EVALUATION OF DONKEYS' CAECAL MEAL AS AN ALTERANATIVE PROTEIN FEEDSTUFF FOR BROILER CHICKENS

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Abstract-The demand increases for protein food for human consumption and animal feed resources has resulted to this innovative exploitation strategies that can reduce cost of feedstuffs, cost of production and improvement of supply as soon as possible. This study evaluates the potential of donkeys' caecal meal (DCM) as an alternative protein feed resources and strategies aimed at achieving food/feed nutritional security in human and broiler diets. One hundred and fifty day old Anak breeds were used for the study. The birds were randomly assigned to five diets in a completely randomized design consisting of three replicates with 10 birds per replicate. Five experimental diets were formulated. Diets were substituted with donkeys' caecal content meal such that diet 1 (T_1) served as control (0%). Diet 2 T_2 contained 2.5% DCM and diets 3, 4 and 5 (T_3, T_4 and T_5) contained 5.0%, 7.5%, 10% (DCM) respectively. The experiment lasted for eight weeks. The data were subjected to analysis of variance (ANOVA) and Duncan New multiple Range Test. The results revealed that birds fed diet (T_2) had significantly ($P<0.05$) improved body weight gain feed intake, superior feed conversion ratio than birds fed control diet (0% of the test diets. For cut-parts, birds fed diets 2 and 3 were significantly ($P>0.05$) the same except the wing/bird (g) and neck/bird (g). Although, diet (T_2) had highest ($P<0.05$) values in all the parameters, followed by diet T_3 in this experiment. The DCM could be substituted up to10% without any adverse effect on the broiler chickens.

Index Terms-Evaluation, Donkeys' Caecal, Alternative Protein, Feedstuff, Broiler Chickens

INTRODUCTION

Nowadays, the world is facing massive problems on food insecurities with climate changes that have led to undernourishment particularly in the developing countries like Nigeria. There is scarcity of protein food materials for human and animals as a result of these challenges there is deficiencies of animal proteins (milk and milk products, meat products, egg and others). These inadequacy of protein sources is seriously increasing danger of malnutrition, high cost of protein feed sources and animal products.

Poultry production shows a significant role in the world nutrition scheme, providing consumers with a major source of high-quality animal protein through meat and eggs (Henchion, *et al*., 2021). Poultry has superior feed conversion with lesser period of production phases, lucrative and makes its products more affordable compared to other animal protein sources (Pesti, *et al*., 2023**)**. The poultry birds are moderately easy to raise and suffer from very little maladies. Normally, poultry feeding practices depend deeply on grains such as corn, wheat, and soybeans, which are also staple foods for humans (Muleta, *et al*., 2024). The shortages of feed have consequently resulted in great increases in costs of poultry products these days. It has affected severely, the price of animal productions for example, poultry and other monogastric thus resulting to increase in the price of their products.

Attempt to reduce the high cost of protein sources as well as cost of animal products has led to search for alternative cheaper, locally available waste and by-products hence this study. This has led to utilization of different novel and alternative feed ingredients, such as leaves or plants, grass/legume and animal by-products into poultry diets suggests encouraging methods towards alleviating the existing challenges in broiler production. Donkeys' caecal contents are the undigested forages inside the caecal; mixed-up with fermented and unfermented forages that contains enough nutrients like protein, mineral, fibre and energy which enhance the growth performance of chicken. It is an animal waste that has enormous potentials. Donkeys' caecal content is readily available, accessible and can serve as alternative feedstuff for livestock especially monogastric animals.

This is economical feedstuff, if these by-product is utilized, it will reduce the cost of animal feeds and alleviate environmental pollutions problem. They are subjected to additional processing steps, such as enzyme treatment, fermentation and heat treatment (Vlaicu, *et al.,* 2023). Mostly, animal's by-product consist of all parts of a live animals which are not parts of the dressed carcass for example animal by-product like, caecal, blood, fat, bone and others. The meat product is inadequate to meet the food requirement of people (Fayemi *et al.,* 2016). Babatunde *et al*. (2017) has proposed in his earlier studies that involving the utilization of feed materials must be improved and as well be evaluated. It is the main source of energy and vitamin particularly vitamin (B) complex (Mahmoud, 2015).

Abattoir by-products like, bone, hide and skins, feather, hoove, horn, hair, bristle with animal by-product may be altered by utilizing the valuable product for human uses as well as domestic animal exploit Irshad *et al.* (2015). The exploitation of ceacal content can serve as alternatives for feed sources in the monogastric production. Globally, lack of feedstuffs, due to climate change has influenced the continued rises in the price of animal feed which is a serious threat to both farmers and their animals thereby affecting the consumers of animal products. One of the ways to reduce the increases in the price of feed with the price of poultry is the exploitation of the cheaper as well as locally accessible alternative by-product particularly those that contains no nutritional values to farmers. This study will evaluate donkey caecal content as alternative protein feedstuff for boiler production and as well alleviate pollution problem.

MATERIALS AND METHODS

Experimental site

The research was conducted at the Teaching and Research farm, Department of Animal Science, Faculty of Agriculture, Alex Ekwueme Federal University Ndufu-Alike, Ebonyi State, Nigeria.

Sources and processing of experimental material

Donkeys' Caecal content was collected from the main abattoir in Ohaukwu at Nkwo-Ezzangbo main market. The intestine was split open with the aid of sharp knife and the content was emptied into a 25 litres plastic bucket. The caecal content was boiled separately for 30 minutes. The donkeys' caecal contents (DCC) were sun dried on concrete floor for 12% moisture. The sun drying was done within the month of April and May. The dried caecal content was milled in a hammer mill and stored for further use.

Experimental diet

The processed DCM was used to formulate five experimental diets such that diet I (T_1) contained 0% DCM without supplementation (control). Diet 2 (T_2) contained 2.5% DCM without supplementation. Diets T_3, T_4 and T_5 contained 5.0%, 7.5% and 10% DCM, respectively.

Table 1: Experimental Diets Containing Donkeys' Caecal Meal (DCM).

Ingredients (%)	0	2.5	5.0	7.5	10
Maize	50.00	50.00	50.00	50.00	50.00
Soyabean meal	25.00	22.50	20.00	17.50	15.00
DCM	0.00	2.50	5.00	7.50	10.00
PKC	9.00	9.00	9.00	9.00	9.00
Wheat Offal	10.00	10.00	10.00	10.00	10.00
Fish Meal	3.00	3.00	3.00	3.00	3.00
Bone Meal	2.00	2.00	2.00	2.00	2.00
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated Chemical Composition					
Crude Protein	20.60	21.29	21.16	21.14	21.11
Crude Fibre	4.28	6.28	6.43	6.48	6.52
Ether Extract	3.96	3.09	3.07	3.04	3.01
Total Ash	3.38	3.88	4.91	4.96	4.98
Metabolizable Energy (kcal/kg)	3101.56	3095.97	3077.05	3058.80	3050.11

Vit.K;2.5g, Vit,B2;0.3g, Vit.B6; 8.0mg, Vit.B12;8.0g, Nicotinic acid; 3.0, Ca-Panthothenate;5.0mg, Fe;10.0g, Al;0.2g, u;3.5mg, Zn;0.15mg, I;0.02g, Cu;0.01g,Sc. DCM = donkeys' caecal meal**,** .PKC = Palm kernel cake. Total ME/Cal (kg) = Total Metabolizable Energy per Calorie in Kilogramme Premix supplied (Univit 15 Roche) contained: 15001.U, Vit.A; 15001.U, Vit.D; 30001U, Vit.E; 3.0g, DCM = donkeys' caecal meal**,** .PKC =Palm kernel cake. Total ME/Cal (kg) = Total Metabolizable Energy per Calorie in Kilogramme.

Experimental Design, animals and management of the broiler chickens.

One hundred and twenty day old chicks were used for the study. Each bird was weighed before the commencement of the experiment and weekly throughout the experiment period. The birds were randomly allotted to five dietary treatments in a completely randomized design (CRD). Other poultry management practices were maintained and the experiment lasted for five weeks (56days).

Statistical analysis

All data obtained were statistically analyzed andsubjected to analysis of variance (ANOVA) as outlined by Sedecor and Cochram (2005). Duncan new multiple Range Test as outlined by Obi (1990) was to separate the means.

Collection of blood samples and analysis

Blood (2ml) was collected from three birds of each replicate via wing vein. Samples collected were put in a sterile bottle tube containing Ethylene Diaminetetra-acetic acid (EDTA) as anticoagulant to prevent blood clothing before the analysis. Packed cell volume (PCV) and haemoglobin count were determined as described by Ewuola and Egbunike (2008). Analysis to be obtained serum albumin and protein were analyzed using sigma kits according to Feteris (1965) total cholesterol was determined spectrophotometrically.

RESULTS

The results of the proximate composition of feed ingredients are shown in Table 2. The result revealed that the crude protein content of 21.67.

Table 2: Proximate Composition of Donkey Caecal Meal (DCM)

Parameters (%)	Donkey Caecal Meal
Moisture (M)	11.23
Crude Protein (CP)	21.67
Crude Fibre (CF)	5.04
Ether Extract (EE)	1.81
Total ash	4.66

There were significant (P<0.05) differences in all the parameters measured except for initial body weight. For final weight/bird, weight gain/bird and weight/bird/day for diets T_2, T_3 and T_4 were significantly (P<0.05) higher than diets T_5 and the least was recorded in diet T_1.

Table 3: Performance of Broiler Chickens fed Graded Levels of Donkey' Caecal Meal

Parameters	T1 (0%)	T2 (2.5%)	T3 (5.0%)	T4 (7.5%)	T5 (10%)	SEM
Initial weights/bird (g)	100.33	102.67	101.67	101.33	101.33	0.30
Final weights/bird (g)	2340.33^{c}	2396.00^{a}	2388.33^{a}	2384.67^{a}	2351.33^{b}	8.03
Weights gain/bird (g)	2231.33^{c}	2293.33^{a}	2286.67^{a}	2283.33^{a}	2250.00^{b}	8.25
Weights gain/bird/day(g)	39.84^{c}	40.95^{a}	40.83^{a}	40.77^{a}	40.18^{b}	0.14
Feed intake /bird (g)	4786.67^{c}	4800.00^{c}	4806.67^{c}	4850.00^{b}	4891.33^{a}	11.20
Feed intake/bird/day (g)	85.48^{c}	85.71^{c}	85.88^{c}	86.61^{b}	87.34^{a}	0.20
Feed conversion ratio	2.14^{a}	2.08^{d}	2.10^{c}	2.12^{b}	2.16^{a}	0.009

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

Birds fed diets T_2, T_3 and T_4 were significantly (P<0.05) influenced than those birds fed control diet T_1. The feed intakes/bird and feed intakes/bird/day revealed that T_1, T_2, and T_3 were significantly (P>0.05) the same but lower than T_4, and T_5. Diet T_5 also was (P<0.05) higher than diet T_4. Feed conversion ratio was significantly (P<0.05) different among the treatment groups. Birds fed diets containing 0% and 10% had highest values followed by diet containing7.5% then diets containing 5.0% and 2.5% DCM. Birds fed diet with 2.5% DCM recorded the best feed conversion ratio followed by diet with 5.0% DCM.

Table 4: Cut parts of Broiler Chickens fed diets containing graded levels of DCM

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	T_5 (10%)	SEM
Live weight (g)	2081.33^{c}	2290.00^{a}	2226.67^{a}	2183.33^{b}	2150.00^{b}	23.50
Dressed weight/bird (g)	1781.33^{c}	1990.45^{a}	1926.67^{a}	1883.33^{b}	1850.00^{b}	23.50
Dressing (%)	85.56^{b}	86.90^{a}	86.52^{a}	86.30^{a}	86.59^{a}	0.015
Thigh muscle/bird (g)	27.01^{c}	28.04^{a}	28.00^{b}	28.00^{b}	28.00^{b}	0.106
Breast muscle/bird (g)	25.00^{c}	25.14^{a}	25.10^{a}	25.05^{b}	25.04^{b}	0.016
Shank/bird (g)	4.06^{d}	4.11^{a}	4.09^{a}	4.08^{b}	4.07^{c}	0.005
Back /bird (g)	7.04^{b}	7.08^{a}	7.08^{a}	7.04^{b}	7.04^{b}	0.005
Wing/bird (g)	6.07^{a}	6.00^{b}	6.00^{b}	6.00^{b}	6.00^{b}	0.009
Neck /bird (g)	5.21^{a}	5.03^{b}	5.03^{b}	5.00^{b}	5.00^{b}	0.021
Head /bird (g)	4.03^{b}	4.06^{a}	4.00^{b}	4.05^{a}	4.05^{a}	0.003
Cloaca /bird (g)	3.80^{b}	3.83^{a}	3.83^{a}	3.83^{a}	3.83^{a}	0.003

[a,b,c,d] Means in a row with different superscripts are significantly different (P<0.05). SEM = Standard Error of mean. DCM= Donkey Caecal Meal

The result the carcass weights of broiler shows that there were significant (P<0.05) difference in all the parameters considered. The live weights and dressed weights values were significantly (P<0.05) higher in diets with 2.5% and 5.0% DCM than others. This was followed by diets containing 7.5% and 10% DCM which were (P>0.05) same. The least value was recorded for birds on control diet (0% DCM). The dressing percent and clocoa of birds fed diets containing 2.5% - 10% DCM were higher (P<0.05). The values for thigh muscle was (P<0.05) higher in birds fed diet 2.5% than others. This was followed by birds fed 5.0%, 7.5% and 10% DCM which was (P>0.05) similar. The least thigh muscle value was recorded for birds fed control diet 0% DCM. The values for breast muscle, shank and back were statistically (P<0.05) higher in diets 2.5% and 5.0% DCM than others.

DISCUSSIONS

Growth Performance

The higher weight gain of birds obtained in diets T_2, T_3 and T_4 could be attributed to proper utilization of protein, energy, vitamin and mineral components of their diets. The observed highest value in feed intakes of birds was recorded for T_5 was because birds ate more feed to attain their energy requirement. The result was similar to the earlier reports of (Mishra *et al*., 2015) who incorporated rumen content in broiler chickens ration. These results were in disagreement with that reported by (Osman *et al.,* 2015) who found that inclusion of dried rumen content in diets at 0.5 % and 10% dried rumen meal did not affect final weight gain/bird and weight gain/bird/day. The differences between the earlier reports may be due to difference in rumen content as a result of different geographical sources of the grasses. This may be as a result proper utilization of protein, energy, vitamin and mineral components of their diet. Diets containing 2.5% donkey caecal meal recorded the highest weights while control diet containing 0% DCM had the least value. Birds fed diet containing 2.5% DCM performed significantly (P<0.05) better than those on other diets. The significant (P<0.05) improvement may be due to lower level of donkey caecal meal which resulted to low fibre content in diets T_2. The result was similar to the earlier report of (Mishra *et al*., 2015) who fed dried blood and rumen content and its effect on performance of broiler birds. On the other hand, the significant (P<0.05) difference observed in this study was not in line with earlier researchers (Anmar and Wazeer, 2016). The improved weight gain of birds fed diets containing 2.5% - 5.0% DCM probably may be due to proper utilization of nutrient. The variation may be due to different forages fed to the animals. Since the higher, the feed conversion ratio the poorer the diets Ogbonna *et al*.(2000) hence diet containing 2.5% donkey caecal meal was more superior than other diets.

The higher values obtained in the live weights and dressed weights on diets 2 and 3 may be due to utilization of nutrients in feed, low ant-nutritional factors, digestion of adequate fibre in the their diet for more metabolizable energy and increased feed intake as level of DCM increased. Birds fed diets containing 2.5% and 5.0% DCM recorded high percentage dressed weight over others which implies that there is proper utilization of nutrients in their diets. It was observed that the overall parameters under carcass yield, dietary treatment performed better than the control diet. Again, it was obtained that in all the parameters measured; that diet 2.5% DCM exhibited a superior performance in the values of cut parts when expressed as percentage of dressed weight. The study revealed similar results (Cherdthong *et al.,* 2014) when incorporation dried rumen content in the cattle diet.

CONCLUSION

This study concludes that donkey caecal meal can be utilized as an alternative protein feedstuff for broiler chickens diets. Birds fed diets containing DCM improved weights gain, feed conversion ratio and carcass yield in all the dietary treatment were better than the control diet. Diet containing 2.5% DCM exhibited a superior performance in the values of cut parts when expressed as percentage of dressed weight. Although, diet (T_2) had highest ($P<0.05$) values in all the parameters, followed by diet T_3 in this experiment. The DCM could be substituted up to10% without any adverse effect on the broiler chickens.

Statements and Declarations:

Statement of Animal Rights: The study was carried out after having consulted the institutional guidelines on the use of animals for scientific research and obtaining ethical clearance.

Conflict of Interest: The authors declare that there was no conflict of interest.

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