GROWTH PERFORMANCE 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 growth performance of broiler 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. The response parameters studied were daily feed intake and daily weight gain, while feed conversion ratio and protein efficiency ratio were calculated from weight gain and feed intake values. Results showed that dietary fat type affected significantly ($P<0.05$) body weight gain as well as feed efficiency in birds fed the palm kernel oil diet compared with those fed the other diets. It was concluded that addition of vegetable fat from palm kernel oil and groundnut oil in broiler diets enhanced the growth performance of birds.

INTRODUCTION
The broiler industry has been developed worldwide to the most intensive and efficient model in comparison to other animal production sectors. The rapid growth, efficient utilization of feed, tender meat production, thrives and produce under varied environmental conditions have been achieved through advanced genetic improvement of the modern broiler chicken. The energy intake of the fast growing broiler chickens, fed *ad libitum* is estimated to reach two or three times greater than their maintenance needs; and so carcass fat deposition increases, causing broiler metabolic and skeletal disorders, beside its undesirable effect on human health. Current commercial hybrids of broiler with high performance require high energy diets, which would enable the maximum exploitation of their genetic potential. Increasing demands for energy in growing chickens can be satisfied by the addition of fat to the feeding mixtures. 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). Digestibility of dietary fats is affected by the fatty acid profiles and several studies have shown better utilization of unsaturated fats leading to a higher metabolizing energy than saturated fats (Celebi and Utlu, 2004). Jeffri *et al.* (2010) reported that increasing fat in broiler diet will increase the amount of feed intake and feed efficiency. According to Rose (2001), animal fat or vegetable oils may be used as a source of energy up to a maximum of 6% in the diet. Above this level it becomes difficult to maintain pellet quality, or to move mechanically the sticky feed when it is not pelleted. The present study was therefore conducted to evaluate the effect of dietary fat sources on growth performance of broilers.

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. This was done using a top loading balance of 10kg capacity. Daily feed intake was obtained from the difference between the quantity of feed offered and that of the leftover from the previous day divided by the number of birds per replicate. Feed conversion ratio was then calculated from these data as quantity (gram) feed consumed per unit (grams) weight gained over the same period. Feed samples were assayed for proximate composition by the method of AOAC (2006). 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 growth performance of broiler birds fed diets containing different fat sources are presented in Table 2. Final body weight (FBW) varied significantly ($P < 0.05$) among the treatments. Birds fed diet containing palm oil (T4) had the highest FBW while birds on other treatments were statistically the same. Total weight gain (TWG), daily feed intake (DFI), total feed intake (TFI), average daily weight gain (ADWG), feed conversion ratio (FCR), protein efficiency ratio (PER), cost feed per kg (CFG) and mortality were all significantly ($P< 0.05$)affected by dietary treatments. Birds on treatment 4 had the highest TWG although it was statistically similar to T3, whereas birds on treatment 4 had the highest DFI value though this value was statistically the same with the values obtained from birds on treatments 1 and 5. Birds on treatments 1, 2, 3 and 5 had similar ($P>0.05$) final body weight values but these were significantly lower than the final body weight value of birds on treatment 5. Birds on treatment 4 had similar TWG value with birds on treatment 3 and this was significantly ($P<0.05$) higher than the TWG values of birds on treatment treatments 1, 2 and 5. Birds on treatment 4 had similar ($P>0.05$) TFI and ADFI values with those on treatment 1 (control), and treatment 5 (diet with groundnut oil) and these were significantly ($P<0.05$) higher than the ADFI and TFI values of birds on treatment 2 (diet with palm oil), and treatment 3 (diet with soybean oil). Birds on treatment 2 and treatment 3 also had similar ($P>0.05$) ADFI and TFI values with those on treatment 1 (no oil) and treatment 5 (diet with groundnut oil). Birds fed diet containing with soybean oil had similar ($P>0.05$) ADWG value with birds on treatment 4 (palm kernel oil) and this was significantly ($P<0.05$) higher than the ADWG value of birds on treatments 1, 2 and 5. The ADWG values of birds on treatments 1, 2, 3 and 5 were similar ($P>0.05$). The FCR value of birds on treatment 5 was similar ($P>0.05$) to those of birds on treatments 1 and 2 and this was significantly ($P<0.05$) higher than the FCR values of birds on treatments 3 and 4. Birds on treatments 1, 2, 3 and 4 had similar FCR values. Birds on treatment 4 had similar ($P>0.05$) PER value with those on treatments 1, 2 and 3, and this was significantly ($P<0.05$) higher than the PER value of birds on treatment 5. The PER values of birds on treatments 1, 2, 3, and 5 were similar ($P>0.05$). Birds fed diet containing palm kernel oil had similar ($P>0.05$) CFG with those on treatment 1, and this was significantly ($P<0.05$) higher than the CFG values of birds on treatments 2, 3 and 4. The CFG values of birds on treatment 1, 2, 3 and 4 were similar ($P>0.05$). As shown in Table 2, there were significant differences ($P<0.05$) among dietary treatments on growth performance of broilers. In the present study, it was observed that birds supplemented with fat sources improved in body weight and feed efficiency than the control group, especially treatment 4 (palm kernel oil), and treatment 3 (soybean oil). The significant improvement in growth performance of birds fed diets containing dietary fat from palm kernel oil and soybean oil could be attributed to the ability of these fat sources to reduce the passage rate of the digesta through the gastrointestinal tract, thereby allowing for better nutrient absorption and utilization (Latshaw, 2008). It has been previously reported that dietary supplementation with vegetable or animal fats did not affect feed passage rate through the digestive tract in Leghorn chicken (Golian and Polin, 1984). However, the dissimilarity between the report of Golian and Polin (1984) and the present results could be attributed to the differences in dietary fat sources and also to the type of birds used in the two studies. Although the inclusion of fat in broiler feed is beneficial to the growth of birds, one of the major concerns and regards to dietary fat supplementation is the actual metabolizable energy (ME) value that can be assigned to each fat source. However, the improvement in utilization of dietary fat components in bird is enhanced by different sources regardless of ME content (Jeffri *et al.*, 2010). Early research on the inclusion of fats in poultry diets indicated that plant-derived oils had higher ME value when compared to animal sources with high free fatty acïd content (Waldroup *et al.*, 1995). Contrally to the results obtained in the present study, Pesti *et al.* (2002), Ghazalah *et al.* (2008) and Mohammadu *et al.* (2011), indicated that there were no significant differences among treatments in all the growth parameters evaluated when broilers were fed diets containing fat from different sources. The result showed that there were marked differences in daily and total feed intake. Birds on diets supplemented with palm oil and soybean oil (treatments 2 and 3) had lower values than the rest of the treatments, which might be as a result of the energy content of these dietary fat sources (Jeffri *et al.*, 2010). The observed result on feed intake thus could indicate that the improvement in body weight may have partially been due to improved nutrient digestibility and better nutrient absorption as reflected by improved feed efficiency. It was also found that broilers fed diets containing palm kernel oil had better growth rate than those in the other treatments, especially the control group. This observation confirms the advantage of adding vegetable oil in birds' diet (Gallardo *et al.*, 2012). The improved growth rate perhaps may be due to the higher percentage of long chain fatty acids and higher contents of triglycerides in vegetable oil (Thacker *et al.*, 1994). The observed similarities in protein efficiency ratio (PER) of birds in the various treatments may be attributed to the fact that vitamins present in most dietary fat sources are involved in amino acid metabolism. Vitamin B12 for instance is required for the production and development of blood cells (sources: Rita T. dela Cruz of www.bar.gov.ph).

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 the growth performance of birds.

REFERENCES

AOAC (2006). Association of official Analytical Chemists. Official Methods of Analysis (21st edition) Washington D.C.USA.

Baião, N.C.and Lara, L.J.C. (2005). Oil and fat in broiler nutrition. *Braz J Poult Sci.*;1:129–141.

Celebi S, Utlu N. (2004). Laying performance, serum lipoproteins, cholesterol and triglyceride of hens as influenced by dietary fat sources. *J Appl Anim Res.*;25:121–124.

Chanmugam P, Boudreau M, Boutte T, Park RS, Hebert J, Berrio L, Hwang DH.(1992) Incorporation of different types of n-3 fatty acids into tissue lipids of poultry. Poultry Science ; 71:516 521.

Duncan, D.B. (1955). New Multiple Range Test Biometrics, 11:1-42.

Gallardo, M.A, Perez, D.D and Leighton F.M.(2012). Modification of fatty acid composition in broiler chickens fed canola oil. *Biol Res.* 45:149–161.

Ghazalah, A.A, Abd-Elsamee M.O, Ali A.M.(2008). Influence of dietary energy and poultry fat on the response of broiler chicks to heat therm. *Int J. Poult Sci.* 2;7:355–359.

Golian A, and Polin D.(1984). Passage rate of feed in very young chicks. *Poult. Sci.*63:1013–1019.

Jeffri D, Firman H, Kamyab A, (2010). Comparison of soybean oil with an animal/vegetable blend at four energy levels in broiler rations from hatch to market. Int Poult Sci.; 9:1027–1030.

Mohammadu M, Lavvaf A, Hajian E, Jaberzadeh V. (2011). The effect of different levels of poultry by product meal on carcass quality in broiler. Res Opin Anim Vet Sci.1:697–699.

Palmquist, D.L.,(2002). An appraisal of fats and fatty acid. In: Poultry Feedstuff: Supply, Composition and Nutritive Value. Chapter 5, pp. 87-97.

Pesti G.N, Bakalli R.I, Qiao M, Sterling K.G. (2002). A comparison of eight grades of fats as broiler feed ingredients. Poult Sci;81:382–390.

Rita T. dela Cruz of www.bar.gov.ph

Rose, S. P. (2001). Principles of Poultry Science. CABI Publishing.

Sadeghi, 1 and S.A. Tabiedian (2005). Effect of different energy to protein ratio and tallow supplementation on broiler performance GH. *International Journal of Poultry Science* 4 (12): 976-981.

Steel R.G.D., and Torrie, J.H. (1980). Principles and procedures of Statistics. A Biometric Approach (2nd Ed). McGraw-Hill Publishers, New York. p. 633.

Thacker, P.A, Campbell, G.L, Xu, Y.(1994) Composition and nutritive value of acidulated fatty acids, degummed canola oil and tallow as energy sources for starting broiler chicks. Anim Feed Sci Technol. 46:251–260.

Waldroup, P.W, Watkins S.E, Saleh, E.A.(1995). Comparison of 2 blended animal-vegetable fats having low or high free fatty acid content. J Appl Poult Res.4:41–48.

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
Salt	0.25	0.25	0.25	0.25	0.25
Vit-min premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
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.

Table 2: Growth performance of broiler finisher birds fed diets containing different fat sources

Treatments*						
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**
Initial body weight (g)	366.74	358.76	363.19	361.67	370.84	5.1
Final body weight (g)	3065.80^{b}	3057.00^{b}	3171.80^{b}	3507.70^{a}	3006.20^{b}	62.4
Total weight gain (g)	2698.90^{b}	2698.20^{b}	2808.70^{ab}	3146.10^{a}	2635.40^{b}	64.93
Daily feed intake (g)	145.01^{ab}	138.25^{b}	138.32^{b}	152.29^{a}	147.00^{ab}	1.85
Total feed intake (g)	7105.51^{ab}	6773.92^{b}	6777.78^{b}	7462.63^{a}	7202.50^{ab}	90.7
Average daily weight gain (g)	55.08^{b}	55.07^{b}	57.19^{ab}	64.21^{a}	53.73^{b}	1.33
Feed conversion ratio	2.63^{ab}	2.53^{ab}	2.42^{b}	2.37^{b}	2.74^{a}	0.05
Protein efficiency ratio	1.89^{ab}	1.98^{ab}	2.05^{ab}	2.10^{a}	1.82^{b}	0.04
Cost of 1kg of feed (₦)	101.94	102.09	104.86	103.76	108.00	0.00
Cost of feed per kg wt gain (₦)	268.10^{ab}	258.30^{b}	253.75^{b}	245.90^{b}	295.93^{a}	5.62

^{a,b,c,d} Means on the same row with different superscript are significantly ($P < 0.05$) different

SEM= Standard error of mean.

T1 = No oil; T2 = Palm oil; T3 = Soybean oil; T4 = Palm kernel oil; T5 = Groundnut oil.