Carcass characteristics and organ proportions of broiler chickens fed different plant protein sources in an Acha grain-based diet

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Abstract

The stiff competition between man and livestock for maize as energy feedstuff has resulted in the high cost of poultry products. Therefore, a study was conducted to evaluate the effect of feeding acha-based diet varying dietary plant protein to broiler chickens on carcass characteristic and organ proportions. A total of 120, one day-old Abor acre broiler chicks were used for the study in a Complete Randomized Design. Four dietary plant proteins were included in the broiler chicken diet at 28% level with an acha grain as the main energy source. Diet 1 contains 28% groundnut cake, while diets 2, 3 and 4 contain 28% of full fat soyabean, soyabean cake and cashew nut meal, respectively. The birds were randomly allotted to the 4 treatment groups, with each group having 30 birds which was further subdivided into 3 replicates of 10 birds each. This study lasted for 56 days. At the end of the feeding trial, carcass evaluation was carried out. One bird per replicate was randomly selected, starved overnight and slaughtered by severing the jugular vein. The visceral were removed and weighed. The results showed that birds fed dietary soyabean cake (Diet 3) had the highest live weight gain (2155.00g), slaughtered weight (1855.00g), defeathered weight (1838.33g), dressed weight (1455.00g) and shank (112.00g). The organ proportions showed significant differences ($p < 0.05$), though followed no definite trend. In conclusion, birds fed diet 3 gave the best carcass weight, and the organ proportions showed no negative effect as par the diets offered the birds. Thus, inclusion of 28%, soyabean meal in an acha-grain based diets proved to be superior over groundnut cake and cashew nut and it is therefore recommended.

Keywords: Soya bean, Groundnut cake, Cashew nut meal, Acha grain, Carcass characteristics, Organ proportions, Broiler chicken

Les caractéristiques de la carcasse et proportions d'organes de poulets de chair nourris avec différentes sources de protéines végétales dans un régime à base de céréales Acha

Résumé

La vive concurrence entre l'homme et le bétail pour le maïs comme aliment énergétique a entraîné le coût élevé des produits de volaille. Par conséquent, une étude a été menée pour évaluer l'effet de l'alimentation à base d'acha avec des protéines végétales alimentaires variées sur les poulets de chair ainsi que les caractéristiques de la carcasse et les proportions des organes. Un total de 120 poussins de chair de 'Abor acre' âgés d'un jour a été utilisés pour l'étude dans un plan randomisé complet. Quatre protéines végétales diététiques ont été incluses dans le régime des poulets de chair à un taux de 28%, le grain d'acha étant la principale source d'énergie. Le régime 1 contient 28% de farine d'arachide, tandis que les

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régimes 2, 3 et 4 contiennent 28% de farine de soja, de gâteau de soja et de noix de cajou, respectivement. Les oiseaux ont été répartis au hasard dans les 4 groupes de traitement, chaque groupe comptant 30 oiseaux qui ont ensuite été subdivisés en 3 répétitions de 10 oiseaux chacun. Cette étude a duré 56 jours. À la fin de test d'alimentation, une évaluation de la carcasse a été effectuée. Un oiseau par réplique a été sélectionné au hasard, affamé pendant la nuit et abattu en sectionnant la veine jugulaire. Les viscères ont été prélevés et pesés. Les résultats ont montré que les oiseaux nourris avec du gâteau de soja diététique (régime 3) avaient le gain de poids vif (2155,00 g), le poids abattu (1855,00 g), le poids sans plumes (1838,33 g), le poids habillé (1455,00 g) et le jarret (112,00 g). Les proportions d'organes ont montré des différences significatives ($p < 0,05$), mais n'ont suivi aucune tendance définie. En conclusion, les oiseaux nourris avec le régime 3 ont donné le meilleur poids de carcasse, et les proportions d'organes n'ont montré aucun effet négatif par rapport aux régimes offerts aux oiseaux. Ainsi, l'inclusion de 28% de gâteau de soja dans un régime à base de céréalesacha s'est avérée supérieure aux gâteau d'arachide et de noix de cajou et elle est donc recommandée.

Mots clés : Graine de soja, Tourteau aux arachides, Farine de noix de cajou, Grain Acha, Caractéristiques de la carcasse, Proportions d'organes, Poulet de chair

Introduction

Poultry is one of the branches of livestock and rank best in conversion of feed to animal products such as meat and egg (Onunkwo, 2017). It needs less capital outlay in comparison with farm animals (Onunkwo and Ekine, 2020). High cost of feed has been observed as one of the most constraints militating against efficient development of poultry (Ekine and Onunkwo, 2020). Feed is the most experience item in poultry production responsible for between 60-80% of total cost of production (Ojewola and Olugbemi, 2011). Maize is the most utilized cereal in the animal feed industry and its future utilization is hampered by its growing global demand for industrial uses and attendant high cost (Onunkwo *et al.*, 2019). The problem of continued scarcity and consequent high prices of the conventional protein and energy sources of livestock in the tropics has stimulated a lot of interest in the search for alternative sources of feeds, particularly for non-ruminants (Udedibie and Opara, 1998).

Acha grain (*Digitaria exilis*) is probably the oldest African cereals (NRC, 1994) and it is

classified as one of the lost crops of Africa. Therefore, this study considered it necessary to utilize the so-called lost crop as possible alternative to the scarce, expensive dietary maize which is in stiff competition both by man, animals and industries for poultry nutrition.

Materials and methods

Location of study

The study was carried out at the poultry unit of the Michael Okpara University of Agriculture, Umudike Teaching and Research Farm, Abia State. This institution is located with the tropical rain forest zone and the environment is characterized by an annual rainfall of 2177mm. It also bears the co-ordinates of 5°28' North and 7°31' East, which lie at an attitude of 122mm above the sea level (NRCRI, 2019).

Experimental diets

A total of four experimental diets were formulated with soybean meal (full fat), soybean cake, groundnut cake and cashew nut meal were used at 28% inclusion level each in Acha-based diets (Table 1).

Experimental birds and management

A total of 120 Abor acre broiler chicks were

used for the study. The birds were raised and managed in deep litter material. The 120 day-old broiler chicks were randomly allocated to the 4 treatment dietary groups with each group having 30 birds replicated thrice (10 birds/replicate) in a Completely Randomized Design (CRD). The study lasted 56 days and the birds were fed and offered drinking water *ad-libitum*.

Data collection

Carcass evaluation was carried out at the end of the study. One bird per replicate was randomly selected, fasted over-night and slaughtered by severing the jugular vein. After scalding in warm water for about a minute, the feathers were manually plucked, each bird was cut into parts for carcass evaluation according to Ojewola *et*

al. (2001). The relative weights of cut- parts are as percentage of dressed weight. The internal organs, such as heart, kidney, gizzard/proviticulus were all weighed separately and recorded using electric micrometer 3000g weighing guage.

$$\text{Dressing percentage} = \frac{\text{dressed weight} \times 100}{\text{Live weight}}$$

$$\text{Organ weight (\% live weight)} = \frac{\text{organ weight} \times 100}{\text{Liveweight}}$$

Statistical analysis

The data collected were subjected to Analysis of variance (ANOVA) as outlined in Completely Randomized Design (CRD) by Steel and Torrie (1980) Significant means were separated using Duncan's New Multiple Range Test (Duncan 1995).

Table 1: Percent gross composition of the experimental die

Ingredient	T1	T2	T3	T4
Acha grain	54.30	54.30	54.30	54.30
Brewers Dried grains	11.00	11.00	11.00	11.00
Groundnut cake	28.00	-	-	-
Soya bean meal	-	28.00	-	-
Full fat soya bean	-	-	28.00	-
Cashew nut cake	-	-	-	28.00
Fish meal (local)	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
Vitamin mineral premix	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Percent crude protein	22.51	21.61	21.61	22.51
ME (Kcal/kg)	2700.00	2806.80	2700.00	2836.80

Results and discussion

The result of the carcass characteristics of broiler chickens fed different plant protein sources in an acha grain-based diet is shown on Table 2. There were significant ($P < 0.05$) differences in all the carcass characteristics measured. Birds fed diet 3 gave the best live weight (2155.00g), slaughter weight (1855.0g), defeathered weight (1838.33g),

dressed weight (1455.00g) and shank (112.00g). Birds fed diet 2 followed in the same manner. This result of this study suggests that the best live weight and carcass yield exhibited by these broiler chickens fed diets 3 and 2 could be attributed to better utilization of its dietary plant protein, its better amino acid profile, and balanced dietary composition. The observed high mean live weight also

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resulted in high dressed weights. This is in an agreement with the findings of Hayse and Marison (1973) who confirmed that heavier birds produced a greater eviscerated yield. The percent carcass yield observed was also in agreement with Ojewola *et al.* (2000).

The results of organ proportions of broiler chickens fed different plant protein sources in acha grain-based diet is shown on Table

3. The lungs, heart, liver, intestine and kidney showed significant difference ($p < 0.05$) among the treatment means while gizzard, bile, proventriculus and spleen were not. The organ proportions followed no definite pattern, thus at variance with the findings of Ojewola and Longe (2000) who reported that volumes and dimensions of broiler parts were directly related to the carcass weights.

Table 2: Carcass characteristics of broiler chicken fed different plant protein sources in acha grain-based diets

Parameters(g)	T1	T2	T3	T4	SEM
Live weight	1408.33 ^c	1924.55 ^a	2155.00 ^a	1005.00 ^b	188.34
Slaughter wt	1265.67 ^c	1641.66 ^a	1855.00 ^a	905.00 ^b	223.81
Defathered wt	955.00 ^b	1605.00 ^a	1838.33 ^a	805.00 ^a	145.70
Dressed wt	821.66 ^b	1455.00 ^a	1455.00 ^a	571.66 ^c	120.68
Shank	74.33 ^b	101.33 ^{ab}	112.00 ^a	60.00 ^c	7.76
Thigh	162.33 ^c	238.00 ^a	253.33 ^a	119.33 ^c	17.19
Breast-cut	219.00 ^b	426.66 ^a	412.00 ^a	140.67 ^b	38.62
Back cut	229.00 ^b	312.33 ^a	347.33 ^a	162.00 ^b	24.32
Drum stick	138.06 ^b	227.00 ^a	236.00 ^a	94.33 ^c	18.68
Wings	124.00 ^b	207.00 ^a	210.66 ^a	82.33 ^c	16.96
Head	51.33 ^b	62.66 ^a	70.33 ^a	41.33 ^b	3.54
Neck	88.00 ^b	111.00 ^a	128.33 ^a	59.00 ^c	8.10

a,b,c, values with different superscripts on same row are significantly different ($p < 0.05$)

Table 3: Organ proportions of broiler chickens fed different plant protein sources in acha grain-based diet

Parameters	T1	T2	T3	T4	SEM
Lungs	11.33 ^{ab}	14.67 ^{ab}	16.00 ^a	9.33 ^b	1.05
Heart	10.16 ^{bc}	12.67 ^{ab}	16.00 ^a	7.33 ^c	1.10
Liver	32.33 ^b	44.33 ^a	44.00 ^a	21.33 ^b	3.2
Gizzard	34.33	32.67	53.33	31.67	4.2 ^{NS}
Bile	1.43	1.17	1.77	1.00	0.49 ^{NS}
Intestine	85.67 ^{ab}	107.00 ^a	99.00 ^a	47.00 ^b	8.47
Proventriculus	8.43	8.10	9.43	8.43	0.09 ^{NS}
Spleen	1.10	1.10	2.43	1.00	0.41 ^{NS}
Kidney	10.67 ^b	17.33 ^a	17.33 ^b	7.00 ^b	1.55

a,b,c, means with different superscripts on same row are significantly different ($p < 0.05$)

Conclusion

From the results obtained in this study, it can be concluded that inclusion of 28%, soyabean meal in an acha-grain based diets proved to be superior over groundnut cake and cashew nut. Inclusion of 28% soyabean (full fat) meal in 54.30% Acha

grain-based diet enhanced growth rate, live weight and dressed weight. The organ proportions gave no definite pattern. Inclusion of cashew nut as plant protein source depressed growth and no demonstrable effect was seen in organ proportions.

References

- Duncan, D. G. 1955.** Multiple Range and Multiple F-tests, Biometries, 11: 1-42
- Ekine, O. A. and Onunkwo, D. N. 2020.** Growth performance and feed cost benefit of starter broiler chickens fed diet containing earthworm meal. *Nigerian Journal of Animal Production*, 47(1):208–213
- Hayse, P. L. and Marison, 1973.** eviscerated Yield, Component part and meat, skin and bone ratios in chicken. *Broiler poult. Sci.* 57:718-722.
- National Research Council 1994.** Nutrient Requirement of Poultry, 9th edition. Research Council, National Academy of Science, Washington 20C page 202.
- NRCRI, 2019.** Agro-Meteorology Unit. National Root Crop Research Institute, Umudike, Umuahia, Abia State, Nigeria.
- Ojewola G. S. and Longe, D. C. 2000.** evaluation of the Production and economic efficiencies of cropea Hull and Maize offel inclusion in layers ratio. *Nigerian journal of Animal Production* 27(1) 35-39.
- Ojewola G.S. and Olugbemi, F. 2011.** Millet Meal, a possible alternative energy source for proceeding of the 36th Annual conference of Nigeria Society or Animal Production held at Uni. Abuja (Edited by A.A. Adeniji E.A. Olatunji and E.S. Ghana) 3-16th March, 2011, 428 440 pp.
- Ojewola, G. S. and Longe, O. G. 2000.** Evaluation of the productive and economic efficiencies of cowpea hall and maize offal inclusion in layers' ration. *Nigerian Journal of Animal Production* 27(1) 35 - 39.
- Ojewola, G. S., Abasiekong, S. F. and Nwachukwu, C. S. 2001.** Methionine supplementation in diet productive two efficiency, carcass characteristics and economical of g r o w i n g indigenous turkey. *Trop. J. Anim sci*; 4:161 - 170.
- Onunkwo, D. N. and Ekine, O. A 2020.** Performance of weaner rabbits fed forage supplemented with local spices. *Nigerian Journal of Animal Production*, 47(2):76 - 81
- Onunkwo, D. N., Anyaegbu, B. C., Ezike, J. C and Daniel-Igwe, G 2019.** Dietary substitution of soya bean meal with processed African yam bean meal as protein source in the diets of finisher broilers. *Nigerian Journal of Animal Production*, 46(2):118–127.
- Onunkwo, D. N 2017.** Dietary inclusion of Direct fed microbe on the growth performance of broiler birds. *The Nigerian Agricultural Journal.* 48 (1): 199-205.
- Udedibie, A. B. and Opara, C. C. 1998.** Responses of growing broilers and laying hens to dietary inclusion of leaf meal. *Animal feed Science technology* 71: 157-164.
- Steel, R. G. D. and Torrie, J. H. 1984.** Principles and Procedures of statistics McGraw Hill. New York.
- Ukachukwu, S. N. and Anugwa, F. O. L., 1995.** Bioeconomic of feeding raw or heated soya beans to broilers. *Nig. J. Anim. Prod.*, 22: 137 - 147.

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