02
Serum phosphorus (mg/100g)	55.78^{b}	54.71^{b}	55.76^{b}	57.25^{a}	0.34
Cholesterol (mg/100g)	12.24	12.04	12.25	12.24	0.11
Protein (mg/100g)	1.73^{b}	1.82^{a}	1.73^{b}	1.62^{c}	0.01
Fatty acid (mg/100g)	0.05^{a}	0.04^{b}	0.03^{c}	0.02^{d}	0.02

a,b,c Mean along the same row followed by different superscripts are significantly (P<0.05), SEM.

The cholesterol (mg/100g) was highest in Bovans Nera (14.22) followed by Bovans Goldline (13.41), while Isa Brown (12.01) was least (P<0.05) behind Dominant Black (12.82). The cholesterol content of eggs has become a very important quality index among consumers. Cholesterol has an important role in the development of an egg embryo; it is a structural component of the cell membrane and is a precursor for hormones, vitamin D, and bile acids (Anton, 2007). Villa (2008) found that cholesterol content was positively correlated with egg and yolk weight, and negatively correlated with egg production and dietary protein level, However, these correlations were not significantly highest (P<0.05). The egg has come under increasing medical and dietary criticism due to its high level of cholesterol the high ratio of saturated to unsaturated fatty acids contained within egg yolk (Liscum, 2002) and the proportion of egg component as influenced by genetic background and age (Marion *et al.*, Kline *et al.,*1965 and Stadelman and Pratt, 1989).

Fatty acids (mg/100g) were highest (P<0.05) significantly in Dominant Black (1.47) and Bovans Goldline (1.46) followed by Isa Brown (1.42) and least value (1.39) was observed in Bovans Nera. The concentration of fatty acid is influenced by the genetic rate of egg production and the composition of hen diets (Naber, 1993; Leeson and Caston, 2003). Furthermore, it also depends on breed and age of layer, management and nutrition and partly on synthesis in the liver during the synthesis of Lipo-protein. Egg calcium (mg/100g) was observed in Bovans Nera (61.51), Isa Brown (58.74) was next while the least (P<0.05) was recorded in Bovans Goldline (56.95) behind Dominant Black (57.94) which implies that Bovans Nera has better capacity to retain more calcium in its egg. The thickness of the egg is influenced by the mineral intake of the laying birds. More calcium seems to be needed for egg thickness than egg production; an egg with a shell less than 0.33mm thick is considered a poor marketing risk (Gunlu *et al,* 2003). Likewise Bovans Nera (83.67) and Dominant Black (70.47) had the highest and lowest (P<0.05) values of phosphorus (mg/100). In some experiments intake of nonphytate phosphorus below 200 mg/day throughout the laying period gave a good shell quality at the large amount (Owing *et al,*,

1977; Milaelian and Sell, 1981) but a value around 150 mg/day decreased egg production in an experiment of Rodrique *et al,*,(1984).

Serum indices as shown in the table indicate that Bovans Goldline (47.61) had the highest (P<0.05) and Isa Brown (42.67) had the lowest serum calcium. However, the literature on the haematological serum biochemical value of birds is limited to higher calcium levels than in non-productive females (Ritchie *et al,*, 1994). This agrees with Kunjarathiti Yapung *et al* (1987) who compared the levels of serum calcium between laying hen (18.10 + 2.64 mgdl) and broiler (6.25 – 13.75 mg/dl).

In the case of serum phosphorus Dominant Black had the highest 57.25 mg/100g and the least was recorded by Bovans Nera at 54.71 mg/100g, from the above table there is more serum phosphorus than the serum calcium and this is by (Edward and Saso, 1981) which stated that due to the specific needs for bone formation the requirement for phosphorus is laying hen is lower by at limestone order of magnitude than for calcium. Bovans Goldline had the highest combination of serum calcium and phosphorus and the least by Isa Brown. Also, Borman *et al* (1985) reported that low phosphate intake may also have a beneficial effect on shell quality since increased serum phosphate causes a decline in egg-specific gravity.

The serum cholesterol among all the strains was similar (P>0.05) and ranged between 12.04 – 12.25, with Bovans Nera recording the least and highest being recorded by Bovans Goldline, the proportion of egg components are influenced by the genetic background and age (Marion et al,, 1966; Kline *et al,*,1965 and Stadlman and Pratt, 1989). This agrees with the research finding as there were no significant differences between the strains due to their similar genetic background and similar age.

Serum protein was highest (P<0.05) in Bovans Nera (1.82) while Isa Brown and Bovans Goldline had similar values (1.73) and the least was Dominant Black (1.62).

SUMMARY, CONCLUSION AND RECOMMENDATION

A breakdown of the findings from the research showing the advantage of each strain are as follows, Bovans Nera had the best live weight at 18 weeks, Bovans Nera and Bovans Goldline recorded the best FCE at 18 weeks, these may be an advantage to producers of point of lay, Mortality to point of lay was lowest in Dominant Black, Egg production to 30 weeks of age was best in Isa Brown and Dominant Black, Shell thickness and Egg shape index which is very important in egg sales and transportation is also best in Isa Brown, Cholesterol was lowest in Isa Brown.

The study revealed differences in performance production characteristics and egg and serum biochemical indices, hence the best strain regards to the indices is Isa Brown, then Bovans Nera, Dominant Black and Bovans Goldline respectively.

In conclusion, the work is a means of evaluating new stock coming into the market by testing the performance of new strains and reappraising old ones in the reality of changing conditions. Further studies should be carried out to investigate egg-laying production pattern up till the entire life cycle of the bird to see if significant differences exist among the strains.

REFERENCES

1. O.A.C, (2023). Association of Official Methods of Analytical Chemists. Official Method of Analysis, 20th edition, Washington, D, C.
2. Ahmad, R. S., Imran, A. and Hussain, M. B. (2018). Nutritional Composition of Meat. In book: Meat Science and Nutrition. DOI: 10.5772/intechopen.77045
3. Akbar, M. K., Gavora, J. S., Friars, G. W. and Gowe, R. S. (1983). Composition of egg by commercial sixe categories: Effects of Genetic Group, Age and Diet. Animal Research Centre, Agriculture, Canada, Ottawa, Ontario, Canada K1A0C6.
4. Akintunde, O. K. (2015). Determinants of Poultry farmers' participation in livestock insurance in Southwest Nigeria. Asian Journal of Poultry Science. 9(4): 233 - 241, ISSN - 1819 - 3609, DOI:

10.3923/ajsaj.2015.233.241.
5. Aletor, V.A. (1983).Manipulation of Lima bean anti-nutritional factors for digestion, nutrition utilization and physiopathology of the rat. A PhD Thesis University of Ibadan.
6. Aletor, V.A. (2000). The performance, nutrient utilization and cost implication of feeding broiler finisher conventional or under-utilized feed resources.
7. Anton, M.,(2007). Composition and Structure of Hen Egg Yolk, chapter 1. In Huopalahti, R., Lopez-F, R., Anton, M.&Schade, R (eds): Bioactive egg compounds. Springer-Verlag, Heidelberg,pp3.
8. Araujo, W. A. G., Albino, L. F. T., Rostagno, H. S., Pessoa, G. B. S., Cruz, S. C. S., Lelis, G. R., Carneiro, P. R. O. and Vieira, R. A. (2015). Sunfolower meal and supplementation of a enzyme complex in layer diets. Brazilian Journal of Poultry Science, Vol. 17(3), Pp. 363 - 370. http://dox.doi.org/10.1590/1516-635x1703363-370
9. Asuquo, B.O; B.Okon and A.O Ekong (1992).Quality Parameter of Isa-Brown and Nigerian Local Chicken Eggs. Nigeria J.of Anim. Production. 19:1-5.
10. Ayorinde, K.L; A.A. Toye and Aruleba, J.P. (1988). Association between body weight and some egg production traits in a strain of commercial layer. Nig. J. Anim. Prod. 15, 119 – 125.
11. Baxter M, Richmond A, Lavery U, O'Connell NE (2021) A comparison of fast-growing broiler chickens with a slower-growing breed type reared on Higher Welfare commercial farms. PLoS ONE 16(11): e0259333. https://doi.org/10.1371/ journal.pone.0259333
12. Bayoumi, M.T. Assad, F. Nassar, A.M and ABD EL-baky S.M. (1986) Serum protein electrophoresis in different physiological stages in ewes, World review of Animal production 22:5-58.
13. Boorman, K.N; Gunaratne, S.P. Dietary phosphorus supply, eggshell deposition and plasma inorganic phosphorus in laying hen. Ben Poult. Sci. 42 (2001). 81-91.
14. Chambers, J.R. (1990). Genetics of growth and meat production in chickens in: Crawford, R.D.(ED). Poultry Breeding and Genetics. Pp 599-644. Elsevier Amsterdam.
15. Congjiao, Sun., Junnian, Liu, Ning, Yang and Giuyan, Xu. (2019). Egg quality and egg albumen property of domestic chicken, duck, goose, turkey, quail and pigeon. Poultry Science, Vol. 98, Pp. 4516 - 4521. http://dx.doi.org/10.3382/ps/pez259.
16. Crawford R.D. (1990b). Poultry Genetics Resource: Evolution, Diversity and Conservation. In (Ed) Poultry breeding and Genetics Pp. 43-60 Elsvier. E. Amsterdam.
17. Crawford, R.D. (1990a) Origin and history of poultry species. In Crawford R.D. (Eds) Poultry Breeding and Genetics Pp 1-42 Elsvier. Amsterdam.
18. Edwards, H.M., and F, A. Saso, (1981), Phosphorus requirement of six strains of caged laying hens. Poultry Sci. 60:2346-2348.
19. Embert H. Coles (1974). Veterinary Clinical Pathology 2nd edition.
20. Emmanuel-Ohagenyi, I. J. and Simeon, O. C. U. (2023). Bottleneck in creating layer breeds of chickens in Nigeria. Poultry farming - New Perspectives and Applications. DOI: 10.5772/Intechopen.109090.
21. Essien, A.I (1994). The pattern of growth of exotic pullets raised in a tropical wet climate. The need for a renewed feeding program. E. Agric. For.J.59.261-267.
22. FAO,IFAD ,UNICEF,WFP&WHO (2019). The state of food and nutrition security in the world. Safeguarding against economic slowdowns and downturns, Rome ISBN 978-92-5-131570-5.
23. FAO. 2003b. A study of the role of livestock in poverty reduction strategy papers, by R. Blench, R. Chapman, & T. Slaymaker. Pro-Poor Livestock Policy Initiative. Working Paper No 1. Rome. (available at http://www.fao.org/ag/againfo/projects/en/pplpi/docarc/wp1.pdf).
24. Fetuga, B. L. (1977): Animal Production in Nigeria. J. Anim. Prod. 4(1) 19-21.
25. Geidam, Y. A., Bukar, M. M. and Ambali, A. G. (2007). Chick quality control: A key to a sustainable poultry production in Nigeria. Nigerian Veterinary Journal, 27(2): 1 - 6. DOI: 10.4314/nvj.v27i2.3509
26. Gunlu, A., K. Kiriki, O. Cetin and M.Carip, (2003). Some external and internal quality characteristics of Patridge (A.graeca) eggs. Food Agric. Enviro., 1:197-199.
27. Hesham, H. M. and Tamer, M. A. (2012). Evaluation of the performance and egg quality in two strains of Lohmann classic breed. Proc. Of the 5th Annual Wealth Research Conf. In the Middle East and North Africa.
28. Hughes, B.O and A.J. Black (1976). The influence of handling on egg production, eggshell quality and avoidance behaviour of hens. Br. Poult. Sci. 17: 135-144.
29. Jesuyon, O. M. A. (2010). Growth pattern, reproductive performance and seasonal sensitivity of Bovan

Nera and Isa Brown parent-stock chickens in Ibadan, Nigeria. A PhD Thesis in the Department of Animal Science, University of Ibadan.

30. Junjie, Wang., Zenymin, Liu., Hai, Lin., Hongchao, Jiao., Jingpeng Zhao., Baishun, Ma., Yao, Wang, Shuying, He and Xiaojuan, Wang. (2024). Daily feeding frequency affects feed intake and body weight management of growing layers. Poultry Science. 103: 103748. https://doi.org/10.1016/j.psj.2024.103748.
31. Khatun, H., Rashid, M. A., Faruque, S., Islam, M. N. and Ali, M. Y. (2016). Study on egg quality characteristics of three commercial layer strains under different storage conditions. International Journal of Animal Resources, Vol. 1, number 2, Pp. 63 - 70.
32. Kline, L.,Meehan, J.H. and Sugihara, T.F. (1965). Relation between layer, age and egg-product yields and quality. Food Technology, No. 9: 1296-1301.
33. Marion, J.E., oodroff, J.G. and Tindell, D. (1966). Physical and Chemical Properties of Eggs as Affected by Breeding and Age of Hens. Poultry Science, 45:6, 1189-1195.
34. N.R.C. (1994). Nutrient requirement of poultry. 9th Rev.Ed Washington D.C. National Academy Press.
35. Naber, E.C. (1993). Modifying vitamin composition of eggs: A review. J. Appl. Poultry Res. 2 385-393.
36. Okon, B and Ekpenyong (1997). Evaluation of the reproductive efficiency of leghorn brown layers in a commercial hatchery. J. of Science Engineering and Technology. (JSET).
37. Olayiwola, S. (1988). The effects of replacing maize with dried sweet potatoes on the performance of layers. Nig. J. Anim. Prod., 15: 99-102.
38. Oluyemi, J.A. (1986). The general principle of poultry management. In: Proceedings of the First August School. Dept. of Animal Science, University of Ibadan. 223-225, 26th Sept., 1986.
39. Oluyemi, J.A.(1998). The general principle of poultry management. Lecture notes on poultry production. Dept. of Animal Science, University of Ibadan.
40. Oluyemi, J.A. and F.A. Roberts (1979). Poultry Production in war and wet climate. Macmillan London.
41. Oluyemi, J.A. Fetuga, B.L.A. and Philips, I.O. (1977). The comparison of deep litter system with cage management system for layers under tropical conditions. E. African. Agric Prod. J. 42. Pp 342-349.
42. Oluyemi, J.A, and F.A. Roberts (2000). Poultry Production in warm and wet climates. Revised edition. Spectrum Books Limited, Ibadan, Nigeria.
43. Owings, W.J., Sell, J.L. and Balloun, S.L. (1977). Meat and milk production, Poultry Science, 56, 2056-2060.
44. Pearson (1980). Chemical analysis of foods by Harold Egan, Ronald's Kirk and Ronald Sawyer. Publ: Longman and Scientific Co.
45. Peter, J.R. and Rosen, W.G.(1977). Lead and calcium content of urban garden vegetables. Trace substance environment. Health, 11: 399-405.
46. Pym, R.A.(1990). Nutritional Genetics. In Crawford, R.D.(Ed) Poultry Breeding and Genetics. Pp 847-876. Elsevier, Amsterdam.
47. Reinhold, J.G (1977). Manual determination of serum total protein, albumin and globulin fraction by the biuret method. In: Reiner, M(ed) Standard Method of Clinical Chemistry Academic Press. New yolk pg 88.
48. Ritchie, B.W, Harrison, J.G.and Harrison, R.L.1994. Avian Medicine, Wingers Publishing, Inc., Florida.
49. Rodriguez ,M., Owings, W.J and sell. , J.L (1984). Meat and milk production, poultry science, 63, 1553-1562.
50. Rose, S.P.(1997). Principle of poultry science, CAB international Wallingford Oxon, U.K. Feeding to keep production up in Tropical climates. World poultry April. 1977. Pp. 23.
51. Sam, I. M. and Okon, L. S. (2022). Comparative evaluation of growth performance, morphometric and carcass traits of three strains of broiler chickens raised in the tropics
52. SAS Institute (2000). SAS STAT Users Guide version 6.115th ed. Statistical Analysis Institute Inc. Cary NC. The USA. Pp943
53. Siegel, D.B. and Dunnington et al, E.A (1987) Selection for growth in chicken. CRC Crit. Rev. Poultry Biol. 1:1-24
54. Stadelman, W.J. and Cotterili, O.J. (1973). Egg science and technology, AVI Publishing Co. Westport, C.T. U.K.
55. Vila, B. (2008). Improvement of the biological and nutritional value of eggs. CIHEAM- Options Mediterranean's, Pp. 390.

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56. Xiang, Fang, Haogiang, Ye, Siyu, Zhang, Lijin, Guo, Yibin, Xu, Dexiang, Zhang and Qinghua, Nie (2023). Investigation of potential genetic factors for growth traits in yellow-feather broilers using weighted single-step genome-wide association study. Poultry Science, 2023.
57. Yamak, U. S., Sarica, M., AkifBOZ, M., Onder, H. (2015). The effect of egg shell thickness on some hatching traits of broiler breeders. Kafkas Univ. FakDerg, 21(3): 421 - 424. DOI: 10.9775/kvfd.2014.12485
58. Yan, Li., Ruiyu, Ma, Renrong, Qi, Hualong, Li, Tunying, Li, Wei, Lui, Yi, Wan., Sanjun, Li., Zhen, Sun, Jiechi, Xu and Kai, Zhan (2024). Novel insight into the feed conversion ratio in laying hens and construction of its prediction model. Poultry Science, 103: 104013. https://doi.org/10.1016/j.psj.2024.103748.