REPLACING MAIZE WITH PALM OIL SLUDGE IN BROILER CHICKEN DIETS: EFFECT ON CARCASS CHARACTERISTICS, ORGAN WEIGHT AND MUSCLE DEVELOPMENT

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ABSTRACT

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The study investigate the effect of replacing 10, 20, 30 and 40% of the energy supplied by maize in a control diet with energy from palm oil sludge on carcass characteristics, organ weight and muscle development of broiler chickens. A total of 200 shaver starbo day old broiler chicks were used for the experiment. The birds were randomly allocated to 5 treatments at 10 birds per replicate and 4 replicate per dietary treatment. The experiment lasted 8weeks. At the end of the experiment, 3 birds per replicate were sacrificed for sample collection. The result showed that apart from the belly fat content which increased with increase levels of palm oil sludge in the diets ($P<0.5$), other parameters for carcass characteristics were not significantly influenced ($P>0.05$) by the dietary treatments. There was no significant influence ($P>0.05$) of the dietary treatment on all the organs measured. The relative length and breadth of the breast muscles, the thigh muscle weight and the drumstick muscle weight were not significantly influenced ($P>0.05$) by the dietary treatment. However, the inner breast muscle and outer breast muscle weight were significantly different ($P<0.05$).

Key words: Palm oil sludge, broiler chickens, maize, carcass characteristics

INTRODUCTION

The livestock industry in Nigeria is dependent on conventional and non conventional feed stuffs, and many researchers have opined that the feed account for about 60-70% of the total cost of livestock production (Ranjhnan, 2001). This could be attributed to the high cost of feed stuffs, which are also consumed by human beings and serve as raw materials for agro-processing industries. The level of meat and animal protein consumed by Nigerians is low. Nigerians consumes about 10g per head per day (Tewe, 1997). This is about 29% of the recommended amount of 35g per head per day (FAO, 1986). Thus, there is the need to increase animal productivity vis-à-vis making animal protein source available and affordable to the Nigerian populace. Babatunde and Tewe (1987) had earlier suggested that the best logical solution to our national meat scarcity is to increase poultry production. Poultry meat has a wide acceptance with little or no limitation in terms of tradition and religious taboos as compared to pork which is rejected by muslims (Afolabi and oladimeji, 2003). One of the problems of Nigeria poultry farmers is the provision of feed of optimum native value. Cereals constitute the major energy feed stuff and also make up more than one-third of the finished feed for poultry. Maize is an important source of energy in human nutrition and due to its high price; it is becoming more expensive to use at high level in poultry feeds. There is therefore a continuous quest for other and indigenous source alternative feed stuffs.

The importance of well documented nutritional effect on carcass traits and muscles of the chest and hind limbs in avian species is well evidenced (Aletor *et al*, 1989; Agbede and Aletor, 1997). Previous report by Aletor *et al*. (1989) showed that apart from changes in nitrogen balance and biochemical parameters, nutrition or dietary manipulation exert several influence on the development of carcass traits, organs and certain muscles in boilers.

However, in considering the nutritional potentials of palm oil sludge for possible substitution in boiler diets, investigation of its effect on the overall performance and carcass characteristics is important. The ability to attain market weight as early as possible, good health and overall quality of the meat from the birds is indices of good nutrition.

This study was designed to access the effect of replacing up to 40% energy from dietary maize with energy supplied by palm oil sludge on carcass characteristics, relative organ weight and muscle development of boiler chickens.

MATERIALS AND METHOD

Experimental site

The experiment was conducted at the Teaching and Research Farm of the Federal University of Technology Akure.

Experimental materials

The palm oil sludge used for the experiment was collected from the palm oil processing unit of the Federal College of Agriculture, Akure, Nigeria. The sludge was used without any processing.

Experimental diets

There were five experimental diets with the gross composition shown in Table 1. The energy supplied by maize in diet 1 was replaced at 10, 20, 30 and 40% by energy supplied by palm oil sludge in diets 2, 3, 4, and 5 respectively (translated to 4, 8, 12 and 16% dietary level of incorporation of palm oil sludge, respectively).

Experimental Layout

Two hundred day old boiler chicks (shaver starbo breed) were used for the experiment. The experimental design was completely randomized and the birds were reared on deep litter. There were 10 birds per replicate and 4 replicate per dietary treatment. The experiment lasted for 8 weeks. Experimental diets and water were given *ad libitum*. At the end of the experiment, 3 birds per replicate were sacrificed to obtain the relative organ weight, carcass characteristics and muscle development as describe by Agbede (2000). All the carcass traits and the relative organ weight were expressed in g/kg body weight except the dressed and eviscerated weights, which were expressed as % live weight. The measurement of the outer and inner breast muscle weight, length and breadth of the muscles were taken. The muscle weights were expressed in g/kg body weight while length and breadth were expressed in cm/kg body weight. All data were subjected to one way analysis of variance using the Minitab statistical package (v.10.2, Minitab Inc, USA.).

Table 1. Gross composition of experimental diets (%)

Ingredient	Starter diet				
	1	2	3	4	5
	0	10	20	30	40
Maize	56.00	50.40	44.80	39.20	33.60
Maize offal	-	0.50	0.50	0.50	0.50
Soya bean meal	16.00	14.00	13.50	12.00	10.50
Groundnut cake	15.35	14.45	14.40	13.53	13.63
Brewerdry grain	4.00	7.47	9.00	12.53	15.00
Palm oil sludge	-	4.53	9.06	13.59	18.12
Basal diet*	8.65	8.65	8.65	8.65	8.65
Total	100	100	100	100	100
			Finisher diet		
Maize	50.00	45.00	40.00	35.00	30.00
Maize offal	13.00	13.00	13.00	13.00	13.00
Soya bean meal	13.00	13.00	13.00	13.00	13.00
Groundnut cake	13.00	13.00	13.00	13.00	13.00
Brewerdry grain	5.30	6.26	7.22	8.18	9.14
Palm oil sludge	-	4.04	8.08	12.12	16.16
Basal diet*	5.70	5.70	5.70	5.70	5.70
Total	100	100	100	100	100
Calculated composition			Starter diet		
Crude protein (%)	22.98	22.36	22.37	21.83	21.72
M.E (kcal/kg)	2982.48	2987.27	2994.10	3003.14	3016.17
Ether extract (%)	4.22	5.02	5.84	6.72	7.52
			Finisher diet		
Crude protein (%)	19.71	19.33	19.44	19.54	19.66
M.E (Kcal/kg)	2916.86	2936.70	2955.55	2974.38	2998.23
Ether extract (%)	5.20	5.90	6.63	9.35	8.07

Basal diet used in the starter diet contains per kg, Fish meal 5.00, Bone meal 2.50, starter premix 0.25, Methionine 0.25, Lysine 0.15 and Salt 0.50.

Basal diet used for formulating the finisher diet contains per kg, Fish meal 1.20, Bone meal 2.50, finisher premix 0.50, Oyster shell 0.50, Methionine 0.25, Lysine 0.15 and Salt 0.50.

RESULTS AND DISCUSSION

The Proximate composition of palm oil sludge used for formulating the diets for the study is presented in Table 2. It has a crude protein content of 8.85%, which make it comparable to maize with about 9% crude protein. The energy content is relatively high (18.7MJ/Kg) which makes it a good energy source in poultry industry. Table 3 shows the result of the carcass characteristics of the broiler chickens fed diets containing palm oil sludge. The belly fat content increased significantly ($P<0.05$) with increasing levels of palm oil sludge in the diets. This suggests that palm oil sludge would promote fat deposition in broiler chickens. The result also shows that both the control and test diets promoted the development of identical carcass traits. It would also be noted that the dressing percentage obtained in this study was higher than 78% reported by Aduku and Olukosi (2000) for Nigerian dressed chickens. This suggests that palm oil sludge inclusion in the diet of broiler chickens promoted carcass yield.

Result of relative organ weight of broiler chickens fed diets containing palm oil sludge is presented in Table 4. The result shows that the relative weight of the heart was highest for birds on diets 4 and 5. This may be as a result of high fat deposition around the pericardium of the heart which may have implications on the dystolic and systolic system of the heart of the chickens Agbede *et al* (2000).

The development of selected muscles (Table 4) shows that the thigh muscle weight and drumstick muscle weight were not significantly ($P>0.05$) influenced by the dietary treatment. However the inner breast muscle weight and the outer breast muscle weight were significant ($P<0.05$), but no trend was observed. All other parameters considered were not significantly influenced by the dietary treatment. Rosochacki *et al* (1986), Aletor *et al* (1989) and schrews (2000) demonstrated that nutrition influenced muscular growth. However, in this study the relative weight of organs measured, the length and breath of the outer breast muscle and inner breast muscle and relative weight of the thigh muscles and drumstick muscle were not significantly influenced by the dietary treatment. The outer breast muscle (pectoralis thoracicus) is the major force component of power for down stroke , while the inner breast muscle (supracoracoides) power for the up stroke and the two muscles help to facilitate the motion in birds (Agbede *et al* 2000). The two muscles are also of economic importance in poultry processing but were not adversely affected by the dietary inclusion of palm oil sludge.

Table 2. Proximate composition (%) and gross energy (MJ/Kg) of palm oil sludge

Components	%
Dry matter	76.29
Crude protein	8.85
Crude fibre	8.00
Ether extract	26.30
Ash	1.10
Nitrogen free extract	31.34
Gross energy(MJ/Kg)	18.7

Table3. Carcass characteristics of broiler finishers fed diet containing palm oil sludge

Parameters	Diets				
	1	2	3	4	5
	0	10	20	30	40
Dressed weight (%)	91.29±0.24	91.09±0.56	92.01±0.92	91.61±0.40	92.63±0.40
Eviscerated weight (%)	85.04±0.16	85.89±2.15	84.97±1.11	85.49±0.71	86.29±0.50
Thigh (g/kgLW)	147.40±46.90	116.06±9.49	107.87±9.21	110.94±7.90	103.30±13.97
Drumstick (g/kgLW)	106.56±10.59	104.98±7.35	97.30±6.82	98.92±5.78	102.31±6.90
Shanks (g/kgLW)	$37.13±2.50^{a}$	$36.51±1.28^{a}$	$36.03±2.30^{a}$	$37.65±1.96^{a}$	$32.37±1.53^{b}$
Wings (g/kgLW)	82.26±3.15	81.46±3.05	81.14±0.07	85.41±1.68	78.18±3.14
Chest (g/kgLW)	189.00±53.20	192.80±26.90	216.75±11.31	194.86±15.51	220.70±19.70
Back (g/kgLW)	140.20±26.00	149.20±36.30	150.60±30.70	154.90±21.70	157.10±17.90
Head (g/kgLW)	20.76±5.60	23.19±0.48	23.42±1.71	13.46±1.10	21.79±2.03
Neck (g/kgLW)	50.03±4.67	53.44±4.67	50.21±2.41	54.23±5.78	51.15±12.69
Belly fat (g/kgLW)	$13.38±0.94^{a}$	$20.94±2.45^{bc}$	$18.71±3.43^{b}$	$21.01±0.20^{bc}$	$23.14±2.28^{c}$

Mean±SD, LW- Live weight

Means with different superscripts within the same row are significantly different ($P<0.05$)

Table 4. Relative organ weight (g/Kg live weight) of broiler finisher fed diets containing palm oil sludge

Parameters	Diets				
	1	2	3	4	5
	0	10	20	30	40
Heart	4.07±0.09	3.70±0.35	3.66±0.66	4.33±0.66	4.53±0.10
Lung	5.46±0.12	5.74±0.75	5.60±0.70	5.81±2.07	5.02±0.60
Liver	18.02±0.64	17.14±2.84	16.56±4.13	15.39±3.01	20.44±4.82
Spleen	1.06±0.12	1.30±0.37	0.99±0.11	1.00±0.15	0.95±0.19
Pancreas	2.58±0.64	2.33±0.06	1.87±0.42	2.14±0.51	1.97±0.20
Kidney	6.18±0.67	6.16±1.02	6.69±0.49	5.97±0.06	6.23±0.95
Bursa	0.96±0.29	1.54±0.98	1.23±1.15	0.72±0.08	0.93±0.44
Gizzard	19.74±1.36	17.92±1.16	19.61±2.19	20.42±2.15	19.87±4.61
Proventriculus	4.01±1.11	4.25±0.64	3.89±0.40	4.24±0.56	3.05±0.68

Mean±SD, LW- Live weight, No two treatment Means within the same row are significantly different (P> 0.05)

Table 5. Selected muscle development in broiler finishers fed diets containing palm oil sludge

Parameters	Diets				
	1	2	3	4	5
	0	10	20	30	40
Thigh muscle weight (g/KgLW)	53.19±0.72	50.06±5.78	43.06±6.85	44.18+2.75	46.13+2.51
Drumstick muscle weight (g/kgLW)	40.27±4.34	36.78±3.25	36.96±4.65	36.18±5.07	43.37±7.26
Inner breast muscle					
Weight (g/KgLW)	19.07±0.01^{a}	17.54±2.49^{ab}	19.78±2.02^{ab}	15.53±0.66^{ac}	20.71±1.18^{ad}
Length (cm/KgLW)	7.37±0.37	6.60±0.42	6.55±0.49	7.03±0.50	6.41±0.31
Breadth (cm/KgLW)	1.67±0.08	1.80±0.03	1.83±0.24	1.63±0.24	1.72±0.14
Outer breast muscle					
Weight (g/KgLW)	57.40±3.51^{a}	51.91±11.13^{ab}	65.54±2.33^{ac}	51.12±6.54^{ab}	65.39±4.28^{ac}
Length (cm/KgLW)	8.90±1.04	7.95±0.39	8.42±0.09	9.06±0.40	8.19±0.09
Breadth (cm/KgLW)	3.22±0.08	3.15±0.40	3.13±0.40	2.82±0.51	3.10±0.25

Mean ± SD, LW – Live weight, Means with different superscripts in the same column are significantly different (P<0.05)

CONCLUSION

From the result obtained it can concluded that:

- Using palm oil sludge in energy for energy substitution (up to 40%) of maize in the diet of broiler chickens which translated to 16% dietary inclusion of palm oil sludge had no negative effect on carcass traits, relative organ weights and muscle development.
- Inclusion of palm oil sludge at up to 30 and 40% energy substitution significantly increased belly fat deposition in broiler chickens.
- The use of palm oil sludge which is a by-product in palm oil processing industries, in broiler diets will help to narrow down the price of poultry feed with attendant increase in broiler meat production in sub-sahara Africa including Nigeria.

REFERENCES

Afolabi, C.A. and Oladimeji, O. 2003. Producer response to retail egg in Ogun state, Nigeria: Implication for increased egg production.Nig. J. Anim.Prod. 30(1): 81-86

Aduku, A. O. and Olukosi, J.O. 2000. Animal product processing and handling in the tropics. 2nd edition G.U. Publications, Abuja-Nigeria. Pg 1-67

Agbede, J.O. 2000. Biochemical composition and nutritive quality of the seed and leaf protein concentrate from underutilized trees and herbaceous legumes. A *Ph.D* Thesis in the Department of Animal Production and Health, Federal University of Technology, Akure. Pg 1-293

Agbede, J.O. and Aletor, V.A. 1997. The performance, nutrient utilization and cost implication of feeding broiler finishers conventional or underutilized feed resources. Applied Tropical Journal 2(2): 57-62

Aletor, V.A., Lasehinde, E.A.O. and Ogunyemi, O. 1989. Equi- protein replacement of fishmeal with soyabean meal in the diets of broiler chickens: Effect on carcass characteristics and the development of certain muscles of the chest and hind limb. Nigerian Journal of Technology Research 1:11-15

Babatunde, G.M. and Tewe, O.O. 1987. Alternative feed sources for pig production in Nigeria. Paper presented at the workshop on pig and rabbit production organized by Nigerian Veterinary Medicine Association Ondo state branch at the Federal University of Technology Akure, Nigeria.

FAO. 1986. Food and Agricultural Organisation. African Agriculture: the next 25 years. Food and Agricultural Organisationof the United Nations Rome, Italy

Ranjhnan, S.K. 2001. Animal nutrition in the tropics. Vikas publishing House, PVT LTO. Pp 31-58.s

Rosochacki, S.R., Grosley, B. and Keller, J.S. 1986. Effect of feed intake on some lysozomal proteolytic activities in pectoral and leg muscles of growing chicken. Archive for Geftugelkinde 50:7-12

Shrews, F.J.G. 2000. Post mortem changes in chicken muscle. World's Poultry Science Journal 56:319-346.

Tewe, O.O. 1997. Sustainability and development paradigms from Nigerian′ s livestock industry. An inaugural lecture delivered at the University of Ibadan. Pp1-42