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THE IMPACT OF PALM OIL ON THE COMBINATION OF BLOOD MEAL AND WHEAT BRAN IN DIET FOR BROILER FINISHER

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ABSTRACT
An experiment was carried out to find out the impact of palm oil on the combination of blood meal and wheat bran in the diet for broiler finisher. Five diets made up of a control (32%crude protein) formulated from blood meal, wheat bran, palm oil(5%), soya bean cake (15%), bone meal (2%), vitamin/ trace mineral premix (0.25%) salt (0.4%), and dl – methionine (0.35) and four others with the fraction of wheat bran and blood meal in the control made out in the ratios 2:1 and 1:1 of fresh cattle blood and wheat bran(mixed with the palm oil and dried immediately as diets 2 and 3 and 24 hours after as diets 4 and 5 respectively), were fed to 30 Anak broiler finishers at four weeks old and 0.60 – 0.71kg average initial weight in 10 compartments as 5 treatments and 2 replicates each in a completely randomized design, for 5 weeks. The result showed that Average feed intake was higher in treatments 1 – 3 (8.43, 9.39 and 8.15kg) than diets 4 and 5(6.67 and 6.54kg), respectively ($p< 0.05$). Final average body weights attained were the same (2.58, 2.27, 2.3, 2.41 and 2.32 kg) for the control and treatments 2 to 5, respectively, ($p> 0.05$). Average weight gain followed the same trend (1.77, 1.57, 1.69, 1.70 and 1.66kg) for all five treatments, leading to superior feed conversion ratio (FCR) in treatments 4 and 5(3.93 and 3.95) than in treatments 1 – 3(4.71, 5.34 and 4.82) respectively, ($p< 0.05$). Broiler breast (keel) weights obtained for all five treatments (0.56, 0.54, 0.63, 0.56 and 0.62kg) were not significantly different ($p> 0.05$). Liver weights were higher for the control (93.5g) followed by treatment 2 (75.00g) than 3 – 5 (52.25, 46.80 and 53.12g) respectively, ($p<0.05$). Abdominal fat content was generally low with the least value in the control and treatment 4 (0.00 and 3.00g with 0.00 and 0.12% of average body weight), followed by treatments 3 and 5 (12.50 and 18.00g with 0.57 and 0.78% of average body weight) and treatment 2 (28.00g with 1.23% of average body weight) respectively, ($p< 0.05$). In conclusion, the use of a low energy carbohydrate source such as wheat bran in combination with a high protein source such as blood meal(processed or fresh, rate of combination not withstanding) and palm oil , results in good growth of broiler finisher and very low abdominal fat content.

KEYWORDS: Impact Wheat bran Palm oil Blood meal Growth Broiler finisher Broiler Parts

INTRODUCTION:

The use of corn in diets for broilers provides adequate carbohydrate energy and provides no room for lipid particularly in the situation of the tropics(Oluyemi and Roberts 2007). However the use of wheat bran in the place of corn to lower the cost of broiler feed provides a likely alternative when corn is scarce (Bekibele et al, 2010). It also lowers the energy content of the diet, thereby making it necessary for the use of a lipid to raise it for effective performance. Aduku (1993), puts the gross energy content of wheat bran at 1256kcal/kg, while that of corn according to Mc Donald (1979) is 3320kcal/kg.

Palm oil appears to provide the best bet of the choice of a lipid to use. According to FAO (1983), processed animal fat are not ordinarily available in the tropics. The most common vegetable oils except crude palm oil are usually refined for human consumption and so are too expensive to use in feed. As a dietary lipid, palm oil could be used as a source of energy containing 8.0kcal/g digestible energy with some essential fatty acid 9.3% Polyunsaturated fatty acid (PUFA). Tacon (1987) reported 10% combined 18: 2n – 6 and 18: 3n – 3 PUFA. Bell et al,(2002), also reported that palm oil which has a low n-6 PUFA, is currently the second most abundant vegetable oil world wide after soya bean oil. Oluyemi and Roberts (2000) revealed that supplementation of

poultry feed with 2.5 – 5%palm oil is beneficial in terms of growth rate of broiler chicks and of the improved performance of layers and breeders (Oruwari *et al,* 1997).

Oluyemi and Roberts (2000) have also stated that linoleic (18:2n-6) and Arachidonic (20: 4n-6) acids (linoleic series) are essential for the fowl, since they cannot be synthesized by it. A deficiency of this series in the ration causes poor growth, liver fat accumulation and susceptibility to respiratory infections of the fowl. Seven percent of the dietary fat they said is sufficient to provide 2% of EFA needed for growth.

The essence of this trial is to find out what influence palm oil with it's high energy and moderate PUFA content would have on the body weight and parts of broiler finishers fed on a combination of the low carbohydrate energy source ,wheat bran and the high protein source, blood meal.

MATERIALS AND METHODS:

Feed formulation - A 32% (crude protein) control diet was formulated with blood meal and wheat bran, with palm oil, soya bean cake, bone meal vitamin and trace mineral premix, salt and dl-methionine fixed at 5, 15, 2, 0.25, 0.4 and 0.35%, respectively. Two other diets were made out so that the fraction of wheat bran and blood meal in the control took the ratio of 2:1 and 1:1 respectively of fresh cattle blood and wheat bran, the rest of the ingredients remaining at the same levels as the control (Table1).

Processing method – The ingredients in the control diet were finely ground, pelleted with a diesel operated Pelleter and crumbled with a pepper grinder. The dry ingredients in the 2:1 and 1:1 diets were finely ground, weighed out according to the formulae and mixed on a slab. Fresh cattle blood collected from Choba abattoir in Port Harcourt, was scaled out at 38.6kg and poured in to the 1:1 ratio diet, while 51.47kg into the 2:1 ratio mixture. Both feeds were mixed thoroughly without the palm oil. The two mixtures were split into two respective portions and each subjected to one of two methods.

A. One was sundried soon after mixing.
B. The other was retained for 24 hours before sun drying in like manner.
   In both processes palm oil was added to the mixtures and thoroughly mixed before sun drying to forestall the likelihood of rancidity. The result after drying were four sets of crumb feed, making a total of five with the control.

Determination of nutrient content:

Two sets of analysis were carried out.

a. Proximate composition of the five feeds (Table 2) were effected at the Nigerian Stored Products Research Institute for crude protein using the semi- micro kjeldahl method according to Markham(1942), moisture, Ether extract, ash and crude fiber according to AOAC(1990) and Nitrogen free extract(NFE) by difference.

b.The profile of fatty acid in the five diets (Tables 3 and 4) determined at the Institute of Fresh water Ecology and Inland Fisheries, Berlin Germany, using the method of Wirth and Stiffens(1998).

Experimental Design

The five processed diets represented five treatments (Table 2). Treatment 1 as the control with dried blood meal, treatment 2 with fresh cattle blood and wheat bran in the ratio 1:1 sun dried soon after mixing as (1:1A), treatment 3 with treatment 2 mixture, sundried 24 hours after mixing as (1:1 B), treatment 4 with cattle blood and wheat bran in the ratio 2:1 sun dried soon after mixing as(2:1 A), and treatment 5 with the mixture in treatment 4, sun dried 24 hours after mixing as (2:1 B). Each treatment was replicated twice. There were thus ten experimental units to which experimental animals were randomly assigned in a completely randomized design.

Table 1. Formulated diets.

Ingredients(%)	Diets		
	Control	1:1	2:1
Fresh cattle blood	-	38.60	51.47
Dried blood meal	20.44	-	-
Wheat bran	56.56	38.60	25. 73
Soya bean cake	15.00	15.00	15.00
Palm oil	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00
Vitamin/Trace mineral premix	0.25	0.25	0.25
Salt	0.40	0.40	0.40
dl- methionine	0.35	0.35	0.35
Total	100%	100%	100%

Table 2.Ingredient and Nutrient composition of the experimental diets

Ingredients (%)	Treatments				
	1 (Control)	2 1:1A	3 1:1B	4 2:1A	5 2:1B
Fresh cattle blood	-	38.60	38.60	51.47	51.47
Blood meal	20 44	-	-	-	-
Wheat bran	56.56	38.60	38.60	25.73	25.73
Soya bean cake	15.00	15.00	15.00	15.00	15.00
Palm oil	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Vitamin/Trace mineral premix	0.25	0.25	0.25	0.25	0.25
Salt	0.40	0.40	0.40	0.40	0.40
dl-methionine	0.35	0.35	0.35	0.35	0.35
Total	100%	100%	100%	100%	100%
Nutrient composition:					
% Crude protein	40.75	32.25	32.88	39.15	36.38
% Ash	8.11	8.56	7.71	7.84	7.86
% Ether extract	4.92	7.78	9.08	6.58	10.45
% Crude fiber	3.82	3.42	4.12	3.72	4.36
% Moisture	10.41	9.23	10.65	12.48	13.56
% NFE	31.99	38.76	35.56	30.23	27.39
ME(kcal/g)	2.75	2.79	2.79	2.91	2.91
P:E ratio (mg /kcal)	148.20	115.59	117.85	134.54	125.02

Feeding Trial

Thirty Anak broiler finishers at four weeks old and 0.6 – 0.71kg average initial weight, were randomly assigned to ten compartments at 3 birds each in a prefab broiler house with each compartment representing a replicate in each of 5 treatments. Feed was provided with adequate water supply every day. At the end of the day, the quantity of feed given was estimated. At the end of every week ,the birds were weighed to determine the response to the diets. The drug oxy-prol was given in water at the sign of watery droppings or coccidial presence. The trial lasted for five weeks, at the end of which the final body weight were taken. Two birds per replicate were slaughtered and the weight of the keel, liver and abdominal fat determined. These parameters were subjected to Analysis of variance(ANOVA) and where differences occurred, the means were separated by Duncan's Multiple Range Test using the general Linear Model (SAS 1999).

Table 3: Fatty acid composition of triglycerides in the five experimental diets in %.

Fatty acids		Treatments				
		1 Control	2 1:1A	3 1:1B	4 2:1A	5 2:1B
Saturated:						
Caprylic (octanoic) acid	8:0	Trace	trace	trace	trace	trace
Capric (Decanoic) acid	10:0	Trace	trace	trace	trace	trace
Lauric acid	12:0	0.20	0.10	1.10	0.70	0.30
	13:0	0.20	trace	trace	trace	trace
Myristic acid	14:0	0.70	0.30	0.40	1.30	0.70
	15:0	0.20	0.30	0.10	0.10	0.10
Palmitic acid	16:0	43.40	23.00	27.20	30.30	48.60
	17:0	0.40	0.10	0.10	0.10	0.10
Stearic acid	18:0	8.30	5.70	5.00	4.64	5.10
	19:0	Trace	0.10	trace	trace	0.10
Arachidic acid	20:0	Trace	0.50	trace	trace	0.30
	21:0	Trace	trace	trace	trace	trace
Behenic acid	22:0	0.30	trace	0.30	0.30	
	23:0	Trace	trace	trace	trace	trace
Lignoceric acid	24:0	0.40	0.60	0.40	0.30	0.10
Unsaturated:						
	12:1	Trace	trace	trace	trace	trace
	14:1n-7	Trace	0.10	trace	trace	trace
	14:1n-5	Trace	0.10	0.10	trace	0.10
	15:1	Trace	0.10	0.10	trace	0.10
	16:1n-9	0.20	0.10	0.10	trace	0.10
Palmitoleic acid	16:1n-7	0.90	0.20	0.20	1.10	0.20
	16:1n-5	Trace	trace	trace	trace	0.10
	16:2n-4	Trace	trace	trace	trace	trace
	16:3n-4	0.20	0.20	trace	0.10	0.10
	17:1	0.30	0.10	0.10	trace	0.10
Oleic acid	18: 1n-9	32.40	23.70	24.60	23.70	28.30
	18:1n-7	0.40	1.60	0.50	0.60	0.40
Linoleic acid	18:2n-6	30.30	34.20	34.10	24.40	26.40
	18:3n-6	0.60	0.10	0.10	0.30	0.20
Linolenic acid	18:3n-3	2.70	2.50	2.40	1.70	1.80
	18:4n-3	0.10	trace	trace	0.10	0.10
	20: 1n-11	Trace	trace	trace	trace	trace
	20:1n-9	0.40	0.50	0.40	1.60	0.50
	20:2n-6	0.10	0.10	0.10	0.10	0.10
	20:3n-6	0.10	0.10	0.10	0.10	0.10
	20:3n-3	Trace	trace	trace	trace	0.10
Arachidonic acid	20:4n-6	0.10	0.20	0.20	0.30	0.20
	20:4n-3	Trace	trace	trace	trace	trace
Eicosapentaenoic acid	20:5n -3	0.30	trace	trace	0.10	0.10
	21:5n -3	Trace	trace	trace	trace	trace
	22:1n-11	Trace	0.30	0.30	0.90	0.30
	22:1n-9	0.40	0.20	0.20	0.40	0.30
	22:2n-6	0.10	trace	0.10	0.10	0.10
	22:3n-6	0.40	0.20	0.20	0.30	0.10
	22:4n-6	Trace	0.30	0.40	0.40	0.60
	22:5n-6	0.10	0.20	0.10	0.40	0.10
	22:5n-3	Trace	trace	0.30	0.60	0.30
Docosahexaenoic acid	22:6n-3	0.50	trace	trace	1.50	trace
	24:1n-9	0.10	1.00	0.90	trace	0.90

Table 4: Fatty acid composition of phospholipid in the five experimental diets in %

Fatty acids		1 Control	2 1:1A	3 1:1B	4 2:1A	5 2:1B
Saturated:						
Caprylic (Octanoic) acid	8:0	Trace	trace	trace	trace	trace
Capric (Decanoic) acid	10:0	Trace	trace	trace	trace	trace
Lauric acid	12:0	0.20	0.10	0.10	0.20	0.20
Myristic acid	14:0	0.70	0.30	0.30	1.60	0.50
	13:0	0.50	trace	0.10	0.50	0.30
	15:0	0.10	0.10	0.30	0.30	0.30
Palmitic acid	16:0	19.50	23.00	23.20	23.70	24.10
	17:0	0.30	0.10	0.20	0.30	0.20
Stearic acid	18:0	5.10	5.70	5.20	5.50	5.80
	19:0	0.20	0.10	0.10	0.10	0.10
Arachidic acid	20:0	0.40	0.50	0.40	1.10	0.80
	21:0	trace	trace	trace	trace	trace
Behenic acid	22:0	trace	0.30	0.30	0.30	0.50
	23:0	trace	trace	trace	trace	trace
Lignoceric acid	24:0	0.60	0.60	0.50	0.40	0.40
Unsaturated:						
	12:1	0.20	trace	trace	trace	trace
	14:1n-7	0.40	trace	0.10	0.40	0.10
	14:1n-5	0.20	0.10	0.10	1.60	0.30
	15:1	0.30	0.10	0.10	0.30	0.20
	16:1n-9	0.20	0.10	0.10	trace	0.10
Palmitoleic acid	16:1n-7	0.60	0.20	0.30	1.60	0.30
	16:1n-5	0.20	trace	0.10	0.20	0.10
	16:2n-4	0.20	trace	0.10	0.20	0.20
	17:1	0.40	0.10	0.10	0.20	0.20
Oleic acid	18:1n-9	32.40	23.70	24.60	23.70	28.30
	18:1n-7	0.40	1.60	0.50	0.60	0.40
Linoleic acid	18:2n-6	30.30	34.20	34.10	24.40	26.40
	18:3n-6	0.60	0.10	0.10	0.30	0.20
Linolenic acid	18:3n-3	2.70	2.50	2.40	1.70	1.80
	18:4n-3	0.10	trace	trace	0.10	0.10
	20:1n-11	trace	trace	trace	trace	trace
	20:1n-9	0.40	0.50	0.40	1.60	0.50
	20:2n-6	0.10	0.10	0.10	0.10	0.10
	20:3n-6	0.10	0.10	0.10	0.10	0.10
	20:3n-3	trace	trace	trace	trace	trace
Arachidonic acid	20:4n-6	0.10	0.20	0.20	0.30	0.20
	20:4n-3	trace	trace	trace	trace	trace
Eicosapentaenoic acid	20:5n-3	0.30	trace	trace	0.10	0.10
	21:5n-3	trace	trace	trace	trace	trace
	22:1n-11	trace	0.30	0.30	0.90	0.30
	22:1n-9	0.40	0.20	0.20	0.40	0.30
	22:2n-6	0.10	trace	0.10	0.10	0.10
	22:3n-6	0.40	0.20	0.20	0.30	0.10
	22:4n-6	trace	0.30	0.40	0.40	0.60
	22:5n-6	0.10	0.20	0.10	0.40	0.10
	22:5n-3	trace	trace	0.30	0.60	0.30
Docosahexaenoic acid	22:6n-3	0.50	trace	trace	1.50	trace
	24:1n-9	0.10	1.00	0.90	trace	0.90

Table5: Body parts of broiler finisher fed the five diets

	Treatments				
Parameters	1 Control	2 1:1A	3 1:1B	4 2:1A	5 2:1B
Growth Performance:					
Av. Initial wt. of broilers	0.70±0.03	0.70±0.04	0.69±0.02	0.71±0.02	0.71±0.05
Average final weight(kg)	2.48±0.10	2.27±0.09	2.30±0.04	2.41±0.06	2.32±0.01
Av. Weight gain (kg)	1.77±0.14	1.70±0.10	1.66±0.02	1.57±0.07	1.69±0.01
Feed Utilization:					
Average feed intake (kg)	8.34^{a}±0.69	8.39^{a}±0.81	8.15^{a}±0.05	6.66^{b}±0.34	6.54^{b}±0.41
Average Feed Conversion Ratio (FCR)	4.71^{a}±0.03	5.34^{a}±0.33	4.82^{a}±0.25	3.93^{b}±0.05	3.95^{b}±0.27
Body Parts:					
Broiler Chest (kg)	0.56±0.01	0.54±0.04	0.63±0.05	0.56±0.01	0.62±0.03
% of average body wt	22.58	23.79	27.39	23.24	26.72
Broiler Liver (g)	93.50^{a} ±10	75^{b} ±30.62	52^{c} ±16.15	46.8^{c} ±6.4	53^{c} ±13.6
% of average body wt	3.79	3.3	2.26	1.95	2.28
Abdominal fat content(g)	0.00^{c} ±0.1	28^{a} ±23.93	12.5^{b} ±9.52	3^{c} ±4.5	18^{b}±9.97
% of average body wt	0.00	1.23	0.57	0.12	0.78

Means with the same superscript a, b,----- not significantly different (p>0.05)

RESULTS AND DISCUSSION:

The combination of energy sources including palm oil, wheat bran and cattle blood, yielded metabolisable energy values of 2.75 – 2.91kcals/g in diets 1 – 5 respectively. These values were relatively low when compared with standards (3.1 – 3.2 kcals/ g) reported by Oluyemi and Robert (2000) for broilers. Broilers consume feed to satisfy their requirement for energy, hence the high consumption rates observed for the birds (8.34, 8.39, 8.15, 6.66 and 6.54kg) in treatments 1 – 5, respectively. This agrees with Oluyemi and Robert (2000) assertion that a decrease of 110kcals/g in the diet of broilers will increase feed intake by 3.5 - 4% and that the adult broiler tend to over consume energy. The low values ME observed may have been due to the use of wheat bran as carbohydrate source with 1.256 kcals ME/g for poultry, according to Aduku(1993). The high rate of consumption resulted in the consumption of high levels of protein from the high protein : energy ratio, resulting in very good growth rate of the broilers yielding final body weights (2.48, 2.27, 2.30, 2.41and 2.32kg) in the five treatments, respectively.This agrees with Fashina – Bombata et al, (1994) that efficiency of gain is closely related to intake levels of nutrients especially protein and energy. Egena and Aya (2007) also confirmed that growth is enhanced in broiler chicken when its requirement for protein and energy is met.

On body composition the diets had a marked impact on broiler chest weight and abdominal fat content. The weight of the chest ranging between 0.53 – 0.63kg and % of body weight (22.58 – 27.39) for the treatments were high and showed the state of good conformation of the carcasses. The values exceeded the 17% of total body weight reported by Morley (1972) and 16.60 – 18.02 obtained by Christopher *et al*,(2007). The abdominal fat content observed (0.00 – 1.23% of total broiler weight) were lower than the > 3% recorded by Sanz et al,(1999) for broiler chicken at slaughter age (49 days). This may not be unconnected with the use of palm oil and the presence of good amounts of linoleic acid as recorded in the fatty acid composition in triglycerides and phospholipids of the five diets. It is in line with Clark *et al*, (1977) report that 3% linoleate in the diet decreased fatty acid synthesis in the liver of rats by 50% while 8% methyl stearate absorbed to the same extent had no effect on fatty acid synthesis. Work by Sanz *et al*, (1999) also showed that broiler chicken fed diets enriched with polyunsaturated fatty acids have less abdominal fat or total body fat (Sanz *et al*, (2000a) deposition than do broiler chickens fed diets containing saturated fatty acids. In addition Sanz *et al*, (2000b) also found out that the abdominal fat deposition of chickens fed sunflower oil enriched diet was significantly lower than that of chickens fed tallow enriched diet. They concluded that this may have resulted from an increased rate of lipid catabolism and lower rate of fatty acid synthesis despite higher dietary fat absorption. Mayes (1979) reported that when availability of glucose in adipose tissue is reduced as in starvation or diabetes less glycerol – 3 - phosphate is formed, allowing the rate of lypolysis to exceed the rate of esterification, with subsequent accumulation of free fatty acids and their release into the plasma. This may have been the case of low

carbohydrate consumption as in the use of wheat bran as carbohydrate source. The relatively low ME of the diets created no room for the high crude protein content brought about by the high inclusion of blood meal, to be converted to body or adipose fat. No EFA (linoleic acid) deficiency symptons as outlined by Oluyemi and Roberts (2000) as poor growth, liver fat accumulation and susceptibility to respiratory infection of the fowls were apparent in all the treatments.

CONCLUSION

The trial thus demonstrated that palm oil could effectively be combined with wheat bran to provide a good balance of energy when used with blood meal as feed for broiler finisher. Diets of this nature would be ideal for the production of quick table sized and low fat broilers and the circumvention of high cost maize in broiler feed.

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