CARCASS YIELD AND ORGAN WEIGHTS OF BROILER FINISHER BIRDS FED DIETS CONTAINING DIFFERENT FAT SOURCES

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ABSTRACT
A four –week study was conducted to determine the effect of four different fat sources on carcass yield, organ weights and lipid profile of broiler finisher birds. One hundred and twenty day-old broiler chicks were randomly divided into five groups of 24 birds each and assigned to five treatments in a completely randomized design (CRD). The dietary treatments consisted of 1% added fat from four different sources as follows: T1, diet containing no oil; T2 diet containing 1% palm oil; T3, diet containing 1% soybean oil; T4, diet containing 1% palm kernel oil and T5, diet containing 1% groundnut oil. Each treatment was replicated three times with 8 birds per replicate. Feed and water were provided *ad libitum* to the birds. Results showed that live weight, carcass weight and dressing % of birds on T4 was significantly different ($P<0.05$) from all other treatments. Most of the internal organ weights of birds on T4 and T1 were significantly ($P<0.05$) higher than in other treatments. The abdominal fat weight of birds on T4 was significantly ($P<0.05$) higher than those in the other treatment. It was concluded that addition of vegetable fat from palm kernel oil and groundnut oil in broiler diets enhanced carcass and organ weights of birds.

INTRODUCTION
Broilers have unique potential as possible solution to Nigeria meat supply situation because of some attributes like high growth rate, high efficient carcass yield, short production cycle and good quality meat. Despite all these attributes, the productivity of poultry in Nigeria has been low due to the problem of poor utilization of feed and high cost of feed. Current commercial hybrids with high performance require high energy diets, which enable the maximum exploitation of their genetic potential. An increasing supplementation of diets with animal or plant fats or oils for intensive poultry production has been observed (Sadeghi and Tabeidian, 2005). The inclusion of fats and oil in animal feed is a common practice in modern poultry production to increase the energy content of diet. Besides supplying energy, it improves the absorption of fat-soluble vitamins (Baiao and Lara, 2005), provides essential fatty acids in large quantity, diminishes the dustiness, increases the palatability of the rations and improves the energy efficiency (Palmquist, 2002). Furthermore, dietary fat reduces passage rate of the digesta through the gastrointestinal trait, allowing for better nutrient absorption and utilization (Baião and Lara, 2005). Because of the increasing demand of energy in growing chicks and the high cost of energy feed ingredient, the addition of fat or oil in low energy feed can help increase the energy content of the feed and as well reduce the cost. Fat metabolism and deposition in poultry can be affected by different dietary fat feed intake and this can lead to poor nutrient absorption and utilization. (Sanz *et al.*, 2000a; Baiao and Lara, 2005). This study therefore, was conducted to determine the carcass trait, organ characteristics and lipid profile of broiler birds fed diets containing different fat sources.

MATERIALS AND METHODS
The study was carried out at the Poultry Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. The study lasted for four weeks. Palm oil, soybean oil, palm kernel oil and groundnut oil and other feed ingredients were used for the study. Five caloric and nitrogenous diets were formulated. The percentage composition of the diets is shown in Table 1. One hundred and twenty four weeks old broiler birds were used for the study. The birds were randomly allotted to five treatment groups of 24 birds each, and assigned to five caloric and nitrogenous diets

(Table 1). Each treatment group was replicated three times with 8 birds per replicate. The birds in each replicate were placed in a deep litter pen of fresh wood shavings measuring 1.50m x 1.50m in the experimental poultry house. Feed and water were provided to the birds *ad libitum*. Body weights of the birds were taken on a weekly basis. At the end of the experimental period, two birds per treatment were randomly selected, starved overnight and weighed for carcass and organ evaluation. The birds were slaughtered by severing the jugular vein, scalded in warm water for a minute and de-feathered by manual plucking. The birds were eviscerated and weighed to obtain their dressed carcass weight. The kidney, abdominal fat, liver, gizzard, heart, spleen and proventriculus were removed and weighed using a sensitive scale. The dressed carcass and organ weight were expressed as percentages of live weight. Data collected were subjected to analysis of variance (ANOVA) in a completely randomized design (CRD) as described by Steel and Torrie (1980). Significantly different means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Data on carcass and organ characteristics of broiler birds fed diets containing different fat sources are presented in Table 2. Birds on treatments 1 and 4 had similar ($P>0.05$) live weight values with those on treatments 2 and 3 and these were significantly ($P<0.05$) higher than the mean live weight value of birds on treatment 5. Birds on treatments 1, 3 and 4 had similar ($P>0.05$) mean values of carcass weight. Treatment 4 birds had significantly ($P<0.05$) higher dressed carcass weight value than birds on treatments 2 and 5. Birds on treatments 3and 4 had significantly ($P<0.05$) higher dressing % value than those on treatments 1, 2 and 5. Birds on treatment 4 had similar ($P>0.05$) mean kidney value with those on treatment 3 and this was significantly ($P<0.05$) higher than the mean kidney values of birds on treatment 1, 2 and 5. Birds on treatment 1 had similar ($P>0.05$) abdominal fat value with those on treatment 2, and these were significantly ($P<0.05$) higher than the abdominal fat values of birds on treatment 3 and 5. The mean spleen values of birds on treatments 1 and 2 were similar ($P>0.05$). Birds on ($P<0.05$) higher than the mean proventriculus value of birds on treatment 5. Birds on treatments 2 and 3 had similar ($P<0.05$) values. Treatment 1 birds had the highest mean value (69.45g) of liver and and this was similar to the mean liver weight values of birds on treatments 2, 3 and 2. Birds on treatment 5 had the least mean value of (48.00g). The gizzard weight value of birds on treatment 1 was similar to the mean gizzard weight values of those on treatments 2 and 3. Data on relative organ weights of broiler birds fed diets containing different fat sources are presented in table 3. The relative heart weight values of birds on treatments 1and 3 were significantly ($P<0.05$) higher than the RHW values of birds on treatment 5. Birds on treatment 4 had similar ($P>0.05$) relative kidney weight value with those on treatment 3 and this was significantly ($P<0.05$) higher than the RKW values of birds on treatments 1, 2 and 5. No significant ($P>0.05$) differences existed among treatments in relative gizzard weight, relative abdominal fat weight, relative spleen weight, relative proventriculus weight and relative liver weight. As shown in table 2, birds fed diet containing palm kernel oil (treatment 4) had significantly ($P<0.05$) higher dressing % than those on treatments 1(control), 2 (palm oil) and 5 (groundnut oil). The results are similar to the findings of Felton and Kerley (2004), but differed from the results reported by Alaedein (2013) which showed that there were no significant difference in dressing percentage of birds fed soybean oil. The results are also in consonance with that reported by Andretti *et al.* (2001) which showed that broilers fed diets containing poultry fat, canola, sunflower oil, corn, soybean and lad, respectively had similar carcass yield values. However, the authors observed significant differences ($P>0.05$) among treatments in the organ weights measured. It was observed(Table 2) that broilers fed diet containing palm kernel oil had the highest abdominal fat value, while the least values were observed in treatments 3 and 5(diet containing soybean oil and groundnut oil, respectively). The increase in abdominal fat observed in birds that consumed the diet containing palm kernel oil is in line with the results reported by Shahryar *et al.* (2011) which showed that the addition of 6% fat caused a significant increase in abdominal fat weight of broilers as compared to those fed control diet. The results reported by Sanz *et al.* (2000b) in a study in which the effect

of two lipid sources (beef tallow, sunflower and soybean oil) were evaluated, showed that there was a significant reduction in the abdominal fat of birds fed diet containing sunflower oil. This shows that the treated broilers were able to utilize the unsaturated lipids in the vegetable oils very efficiently. This may have resulted in the reduction of the abdominal fat with the resultant increase in the lean carcass weight of broilers. This is in agreement with the result of the present study were birds fed diets with soybean oil and groundnut oil has the least abdominal fat deposition. Crespo and Esteve- Grarcia (2002) suggested that reduction in the abdominal fat of broilers fed diets containing soybean oil and groundnut oil seems to be a consequence of higher lipid oxidation despite the higher synthesis of endogenous fatty acids. Soybean oil contains high levels of unsaturated acids and are more completely digested of by fowls. The dressed carcass weight and most of the organ weights (kidney, spleen, heart, proventriculus, liver and gizzard weights) were significantly ($P<0.05$) affected by the inclusion of fat from different sources when compared to the control group. The spleen, heart, proventriculus, liver and gizzard weights were significantly ($P<0.05$) higher in the control as compared to the group fed diet containing groundnut oil. Similar observation had been reported by Tabeidian *et al.* (2005) in a study that investigated the effect dietary fats on organ characteristics of birds. The difference observed in the gizzard weight for instance might be due to decrease in the passage rate of food which might have gradually increased gizzard function with the resultant increase in gizzard muscular mass, a condition known as muscular hypertrophy. This suggestion is in agreement with the observations of Lopez-Ferrer *et al.* (2001) and Habib *et al.* (2011). The liver and to some extent the heart play a major role in detoxification, their similarity in weight tends to suggest that the different dietary treatments did not have any toxicity effect on these organs. This is in line with the findings of Diara *et al.* (2014).

CONCLUSION

Based on the results obtained in the present study it was concluded that addition of vegetable fat from palm kernel oil and groundnut oil in broiler diets enhanced carcass and organ weights of birds.

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Table 1: Percentage composition of experimental diets

Ingredients(%)/Diets	1	2	3	4	5
Maize	34.00	35.00	35.00	36.00	35.00
Cassava root meal	20.04	17.00	16.00	17.4	16.00
Wheat offal	5.00	6.00	7.0	5.0	7.0
Soybean meal	12.42	11.80	11.50	12.20	11.50
Groundnut cake	16.00	16.00	16.00	16.00	16.00
Palm kernel cake	5.4	6.2	6.50	5.4	6.5
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	4.00	4.00	4.00	4.00	4.00
Fixed ingredients*	1.00	1.00	1.00	1.00	1.00
Palm oil	-	1.00	-	-	-
Soybean oil	-	-	1.00	-	-
Palm kernel oil	-	-	-	1.00	-
Groundnut oil	-	-	-	-	1.00
Total	100	100	100	100	100
Calculated Composition:					
Crude protein (%)	20.13	20.12	20.14	20.11	20.14
Energy(Mcal/kg ME)	2.93	2.93	2.93	2.92	2.93
Crude fibre(%)	4.51	4.54	4.63	4.39	4.63
Determined composition:					
Dry matter(g)	88.5	91.0	89.0	90.5	89.5
Ash (%)	7.0	6.0	8.5	8.0	8.5
Crude Fiber (%)	4.5	5.5	5.63	4.0	4.5
Crude protein (%)	19.89	19.88	19.38	20.26	20.69
Ether Extract (%)	4.0	3.5	2.0	2.5	5.0
Nitrogen Free Extract (%)	53.11	56.12	53.49	55.74	50.81

* Vit A – 10,000.00 iu., D_3-2,000 iu., B_1-0.75g., B_2-5g., Nicotinic acid – 25g., Calcium pantothenate 12.5g., B_{12}-0.015g., K_3-2.5g., E-25g., Biotin – 0.050g., Folic acid –1g., Manganese 64g., Choline chloride 250g. Cobalt-0.8g., Copper 8g., Manganese 64g., Iron –32G., Zn-40g., Iodine-0.8g., Flavomycin-100g., Spiramycin 5g., Dl-methionie-50g, Selenium 0.6g., Lysine 120g., BAT-5g. *Fixed ingredients are: salt,0.25%, vit/min premix, 0.25%, lysine, 0.25% and methionine, 0.25%.

Table 2: Carcass and Organ Characteristics of broiler birds fed diets containing different fat sources.

Treatments*						
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Live weight (kg)	3.43^{a}	3.05^{ab}	3.13^{ab}	3.58^{a}	2.55^{b}	0.14
Carcass weight (kg)	2.35^{ab}	2.05^{b}	2.35^{ab}	2.90^{a}	1.75^{b}	0.14
Dressing %	70.68^{bc}	67.26^{c}	74.94^{ab}	81.10^{a}	68.52^{bc}	1.77
Kidney (g)	1.70^{b}	1.20^{b}	3.70^{ab}	5.60^{a}	2.25^{b}	0.58
Abdominal fat (g)	37.35^{b}	37.35^{b}	16.05^{c}	46.10^{a}	11.05^{c}	5.58
Spleen (g)	4.80^{a}	3.45^{b}	3.60^{b}	4.21^{a}	2.30^{c}	0.38
Proventiculous (g)	13.70^{a}	11.55^{ab}	12.60^{ab}	13.85^{a}	9.45^{b}	0.65
Heart (g)	13.75^{a}	11.15^{ab}	13.05^{a}	14.15^{a}	8.55^{b}	0.78
Liver (g)	69.45^{a}	59.35^{ab}	58.65^{ab}	59.75^{ab}	48.00^{b}	2.86
Gizzard (g)	56.35^{a}	51.20^{ab}	50.15^{ab}	46.45^{b}	40.85^{b}	2.65

^{a,b,c,d} Means on the same row with different superscript are significantly ($P < 0.05$) different
SEM= Standard error of mean. **T1** = Control; **T2** = Palm oil; **T3** = Soybean oil; **T4** = Palm kernel oil; **T5** = Groundnut oil

Table 3: Relative Organ Weight of broiler birds fed diet containing different fat sources.

	Treatments*					
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Gizzard (%)	1.70	1.68	1.64	1.30	1.59	1.85
Heart (%)	0.42^{a}	0.37^{ab}	0.42^{a}	0.40^{ab}	0.33^{b}	0.01
Kidney (%)	0.05^{c}	0.04^{c}	0.12ab	0.16^{a}	0.09^{bc}	0.02
Abdominal fat (%)	1.12	1.23	0.56	1.29	0.44	0.16
Spleen (%)	0.15	0.12	0.12	0.12	0.09	0.01
Proventiculous(%)	0.42	0.38	0.41	0.39	0.37	0.01
Liver (%)	2.09	1.95	1.89	1.68	1.88	0.06

^{a,b,c,d} Means on the same row with different superscript are significantly ($P < 0.05$) different
SEM = Standard Error of Mean.
T1 = Control; **T2** = Palm oil; **T3** = Soybean oil; **T4** = Palm kernel oil; **T5** = Groundnut oil