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Effects of different calorie: protein ratios on the morphometric traits of two strains of commercial pullets

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Abstract

Poultry birds of all species require energy and protein for growth and production. It is therefore, necessary to know the ratio of both components which is required for each specie to produce optimally at different ages. The present investigation was aimed at comparing the performance of two commercial pullet strains based on different calorie: protein ratio based. The strains are Isa Brown and Nera Black pullets and the calorie: protein ratios are Normal Calorie: Protein (NC:P), High Calorie: Protein (HC:P) and Low Calorie: Protein (LC:P) ratios . A total number of 420 growers which comprised 210 Isa Brown and Nera Black strains were procured and used for the study which lasted 56 days. The birds were divided into fourteen treatments, and each was replicated three times on strain basis. Each replicate containing ten birds each in 2 x 3 factorial arrangement with one control each for the strains in a Completely Randomised Design. The morphometric traits evaluated included body weight, body length, breast girth, wing length, thigh length, leg length and neck length in centimetres. Analyzed results showed significant strain x calorie: protein effects (P<0.005) on all the parameters considered. Body weight of Nera Black fed HC:P and NC:P had the highest mean values than other interaction effects. Body length mean value was higher for Nera Black fed HC:P similar for birds fed LLC:P, Isa Brown fed NLC:P while the least value was recorded for Isa Brown fed LHC:P. It could be concluded that morphometric traits in commercial pullets are strain x calorie: protein dependent.

Keywords: Nera Black, Isa Brown, calorie: Protein, body weight, body length.

Effets de différents rapports calories:protéines sur les caractères morphométriques de deux souches de poulettes commerciales

Résumé

Les volailles de toutes espèces ont besoin d'énergie et de protéines pour leur croissance et leur production. Il est donc nécessaire de connaître le ratio de ces deux composants nécessaire à chaque espèce pour une production optimale à différents âges. La présente étude visait à comparer les performances de deux souches commerciales de poulettes selon différents rapports calories/protéines. Il s'agit des poulettes Isa Brown et Nera Black, dont les rapports calories/protéines sont : Normal Calories/Protéines (NC:P), Hyper Calories/Protéines (HC:P) et Faible Calories/Protéines (LC:P). Au total, 420 reproducteurs, comprenant 210 souches Isa Brown et Nera Black, ont été sélectionnés et utilisés pour l'étude, qui a duré 56 jours. Les oiseaux ont été répartis en quatorze traitements, chacun étant répliqué trois fois par souche. Chaque réplicat comprenait dix oiseaux chacun selon un arrangement factoriel 2 x 3, avec un témoin pour chaque souche, selon un plan entièrement randomisé. Français Les caractères morphométriques évalués comprenaient le poids corporel, la longueur du corps, le périmètre thoracique, la longueur des ailes, la longueur des cuisses, la longueur des pattes et la longueur du cou en centimètres. Les résultats analysés ont montré des effets significatifs souche x calories:protéines (P < 0,005) sur tous les paramètres considérés. Le poids corporel des Nera Black nourries avec HC:P et NC:P présentait les valeurs moyennes les plus élevées par rapport aux autres effets d'interaction. La valeur moyenne de la longueur corporelle était plus élevée pour Nera Black nourrie avec HC:P, similaire pour les oiseaux nourris avec LLC:P, Isa Brown nourrie avec NLC:P, tandis que la valeur la plus faible a été enregistrée pour Isa Brown nourrie avec LHC:P. On peut conclure que les caractères morphométriques chez les poulettes commerciales dépendent de la souche x calories:protéines.

Mots-clés : Nera Black, Isa Brown, calories:protéines, poids corporel, longueur corporelle.

Introduction

White meat is superior to red meat in health aspects because of its comparatively low content of fat, cholesterol, and more importantly for men, Iron (Jaturasitha *et al*., 2008). Chicken meat is unique in that its price is comparatively low, easy to partition into smaller parts and no religious restriction against its consumption (Jaturasitha, 2004). The performance of our livestock species depends to a large extent on their genetic constitution, and also on the environmental conditions in the vegetational zone where the animals live.

Literature is replete with information with regards to strain effect on performance of poultry species. Olawumi (2011) reported significant strain differences in body weight and linear measurements in commercial pullets. Linear body measurement is another method of growth evaluation. It is a simple way of predicting live weight in poultry as well as in other animals. Pertaining to carcass characteristics, it was reported that strain significantly affected live weight (Jaturasitha *et al*., 2008), carcass weight (Olawumi and Fagbuaro, 2011), breast, back and leg muscle weights (Musa *et al*., 2006, Ojedapo *et al.*, 2008). In addition, significant strain differences in body weight, feed intake and feed conversion ratio were reported in previous studies (Rondelli *et al*., 2003).

While separate effects of strain and diet had been reported in the literature, their interactions have not been given much attention. This refers to the ranking order of strain and diet on a scale of preference in respect of those traits measured. Olawumi *et al.* (2012) reported genotype x sex interaction effect on carcass traits of three strains of commercial broilers. Previous investigations also found significant strain x sex effect on live weight and linear measurement (Ajayi and Ejiofor, 2009), strain x sex and sex x diet interaction on carcass fat, meat and total muscle (Shahin and Elazeem, 2005).

The present investigation was aimed at finding strain x calorie: protein ratio on body weight and linear measurements of commercial pullets. This study will indicate which strain and calorie:protein ratio that is superior, and which can be adopted for increased productivity and profit.

Materials and Methods

The study was carried out at the Teaching and Research Farm, Ekiti State University, Ado-Ekiti located on 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 and has two distinct seasons namely rainy seasons from May- October, and the dry season that starts from November - April of every year. The experimental diets for the growers were formulated to have three regimes of calorie: protein ratio indicating three factors of Calorie: Protein ratios and as Diet 1 - Normal Calorie: Protein ratio (NCP) of 187:1, Diet 2 is High calorie: protein ratio (HCP) of 192:1 and Diet 3 as Low Calorie: Protein ratio (LCP) with value 180:1.

The composition comprised Maize -55%, Groundnut cake -2%; Soyabean meal -6%, palm kernel meal -17%, wheat offal -16.05%, Bone meal -2%, Oyster shell -1.0%, salt -0.3%, Growers Premix -0.25%, DL-Methionine -0.2, L-Lysine -0.2%. The diets differ in composition with slight variations in the Maize, Soybean and Palm kernel meal. Diet 1 that represented Treatment 1 contained 15.88% CP and 2810kcalkg^{-1} ME, the HCP contained 14.51% and 2707 kcal/kg which represented the diet for treatment 2 and LCP while diet 3 contained 18.38% and 2902 kcalkg^{-1}. The above arrangement was done for each of the strains to give six treatments groups where the protein and energy contents of the diets were manipulated to obtain the different categories of the Calorie :Protein ratio as shown in the proximate composition of the experimental diets using the recommended ideal data of NRC (1994) (See Table 1). A total of 420 growers that comprised 210 Isa Brown and Nera Black strains each were procured from a reputable hatchery in Ibadan, South west Nigeria and were divided into fourteen treatments and each treatment replicated three times totalling forty two (42) replicates, each replicate containing ten birds each in 2 x 3 factorial arrangement with one control each for each of the strain in a complete Randomised Design, The birds were fed *ad libitum*

for a period of 56 days. Data were collected on the Morphometric measurement of the birds such as Body weight, Body length, Breast girth, Wing length, Thigh length, Leg length and Neck length in centimetres. The experimental feed were analysed for proximate using techniques described by AOAC (2010) while the metabolizable energy (ME) was calculated using the prediction equation described by Panzenga (1985) as indicated i.e. ME=37 x %CP +81.8x %EE+35.5 x% NFE. All the data were subjected to statistical analysis using SAS (1987) computer software for ANOVA and means separated by Duncan Multiple Range Test. The variables analysed were growth performance indices.

Results and Discussion

Table 1: Determined Proximate Analysis of Experimental Diets (%)

Calorie:Protein	NC:P(187:1)	HC:P(192:1)	LC:P(180:1)
Dry matter (%)	94.16	94.39	93.97
Crude Protein (%)	15.88	14.51	18.38
Crude Fibre (%)	5.70	5.30	6.02
Crude Fat (%)	7.50	10.30	8.60
Ash (%)	7.90	10.30	9.10
Kcal/kg ME	2809.89	2706.93	2902.36
Calculated C/P (%)	15.00	14.10	16.09

NC:P (Normal Calorie: protein) HC:P (High Calorie: Protein) LC:P (Low Calorie: Protein)

The result of the strain effect on morphometric traits of growing pullets (8-16 weeks) indicates that all the parameters measured were significantly ($P<0.05$) influenced by strain with respect to body weight, body length, girth length, wing length, leg length and neck length with Nera Black having the highest mean values for all the parameters (Table 2).

Table 2: Main effect of Strains on Morphometric traits of grower pullets (8-16 Weeks)

	STRAINS		
PARAMETER	**ISA BROWN**	**NERA BLACK**	**SEM**
Body weight (gm)	983.49^{b}	1081.23^{a}	0.71
Body Length (cm)	33.29^{b}	34.08^{a}	0.09
Breast Girth (cm)	15.80^{b}	16.56^{a}	0.01
Wing Length (cm)	19.15^{b}	21.12^{a}	0.01
Thigh Length (cm)	18.99^{b}	19.81^{a}	0.01
Leg Length (cm)	9.05^{b}	9.60^{a}	0.14
Neck Length (cm)	9.22^{b}	9.40^{a}	0.00

a ,b Means in the same row with different superscripts are significantly different ($P<0.05$)

Main effect of calorie: Protein ratio on Morphometric of grower pullets (8- 16 weeks) showed that parameters measured were significantly ($P<0.05$) influenced by different calorie: protein ratio diet (Table 3). The body weight recorded the highest mean value for birds fed NLC:P while the least mean value was recorded by birds fed LHC:P. Body length recorded highest mean value with birds fed HLC:P, while least mean value was recorded for birds fed LHC:P. Birds fed HLC:P had the highest mean value of for breast girth while birds fed HHC:P had lowest mean value. Wing length recorded highest mean value for birds on NHC:P while the lowest mean value was recorded for birds fed HHC:P. Thigh length had the highest mean value for birds fed LLC:P while least mean value was recorded by birds

fed LHC:P. Leg length showed highest mean value in birds fed HLC:P, and the least mean value was recorded by birds fed NHC:P. Neck length had highest mean value was recorded in birds fed LLC:P while lowest mean value were recorded for birds on LHC:P.

		NORMAL		HIGH		LOW		
PARAMETERS	**NORMAL**	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**	**SEM**
Body Wt (gm)	1065.00^{d}	961.39^{e}	1122.78^{a}	963.74^{e}	1102.21^{b}	928.10^{f}	1084.30^{c}	1.33
Body Length (cm)	34.02^{ab}	33.34^{c}	34.29^{a}	33.53^{bc}	34.32^{a}	32.31^{d}	33.98^{ab}	0.18
Body Girth (cm)	16.15^{d}	15.86^{f}	16.55^{b}	15.47^{g}	16.79^{a}	15.93^{e}	16.50^{c}	0.01
Wing Length (cm)	20.78^{b}	20.80^{a}	20.11^{e}	17.86^{f}	20.41^{c}	20.22^{d}	20.76^{b}	0.01
Thigh Length (cm)	19.29^{e}	19.04^{f}	19.75^{b}	19.51^{d}	19.60^{c}	18.66^{g}	19.94^{a}	0.01
Leg Length (cm)	9.36^{a}	8.56^{b}	9.70^{a}	9.15^{ab}	9.83^{a}	9.22^{ab}	9.48^{a}	0.25
Neck Length (cm)	9.48^{b}	9.14^{d}	9.49^{b}	9.10^{e}	9.37^{c}	9.02^{f}	9.59^{a}	0.01

Table 3: Main effect of calorie: protein ratio on Morphometric traits of grower pullet (8-16 weeks)
a ,b ,c Means in the same row with different superscripts are significantly different ($P<0.05$) SEM (Standard Error of Means)

Table 4 showed the interaction effects of strain and calorie: protein ratio on morphometric traits of growing pullets (8-16 weeks). Significant strain x calorie : protein ratio differences ($P<0.005$) were observed in all the parameters considered. Body weight of Nera Black fed HLC:P and NLC:P had the highest mean values while lowest mean values were recorded for Isa Brown fed HHC:P and LHC:P. Body length mean value was higher for Nera Black fed HLC:P similar for birds fed LLC:P, Isa Brown fed NLC:P while the least value was recorded for Isa Brown fed LHC:P . Isa Brown fed HLC:P had higher mean value while same strain fed LHC:P had the least value for breast girth. Wing length mean value was higher for Nera Black fed HHC:P while Isa Brown fed HHC:P recorded the least value. Interaction between strain and calorie: protein ratio reveal Nera Black fed HHC:P recorded the highest mean value for thigh length while Isa Brown fed LHC:P recorded the least value. Higher leg length value was recorded by Nera Black fed HLC:P and the least value was recorded by the same strain fed NHC:P. Isa Brown fed LLC:P showed better value for neck length while the least value was recorded for Isa Brown fed LHC:P.

Table 4: Interaction effect of strain and calorie: protein ratio on Morphometric traits of grower pullets (8-16 weeks)

PARAMETERS		IB						NB					
		NORMAL		HIGH		LOW		NORMAL		HIGH		LOW	
		NORMAL	HIGH	LOW	HIGH	LOW	HIGH	LOW	NORM	HIGH	LOW	HIGH	LOW
Body Wt (gm)		1063.44^{d}	882.57^{j}	1094.09^{c}	896.64^{i}	1051.59^{e}	861.38^{k}	1034.70^{g}	1064.55^{d}	1040.22^{f}	1151.47^{a}	1030.83^{g}	1152.82^{a}
Body (cm)	Length	33.75^{bc}	32.57^{d}	34.30^{ab}	33.53^{bc}	33.91^{bc}	31.26^{e}	33.71^{bc}	34.29^{ab}	34.10^{abc}	34.27^{ab}	33.52^{bc}	34.74^{a}
Breast (cm)	Girth	15.88^{g}	15.35^{h}	16.64^{c}	14.25^{j}	16.80^{a}	15.24^{i}	16.42^{ef}	16.42^{e}	16.37^{f}	16.46^{e}	16.70^{b}	16.78^{a}
Wing (cm)	Length	20.86^{e}	20.32^{h}	18.54^{k}	14.32^{l}	20.07^{i}	19.58^{j}	20.35^{h}	20.69^{g}	21.28^{c}	21.68^{a}	21.41^{b}	20.74^{f}
Thigh (cm)	Length	19.24^{g}	18.76^{i}	19.44^{d}	18.57^{j}	19.16^{h}	17.94^{k}	19.82^{c}	19.33^{ef}	19.32^{f}	20.05^{b}	20.45^{a}	20.04^{b}
Leg (cm)	Length	9.05^{abcd}	8.92^{bcd}	9.42^{abc}	8.72^{cd}	9.42^{abc}	9.77^{bcd}	9.08abcd	9.66^{abc}	8.20^{d}	9.98^{ab}	9.58^{abc}	10.24^{a}
Neck (cm)	Length	9.29^{d}	9.06^{h}	9.12^{g}	9.02^{i}	9.23^{e}	8.96^{j}	9.89^{a}	9.66^{b}	9.22^{e}	9.86^{a}	9.18^{f}	9.51^{c}

a ,b ,c Means in the same row with the different superscripts are significantly different (P<0.05) SEM (Standard Error of Means)

IB-Isa Brown, NB-Nera Black.

The results of this study indicate that morphometric traits in pullet birds are strain and calorie:protein dependent. This implies that the two factors are important to the performance of birds. This corroborates the earlier investigators who reported significant strain x diet or strain x sex interaction effects on body weight and linear measurements in chickens (Shahin and Elazeem, 2005, Ajayi and Ejiofor, 2009, Olawumi *et al.*, 2012).

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