CARCASS CHARACTERISTICS AND LIPID PROFILE OF BROILER CHICKENS FED THREE SEED CAKE-BASED DIETS WITH AND WITHOUT MULTIENZYMES SUPPLEMENTATION

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ABSTRACT
The study was conducted to evaluate the impact of feeding three seed cake-based diets partly substituting soya bean cake with and without multienzymes supplementation, on carcass characteristics and lipid profile of broiler chickens. In feeding trial one and two, 352 and 330 Cobb 500 day old broiler chicks were allocated to four and five dietary treatments respectively. In trial one; the diets contained Groundnut cake (GNC), Roselle seed cake (RSC) and Baobab seed cake (BSC); while in trial two, it contained BSC and RSC with and without multienzymes, all in a completely randomized design, at 20% inclusion level for 49 days each while diet with maize-soya bean cake based diet served as control. Four and five nitrogenous diets with 23 and 20% crude protein were formulated for starter and finisher phases respectively. From the results, Breast weight was higher ($P<0.05$) for birds fed SBC (29%) and RSC (30%) without multienzymes, birds fed RSC had least ($P<0.05$) cholesterol (79.60 mmol/L) and low density lipoprotein levels (13.30 mmol/L). Carcass characteristics of some cut parts (breast and back), organs (liver, heart, gizzard and lungs), abdominal fat were significant ($P<0.05$) with multienzymes addition while lipid profile of the birds were not significantly ($P>0.05$) affected with multienzymes supplementation.
Keywords: Carcass characteristics, Lipid profile, Seed cakes, Multienzymes, Broiler chickens.

INTRODUCTION
Broilers chickens are fast growing and efficient converters of nutrient in feed to muscle. Energy and protein sources are largest portion by volume for broiler chicken diet and are becoming more expensive, therefore nutritionist substitute these ingredients to replace them with cheaper and readily available one's, and sometimes add enzymes and other feed additive, to reduce feed cost. It consequently affects either positively or negatively; proportion and weight of carcass cut parts, fat deposition in meat and muscle development. Most broiler chicken farmers harvest their crops at an early age of four to six weeks with poor feeding, this lowers carcass yield and meat cut proportions. Major carcass parts (breasts, thighs and drumsticks) and lipid profile of broiler chickens can be affected by some factors like genotype, health, age at slaughter, ingredient type/diet composition, energy to protein ratio and plain of nutrition (Nikolova and Pavlovski, 2009). Carcass yield, fattiness and proportion of each cut part is very important to actors along poultry value chain that produce and or sell chicken parts to final consumers and processing industries. Poultry products are produced according to needs of consumers and processing industries. Therefore, there is need to use cheap and available protein and energy source to improve carcass yield, produce lean and healthy meat at low cost that will fit into the need of final consumers and poultry processing industries.

MATERIALS AND METHODS
Experimental site
This research was conducted at Teaching and Research farm of Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University Zaria. The area is located at latitude 11°09'06" N and longitude 7°38'35" E, in Northern Guinea Savannah of Nigeria (Ovimaps, 2018).
Experimental Design and Management of Birds
In trial one and two, 352 and 330 Cobb 500 day old broiler chicks were purchased from Olam farm in Kaduna State. They were assigned into four and five dietary treatments respectively, each were replicated 4 times with 22 chicks in a completely randomized design (CRD). Each feeding trial lasted for eight (8) weeks. Ethical approval for animal use and care was obtained, prior to the

commencement of the experiment. Trial one and two were carried out from July to October and December to February respectively.

Experimental diets

Four and five diets with 23 and 20 % crude protein were formulated for starter and finisher phases for trial 1 and 2 respectively as shown in Table 1. Groundnut cake, RSC and BSC were included at 20% and served as the experimental diets for trial 1, BSC and RSC with and without multienzymes served as experimental diets for trial 2, multienzymes (Maxigrain (E); protease 4000 IU, xylanace10000IU, phytase 2500 FTU and cellulase 10000 IU) was incorporated based on manufacturer's dose (100g/1000kg diet), while diet with maize-soya bean cake served as control for both trials.

Determination of Carcass characteristics and Lipid profile

Four (4) averagely weighed chickens from each treatment at 9 weeks after digestibility, were used for carcass evaluation. Birds were starved of feed for 12 hours, bled by severing jugular vein and scalded. Live weight for each was taken before slaughter, dressed weight, weight of organs and standard cut parts were measured while dressing percentage was calculated. Organs were expressed as of live weight while cut parts were expressed as percentages of dressed weight (Jiya *et al*., 2014). Blood samples (2 ml) were initially collected (from same set of birds into sterilized sample bottles without anticoagulant and were taken to the Clinical Pathology Laboratory of Ahmadu Bello University Teaching Hospital, Zaria for determination of lipid profile using standard laboratory procedures (Lamb, 1991).

Table 1: Composition of Broiler Starter/Finisher Chicken Diets Containing Groundnut Roselle and Baobab Seed Cakes Partly Substituting Soya Bean Cake with and without Multienzymes

	Diets							
Ingredients	Starter diet				Finisher diet			
(Trial one)	**SBC**	**GNC**	**RSC**	**BSC**	**SBC**	**GNC**	**RSC**	**BSC**
Maize	58.80	58.70	55.90	56.8	59.00	58.8	56.80	57.00
Soya bean cake	35.00	15.00	15.00	15.00	29.00	10.00	10.00	10.00
Groundnut cake	0.00	20.00	0.00	0.00	0.00	20.00	0.00	0.00
Roselle seed cake	0.00	0.00	20.00	0.00	0.00	0.00	20.00	0.00
Baobab seed cake	0.00	0.00	0.00	20.00	0.00	0.00	0.00	20.00
Maize offal	0.00	0.00	0.00	0.00	7.00	6.00	5.00	7.00
Blood meal	2.00	2.00	5.00	4.00	1.00	1.00	4.00	2.00
Bone meal	3.00	3.00	3.20	3.00	3.00	3.00	3.00	3.00
Limestone	0.50	0.50	0.20	0.50	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.00	0.10	0.00	0.00	0.00	0.20	0.20	0.00
*Vit-min premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
(Trial two)	**RSC**	**RSC+E**	**BSC**	**BSC+E**	**RSC**	**RSC+E**	**BSC**	**BSC+E**

*Note: ingredients composition for trial one and two, were the same except in trial two, where multienzymes was added to RSC and BSC at 100g/1000kg of diet, soya bean cake diet also served as control for trial two, E= multienzymes.

Statistical analysis

Data were analyzed using ANOVA procedure of Statistical Analysis System (SAS 2002) and treatment means were statistically separated using Least Significant Difference (LSD), at $P<0.05$ level of significance.

RESULT AND DISCUSSION

The carcass characteristics of broiler chickens fed SBC, GNC, RSC and BSC diets, and broiler chickens fed RSC and BCS with and without multienzymes partly substituting SBC is presented in Table 2. Live and dressed weights for birds fed SBC were significantly ($P<0.05$) higher than other treatments and least mean was recorded for those fed BSC. Dressing percentage was significantly ($P<0.05$) higher in birds fed SBC, GNC and RSC and least was observed for those fed BSC. There were significant ($P<0.05$) effects of dietary treatments in major cuts for breast yield and in organs

weight for gizzard. This indicated that dietary treatments had no significant effect on other cut parts and organ weights. Bigger breast muscle yield was recorded in birds fed SBC and RSC in their diets and this could be an indication that they had the ability to improve breast yield in chickens. The result is in agreement with that of Ojile (2017) who reported that RSC improves breast Muscle yield.

Table 2: Carcass Characteristics of Broiler Finisher Chickens Fed Roselle and Baobab Seed Cake Diets Partly Substituting Soya Bean Cake with and without Multienzymes

Parameters	**Dietary Levels of the Seed Cakes (kg/100kg diet) Trial One**					**Trial Two**					
	SBC	**GNC**	**RSC**	**BSC**	**LSD**	**SBC**	**RSC**	**RSC+ E**	**BSC**	**BSC+ E**	**LSD**
Live weight (g)	3450^{a}	3195^{b}	3166^{b}	2450^{c}	209	3126^{a}	2860^{ab}	2700^{bc}	2473^{c}	2633^{bc}	281
Dressed weight (g)	3143^{a}	2900^{b}	2833^{b}	2211^{c}	172	2793^{a}	2583^{ab}	2433^{bc}	2300^{c}	2383^{bc}	280
Dressing percentage (%)	81^{a}	80^{ab}	84^{a}	76^{b}	4.83	76	76	77	75	75	5.55
Major cuts expressed as percentage of dressed weight											
Thigh (%)	13	13	12	12	1.00	12	12	12	12	11	1.64
Breast (%)	29^{ab}	27^{b}	30^{a}	25^{c}	1.80	31^{a}	27^{bc}	28^{ab}	23^{c}	25^{bc}	3.65
Drumstick (%)	11	10	10	11	0.95	10	10	10	10	10	1.77
Back (%)	12	12	12	12	0.83	12^{b}	12^{ab}	13^{ab}	13^{a}	12^{ab}	1.10
Organs expressed as percentage of live weight											
Liver (%)	1.85	1.99	1.91	2.02	0.40	1.62^{b}	2.08^{ab}	1.76^{ab}	2.26^{a}	1.80^{ab}	0.56
Heart (%)	0.39	0.44	0.38	0.42	0.08	0.39^{b}	0.47^{ab}	0.53^{a}	0.49^{ab}	0.45^{ab}	0.11
Kidney (%)	0.48	0.60	0.63	0.53	0.16	0.53	0.48	0.54	0.56	0.43	0.17
Spleen (%)	0.13	0.11	0.11	0.10	0.05	0.11	0.10	0.08	0.06	0.10	0.05
Gizzard (%)	2.15^{b}	2.31^{b}	2.30^{b}	3.41^{a}	0.29	2.33^{b}	2.71^{a}	2.72^{a}	2.92^{a}	2.94^{a}	0.36
Lung (%)	0.59	0.56	0.46	0.63	0.20	0.48^{a}	0.45^{ab}	0.53^{a}	0.49^{a}	0.40^{b}	0.07
Abdominal fat (%)	1.03	1.19	1.37	1.59	0.86	1.11^{b}	1.70^{ab}	1.77^{ab}	3.18^{a}	2.32^{ab}	1.81

^{abc}= Means with different superscripts on the same row are significantly different $P < 0.05$, SBC= Soya Bean Cake, GNC= Groundnut Cake, RSC= Roselle Seed Cake, BSC= Baobab Seed Cake, LSD= Least Significant Difference.

In trial two, live and dressed weights were significantly higher ($P<0.05$) for birds fed SBC diet (3.12 and 2.79 kg) but was similar ($P>0.05$) to RSC + E (2.86 and 2.58 kg). Dressing percentage was not significant ($P>0.05$) for all dietary groups. For major cuts, breast and back percentages were significant $P<0.05$ while thigh and drumstick percentages were not significant ($P>0.05$). Carcass characteristics of all the organs were significant ($P<0.05$) except for kidney and spleen. The breast percentage for SBC and RSC were similar and was comparable to the findings of Ojile (2017), that the breast cuts showed no significant difference when broiler chickens were fed RSC replaced with SBC at 24%. Muataz (2019) also reported that enzyme supplementation had a highly significant impact in all cut part proportions of broiler chickens, with negative breast and positive thigh, but had no effect in drumstick proportion. The finding of Muataz (2019) on the effect of enzyme supplementation in drumstick proportion were similar to the results in this study, but was contrary to breast and thigh percentages. Addition of multienzyme also had significant effect in liver, heart, gizzard and lung proportions (%) for RSC and BSC. High abdominal fat was seen in broilers fed all dietary treatments except SBC, this could be due to the conversion of excess energy to fat which acted as reserve energy for the chickens (Fouad and El-Senousey, 2014).

Lipid profile

Result of lipid profile of broiler chickens fed GNC, RSC and BSC diets is shown in Table 3. Triglycerides and high density lipoprotein were not significant ($P>0.05$) for all the treatments. Cholesterol and Low density lipoprotein were significantly higher ($P<0.05$) for birds fed SBM, GNC and BSC while the least was observed in those fed RSC. All values obtained were within normal range but RCS was lowest when compared with other diets. Plane of nutrition, feed type, ingredients used, anti-nutrients, amount of crude fiber, breed of chicken and environmental factors could be the

reason for variations in cholesterol levels. This was consistent with Sutrihadi *et al.* (2013) that dietary crude fiber could affect blood cholesterol. All parameters tested were not significant (P>0.05) and were within normal range for birds fed RSC and BSC with and without multienzymes.

CONCLUSION AND RECOMMENDATION

Based on the results, dietary inclusion of the seed cake-based diets with and without multienzymes significantly; Increased breast muscle yield with RSC addition and had no effect on the lipid profile of the broiler chickens. Poultry farmers can feed SBC or partly substitute SBC with RSC at 20% in broiler chickens diet for bigger breast muscle yield.

Table 3: Lipid Profile of Broiler Chickens Fed Roselle and Baobab Seed Cake Diets Partly substituting Soya Bean Cake with and without Multienzymes

	Dietary Levels of the Seed Cakes (kg/100kg diet)						
Parametes	**SBC**	**GNC**	**RSC**	**BSC**		**LSD**	**Reference**
(Trial One)							**Range**
Triglycerides(mmol/L)	66.85	64.78	86.63	82.30		25.35	<150.00**
Total cholesterol(mmol/L)	110.02[a]	104.55[a]	79.60[b]	106.22[a]		17.19	52.00-148.00*
High density lipoprotein (mmol/L)	44.38	48.63	28.93	52.20		39.55	≥22.00**
Low density lipoprotein (mmol/L)	23.350[a]	28.15[a]	13.300[b]	26.150[a]		9.35	≤130.00**
(Trial Two)	**SBC**	**RSC**	**RSC+E**	**BSC**	**BSC+E**	**LSD**	
Triglycerides(mmol/L)	68.59	68.54	65.13	63.63	67.67	10.75	<150.00**
Total cholesterol(mmol/L)	105.79	102.15	112.38	97.44	102.06	16.97	52.00-148.00*
High density lipoprotein (mmol/L)	52.80	57.36	53.92	57.83	47.80	17.53	≥22.00**
Low density lipoprotein (mmol/L)	39.27	31.03	45.43	33.11	40.73	22.10	≤130.00**

[ab]= Means with different superscripts on the same row are significantly different P < 0.05, SBC= Soya Bean Cake, GNC= Groundnut Cake, RSC= Roselle Seed Cake, BSC= Baobab Seed Cake, LSD= Least Significant Difference, *Basmacioglu and Ergul, (2005), **Manoppo *et al*., (2007).

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