GROWTH PERFORMANCE AND ECONOMIC BENEFITS OF ISA-BROWN STARTER COCKEREL FED VARYING DIETARY PROTEIN LEVELS

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ABSTRACT

This study was carried out to investigate the growth performance and economic benefits of Isa-brown starter cockerels (0-6weeks) fed varied dietary protein levels. A six weeks feeding trial was done in a completely randomized experimental design of three treatments (18, 20 and 22% crude protein levels with constant metabolizable energy level, 2900kcl/kgDM), replicated three times with 10 birds per replicate and 30 birds per treatment. Measured growth performance traits were as follows; Daily Feed Intake (DFI), Daily Body Weight Gain (DBWG), Final Body Weight (FBW), Daily Metabolizable Energy Intake (DMEI), Daily Protein Intake(DPI), Feed Conversion Ratio(FCR), Protein Efficiency(PE) and Energy Efficiency(EE). At the end of the feeding trial, economy of production was assessed. DFI, DPI, FCR and DMEI of Isa-brown starter cockerel decreased significantly (P<0.05) with increasing dietary levels of crude protein (CP) whereas FBW, PE and EE increased with increasing dietary CP levels. It was concluded that feeding Isa brown cockerel with diet containing 22% CP and 2900kcalME/kgDM for 6 weeks gave optimal performance for live weight (318.89g) with the least cost of feed intake per Kg BWG (₦1,099).

Key words: Growth performance, Isa-brown starter cockerel, Dietary protein, Economic benefits, Feed Intake.

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INTRODUCTION

Poultry can be said to be any kind of domesticated birds kept by humans for meat and eggs (FAO, 2013). Poultry farming has become one of the most important and lucrative enterprises in the field of Agriculture (Aminu and Hermanns, 2021). It involves intensive rearing of birds with a balanced composition of nutrients in their diets, which maybe predicted upon certain perimeters such as genetic, age, sex, housing system, ambient temperature, and production purpose (Satish Vohra, 2018). As most farmers' focus is on broiler farming for meat, cockerel production has not received the attention it deserves over the years. With increasing global human population, it is necessary to boast the production of animal and poultry that will meet the urgent market need for animal protein (Steinfeld, 2003). One approach to tackle this is to stimulate the cockerel industry, the neglected area of poultry production.

Protein is a crucial component of chicken diet. It has essential metabolic roles in the body as seen in the functions of blood plasma protein, hormones, enzymes, and antibodies, each of which has a distinct function (McDonald *et al.,* 2022). With significant levels of vital amino acids like lysine and methionine, pullet diets are always designed to include 18-19% CP for starters and 15-16% CP for layers (NRC, 1994). Research shows that proteinous feedstuff used in feed formulation incurred 45% of the total cost of poultry production (Ahmad *et al*., 2006). Farmers' profit margin from cockerels' production can be increased by optimizing productivity through the use of efficient levels of protein in their feed, particularly during the starter phase of production when protein is needed for the development of the body's supporting and structural tissues. The performance of Ugandan chickens reared under intensive conditions was impacted by variations in their diet's protein content (Magala *et al*., 2012). According to Tadelle *et al*., (2003) and Kingori *et al*., (2007), the environmental factors (nutrition and management) can have a significant impact on the growth performance of chicken raised locally.

The objective of this study was carried out to investigate the dietary levels of protein with the same energy levels that will enhance growth performance and at the same time reduce the cost of production of Isa brown starter cockerels fed for six weeks.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Poultry Unit of Teaching and Research Farm of University of Uyo, Akwa Ibom State, Nigeria. Uyo is located in a rainforest zone between latitude 4°57'N and longitude 7°53'E with average monthly rainfall of 200 to 800mm. It has an annual relative humidity, monthly temperature and annual sunshine of 71-88%, 28-36°C and 1400-1500hours per year respectively (WWO, 2021).

Experimental design, animals and management

Ninety day old Isa brown cockerels were purchased from a reliable distributor in Uyo, Akwa Ibom State, Nigeria. The brooder house, drinkers, and feeders were cleaned, sanitized, and fumigated two weeks prior to the chicks' arrival. After being weighed to determine their initial body weight upon arrival, the chicks were kept in a deep litter pen that were divided into sections with a temperature of 35°C. This temperature was progressively lowered each week until the start of the fourth week, at which point the birds were placed in an open-sided pen with wires and exposed to a room temperature of 28°C.Three experimental diets which contained 18%, 20% and 22% crude protein (CP) levels with 2900kcalME/kgDM were formulated and used throughout the duration of the study (6 weeks).The experimental diets represented the treatments, and each treatment was replicated three times with 10 birds per replicate and 30 birds per treatment in a Completely Randomized Design (CRD). Gross composition of the experimental diet is as shown in Table 1 below. The birds had access to fresh water ad-libitum throughout the period of the study. Birds in all treatment groups received similar standard routine management practices. They were vaccinated against Newcastle disease, infectious bursal disease and fowl pox disease as per routine vaccination schedule.

Data collection

Birds were weighed on commencement of the feeding trial as the initial body weight and afterward, the birds' weight was taken weekly for six weeks. This was used to estimate the Daily Body Weight Gain (DBWG). At the end of the feeding trial, weights of the birds were taken for Final Body Weight (FBW). Daily Feed Intake (DFI) was calculated. Feed Conversion Ratio (FCR) was obtained using the ratio of DFI to DBWG. Daily Protein Intake (DPI) was calculated by multiplying the %CP in feed by the DFI and the ratio of DBWG to protein consumed was used to calculate the Protein

Efficiency (PE). Daily Metabolizable Energy intake (DMEI) was calculated by multiplying the metabolizable energy per kg in the feed by DFI (in kg) and the ratio of DBWG to metabolizable energy consumed was used to calculate the Metabolizable Energy Efficiency (MEE).

Economic analysis of Isa-brown starter cockerels' production was based on the prevailing market price of feed ingredients and diets at the time of purchase which was used to compute the cost of feed intake per bird, and the cost of feed intake per kg body weight gain.

Statistical analysis

Data obtained were subjected to Analysis of Variance (ANOVA) and their means were separated using the Duncan Multiple Range Test of GENSTAT, (2008). The adopted model was;

$$Y_{ij} = \mu + t_i + e_{ij}$$

Where, μ = overall mean;

t_i = Effect of dietary protein treatment;

e_{ij}= Error incurred while applying the treatment.

Table 1 : Gross compositions of experimental diets with varying dietary protein levels

Treatments	**1**	**2**	**3**
Protein levels	**18**	**20**	**22**
Ingredients (%);			
Maize	61	60.4	57.2
Palm Oil	0.5	0.2	0.5
FFSBM	22	27.3	33.4
Fish meal	1	1.9	2
PKC	5	1.65	1.3
Wheat offal	5.95	4	1.05
Bone ash	3.6	3.6	3.6
Table Salt	0.25	0.25	0.25
L-Lysine	0.2	0.2	0.2
DL-Methionine	0.25	0.25	0.25
Premix	0.25	0.25	0.25
Total	**100**	**100**	**100**
Calculated composition:			
ME	2907	2901	2909
CP	18.01	20.04	22.01
EE	3.58	3.32	3.11
CF	4.1	3.38	3
Ca	1.12	1.16	1.18
TP	0.81	0.83	0.84
Lysine	1.18	1.36	1.51
Methionine	0.41`	0.41	0.41

FFSBM= Full Fat Soya Bean Meal; PKC= Palm kernel cake; ME=Metabolizable Energy; CP= Crude Protein; EE= Ether Extract; Ca= Calcium; TP=Total phosphorus. *supplied per Kg diet: Vit. A 4×106 I.U, Tocopherols 4×103 I.U, Vit. K3 800mg, Folacin 200mg, Thiamine 600mg, Cyanocobalamin 4mg, Biotin 8mg, Manganese 3kg, Zinc 20g, iron 3g, choline chloride 80g, copper 2g, iodine 480mg, Cobalt 80mg Selenium 40mg BHT 25g and Anti – caking agent 6g.

RESULTS

Growth performance

The growth performance of Isa-brown starter cockerels fed varying dietary protein levels from 0-6 weeks is as shown in Table 2 below. The initial body weights (34 - 35g) of the cockerels were similar (p>0.05) across the diet groups. There were significant differences in the daily feed intake, daily body weight gain, final body weight, feed conversion ratio, daily protein intake, protein efficiency, daily metabolizable energy intake and metabolizable energy efficiency.

Starter cockerels fed with diets 1, 2 and 3 were significantly different (P<0.05) for feed intake (25.61g, 20.93g, 14.99g). It was observed that feed intake decreased with increasing levels of dietary CP. Daily BWG (5.54-6.78g) varied significantly across the diet groups with starter cockerels fed diet containing 22% CP having the highest value that was also similar to those on 20% CP diet, just as those on diet with 18% CP were not significantly different (P>0.05) from birds fed with 20% CP diet. Birds on diet 1 and 2 were similar for final body weight (264.30g and 294.50g) just as those on diet 2 and 3 were also similar (294.50g and 318.89g). Final body weight was observed to increase with increasing protein level. Feed conversion ratio, daily protein intake and daily metabolizable energy efficiency decreased with increasing CP with birds on diet 1 having the highest value (4.67, 4.61g and 74.28kcal respectively) and those on diet 3 having the least value (2.25, 3.30g and 43.46kcal respectively). Birds on diet with 22% CP showed significantly (P<0.05) higher protein efficiency and metabolizable energy efficiency.

Economics of production

The economy of Isa brown starter cockerel fed varying levels of protein is as shown in Table 3 below. The cost of feed intake per bird (₦306.97- ₦ 461.30) decreased significantly (P<0.05) across treatment as the dietary protein levels increased. The cost of feed intake per Kg body weight gain varied significantly from ₦ 1,099 to ₦ 2,004.11 with the least cost of feed intake per Kg body weight gain (₦ 1,099) obtained for birds on 22% CP. Birds on this diet had the least feed conversion ratio, highest final body weight, daily body weight gain, protein efficiency and metabolizable energy efficiency.

DISCUSSION

Initial body weights of the birds were similar across the diet groups as chicks were equally distributed by weight to the experimental diets. Daily feed intake was observed to decrease significantly with increasing levels of dietary CP. This agrees with the findings of Salami *et al*., (2003) who reported that starter cockerels fed 16% and 18% CP diets consumed more feed than those on high protein diets so as to meet their CP requirements for maintenance and production. Birds on diet with the highest protein level, 22 % had significantly (P<0.05) higher daily body weight gain, final body weight, protein efficiency and Metabolizable energy efficiency. According to the report of Afolabi *et al*., (2022) and Ghersari *et al*., (2015), daily body weight gain and final body weight of broilers increased significantly with increased levels of dietary levels of CP. This was in line with the result of this study. The least FCR value (2.25) was obtained for birds fed diet containing 22% CP. Results indicated that starter cockerels on this diet utilized feed more efficiently than those on lower CP level diets. Similar CP level diet (22%) for best FCR was reported by Kumar *et. al*. (2009) and Salami *et al*. (2003) for starter cockerels, 0-8weeks and starter cockerels, 3-9weeks respectively.

Table 2 : Growth performance of Isa-brown starter cockerels (0 - 6 weeks) fed varying dietary protein levels

Treatments	1	2	3	SEM
Crude protein levels (%)	18	20	22	
Performance parameters:				
Initial Body Weight (g)	35.07	35.00	34.00	0.28
Daily Feed Intake(g)	25.61^{a}	20.93^{b}	14.99^{c}	1.20
Daily Body Weight Gain(g)	5.54^{bc}	6.18^{ab}	6.78^{a}	0.09
Final Body Weight (g)	264.30^{bc}	294.50^{ab}	318.89^{a}	4.32
Feed Conversion Ratio	4.67^{a}	3.39^{b}	2.25^{c}	0.24
Daily Protein Intake	4.61^{a}	4.19^{b}	3.30^{c}	0.25
Protein Efficiency	1.23^{c}	1.47^{b}	2.07^{a}	0.06
Daily Metabolizable Energy Intake	74.28^{a}	60.71^{b}	43.46^{c}	2.99
Metabolizable Energy Efficiency	0.08^{c}	0.10^{b}	0.16^{a}	0.01

$^{a-c}$ Means along same Column with different superscript are significantly ($P \leq 0.05$) different. SEM - standard error of mean

Table 3: The economy of Isa-brown starter cockerels (0 - 6 weeks) fed varying dietary protein levels.

Treatments	1	2	3	SEM
Crude protein levels (%)	18	20	22	
Economic parameters (₦):				
Cost per kg Feed	428.84	463.73	487.72	6.60
Cost of Feed Intake/Bird	461.30^{a}	407.71^{b}	306.97^{c}	17.78
Cost of Feed intake/Kg BWG	2004.11^{a}	1570.50^{b}	1099.00^{c}	84.69

$^{a-c}$ Means along same Column with different superscript are significantly ($P \leq 0.05$) different.
SEM - standard error of mean; BWG = Body weight gain.

CONCLUSION

- Feeding Isa-brown starter cockerel with diet containing 22% CP and 2900kcalME/KgDM for 6 weeks gave optimal performance of live weight (318.89g) with the least cost of feed intake per Kg body weight gain.

REFERENCES

Afolabi, K. D., Eko, P. M., Unah, U. L. and Moffat, B. M. 2022. Growth performance, carcass traits and economy of broiler chickens fed straight diets with varying protein levels. *Asian Journal of Research in Animal and Veterinary Sciences.* 10 (3):13 -22.

Ahmad, M. H., Miah, M. Y., Ali, M. A. and Hossian, M. A. 2006. Effects of different protein concentrates replacement of fishmeal on the performance of broilers. *International Journal of Poultry Science.* 5(10): 952 -956.

Aminu, F. and Heemanns, U. 2021. Profitability evaluation of poultry production in Lagos state, Nigeria. *Discovery Agriculture*, 7 (17):37 – 44.

FAO, Food and Agriculture Organization 2013. *Poultry Development Review.* Monogastric Research Centre, Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand pp. 1-83.

Genstat 2008. Genstat for windows. Genstat Release 8, 1, 8th Edition, Lawes Agricultural Thrust (Rothmasted Experimental Station). www.vsn.intl.com.

Gheisari, H. R., Asasi, K., Mostafa, I. and Mohsenifard, R. 2015. Effect of different levels of dietary crude protein on growth performance, body composition of broiler chickens and low protein diet in broiler chickens. *International Journal of Poultry Science*. 14(5):285-295.

Kingori, A. M., Tuitoek, S. K., Muiruri, H. K. and Wachira, A. M. 2007. Protein intake of growing local chickens on free range and their response to supplementation. *International Journal of Poultry Science*. 6: 617-621.

Kumar, S. A, Singh, P. K., Prasad, A. U. and Chanramoni, O.P. 2009. Effect of graded level of dietary energy and protein on the growth performance of cockerels. *Indian Journal ofAnimal Nutrition.* 26 (1) : 86 – 89.

Magala, H., Kugonza, D. R., Kwizera, H. and Kyarisllma, C.C. 2012. Influence of varying dietary energy and protein on growth and carcass characteristics of Ugandan local chicken. *Journal of Animal Production Advanced,* 2: 316 – 324.

McDonald, P., Edwards, R. A., Greenhalgh, J. F. D. and Morgan, C. A. 2002. Evaluation of Food energy content of food and the partition of food and the partition of food energy within the animal. In: *Animal Nutrition 6thEdition.* ,Pearson Education Limited. Essex. pp. 263-291.

NRC. 1994 *Nutrient Requirements of Poultry*. 9th Revised. Edition. National Academy Press, Washington D.C., pp 115[Accessed: January 16, 2020].

Salami R. I., Akindoye, O., and Akanni, E. O. 2003. Protein and energy requirement of some Cockerel starters in the tropics. *Ghana Journal of Agricultural Science.* 36:69-77.

Satish Vohra 2018. Poultry management. Poultry, Nutrition and Feed Management. Paradise Press. pp. 102 - 127.

Steinfeld, H. 2003: Economic constraints on production and consumption of animal science foods for nutrition in developing countries. *Journal of Nutrition.* 133: 4054 – 4061.

Tadelle, D., Million, T., Alemu, Y. and Peter, K. J. 2003. Village chicken production in Ethiopia. Flock characteristics and performance. *Livestock Research for Rural Development.* 15(9): 342-346

WWO. 2021. World Wealth Online. Uyo Monthly Climate Averages, Akwa Ibom State, Nigeria. Downloaded from: https://www.worldweatheronline.com/uyo-weather-averages/akwa-ibom/ng.aspx (Accessed 22nd May, 2021).