PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILERS FED DIETS CONTAINING GRADED LEVELS OF PALM OIL SUPPLEMENTED WITH VITAMIN E

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ABSTRACT

Experiment was conducted for 9 weeks to test performance and carcass quality of 96 day-old Anak broiler chicks fed diets containing graded levels of palm oil supplemented with vitamin E. The inclusion levels of the palm oil were 0, 5, 10 and 16% supplemented with 0, 0.06, 0.12 and 0.18g of vitamin E/kg of feed tested at starter phase (1-5wks) as diets 1 - 4 and finisher phase (6-9wks) as diets 5 - 8. The diets were formulated such that diets 1 and 5 (control diets) had no palm oil and vitamin E while others 2, 3, 4, 6, 7 and 8 (test diets) had palm oil and vitamin E at the respective levels mentioned above. The energy and protein levels at the starter phase were 12.35 MJME/kg and 23% crude protein (CP) while at the finisher phase, energy and protein levels were 12.60 MJME/kg and 20% CP. The average feed intake of the birds on diets 3 and 4 were significantly increased (P<0.05) while the averages of body weight and metabolizable energy intake of birds on diet 4, body weight gain and efficiency of feed utilization of birds on diet 3 were better (P<0.05) than others at the starter phase. At the finisher phase, average feed intake of birds on diets 7 and 8, averages of body weight and metabolizable energy intake of birds on diet 8, averages of body weight gain (diet 7) and efficiency of feed utilization of birds on diets 5 and 7 were increased significantly (P<0.05) than those of other diets. The average back weight of birds on diets 5, 6 and 8, average neck weight of birds on diet 7, average shank weight of birds on diets 5 and 8, averages of gizzard weight of birds on diets 5 and 8 and proventriculus of diet 5 were significantly increased (P<0.05) more than the other diets while nominal increases were recorded in some parameters measured. There were no significant differences in the average values of live, carcass and dressed weights. The results of the research showed that high level of palm oil supplemented with vitamin E especially at 16% of palm oil inclusion enhanced performance of broilers at starter and finisher phases.

KEY WORDS: Performance, carcass, broilers, palm oil, vitamin E, starter, finisher

INTRODUCTION

Livestock feedstuffs demand outstripped supply in Nigeria recently and the bulk energy supplier like maize was worst hit. At the local market one kilogram of maize sold for eighty naira (N80.00) as against the price of thirty naira (N30.00) before the increase. The scarcity was caused by dwindling harvest of farm produce. Input resource such as maize and its availability all year round has come into focus especially in Nigeria where post harvest handling and processing of produce is not undertaken in a large scale. In that whatever is used as input is directly derived from the farm with little or no reserve for sustenance. Storage facility like silos where they exist is not enough to store grain in order to sustain the demand on feed input resource through to the next harvest. Therefore palm oil as energy source will be used in this study to fill these gaps that might be created during period of maize scarcity. Feed resource is a major input in poultry production systems in Nigeria. It is estimated that feed accounts for more than 60 percent of total costs of production in commercial poultry sub-sector (Ogunwolere and Onwuka, 1997). Due to palm tree high productivity, availability of oil is secured throughout the year in the south eastern part of Nigeria (Anonymous b, 2001; Wiki, 2006). Palm oil is moderately cheap and enhances smell and taste and in turn feed intake by animals (Crespo and Nsteve-Garcia, 2002). Chickens fed with diets containing oil showed better performance than those fed without oil (Moura, 2003).

To supplement maize partly with palm oil and preventing rancidity or oxidation using vitamin E in broiler's diet is to be harnessed in this study. Palm oil has 2.3 times more energy than maize per unit value

(Lehninger, 2001). Fat and oil provide varying quantities of essential nutrient, linoleic acid (Lesson and Summers, 2001). Fats in diets inhibit de novo lipogenesis in broiler chickens (Yen and Leveille, 1971) thereby sparing carbohydrate (glucose) that would have been used. Onibi (2002) reported that pig and chicken are able to incorporate dietary fatty acid directly into adipose tissue.

Some unconventional feedstuffs have been reviewed. These include; bran (rice, wheat, millet and sorghum), peels (cassava, plantain and yam), pulps (citrus and pineapple) and industrial byproducts (molasses and brewers' grain) based on intensive poultry production units by Musharaf (1990), Sonaiya (1993) and Aletor (2005). These feedstuffs can also be fed alternatively at cheaper cost to animals since humans do not usually consume them. The future of efficient and profitable production of meat from poultry (broilers) could therefore depend on identifying these alternatives and finding ways of using them as component to augment (Isika, 1999 & 2001) maize as energy source (Babatunde, 1989) in animal feed especially nonruminant animals. Advanced genetic engineering and nutrition (Anonymous c, 2004) have produced very efficient strains of poultry birds, which can utilize palm oil and other feedstuffs to enhance growth performance. The supplementation of poultry feed with 2.5 5% oil has been reported to be beneficial in terms of growth rate, health and well being of broilers (Oluyemi and Roberts, 2001). Blanch *et al*. (1995) recommended 5% optimal inclusion of oil in diets for monogastrics. Ezeokeke *et al*. (2008) used diets containing 14% level of palm oil supplemented with vitamin E to enhance performance of broilers. But in this study graded levels of palm oil with vitamin E will be tested in the starter and finisher phases.

From convention oxidation poses a serious problem in feeds containing high amount of palm oil and through consumption having developed some free radicals may be toxic to the animal. Oxidation reduces feed quality and absorption. Also the health status of the animal is jeopardized. This is because oxidation leads to breakdown of feed nutrients especially fats and generates heat, which adversely affects other heat labile nutrients. This problem will be prevented by supplementing the feed with an antioxidant in the form of vitamin E (Mac Donald and Edwards, 1995). Vitamin E is well recognized for the effective inhibition of lipid oxidation in food and biological systems (Kamal and Appleqvist, 1996). Vitamin E is an effective natural antioxidant of lipid, which is deposited in the cellular and sub-cellular fraction of muscle and adipose tissue (Onibi, 2002). The American Pharmacopoeia (1980) recommended 56mg vitamin E per Kg body weight of bird as an antioxidant to be added.

Animal protein supply in Nigeria range between 4.4 and 6.6g per capita per day (Tewe, 1998). Therefore, this study is one way to boost animal protein production in the south east of Nigeria using broilers maintained on diets containing high level of palm oil supplemented with vitamin E to prevent oxidation. The step taking in preparing the diet this way may improve the nutritive value of the feed and hence enhance growth of the broilers.

MATERIALS AND METHODS

Ninety six day old unsexed broiler chicks of Anak breed were used to test growth performance of broilers at starter and finisher phases with or without palm oil and vitamin E. The experiment was carried out in deep litter house measuring 2 x 4m at the Teaching and Research Farm, Federal University of Technology, Owerri. The birds were distributed to treatments using completely randomized design. Three replicates per treatment were used, each replicate had 8 birds. The experiment lasted for nine weeks.

Diets 1, 2, 3 and 4 had energy and protein levels of 12.35 MJME/Kg and 23% crude protein (CP) at the starter phase (1-5wks) while diets 5, 6, 7 and 8 had energy and protein levels of 12.88 MJME/Kg and 20% CP at finisher phase (6-9wks). Diets 1 and 5 had no palm oil and vitamin E additions while diets 2, 3, 4, 6, 7 and 8 had palm oil and vitamin E at levels of 5% and 0.06g (diets 2 and 6), 10% and 0.12g (diets 3 and 7), 16% and 0.18g (diets 4 and 8), respectively.

Vaccination and normal routine hygienic practice were strictly adhered to. The chicks were inoculated with intraocular Newcastle disease vaccine and fowl cholera vaccine at the first week. Within the same week, biovit-glucose preparation was administered by mixing in water and giving for 3 consecutive days to supply energy and reduce stress to the chicks. After 2 weeks 'gumboro' vaccine was administered to the chicks by dissolving 200 doses of it in water. The chicks were starved of water in order to make them take enough of the mixture in a short time. The 'gumboro' vaccine was administered the second time after the 3rd week. Lasota was administered at the 28th day to ensure long lasting immunity against disease. Anti-coccidiosis and piperazine water-soluble powder for de-worming the chicks were administered at the 4th week.

Feed and water were provided at liberty for the chicks. The birds were fed for 5 weeks on starters' diet and finishers' diet for another 4 weeks. Feed intake was determined by deducting the remnant from the total quantity given to the birds the previous day. Feed wastage by the birds was prevented by using commercially available adjustable metal feeders. The birds were weighed at the beginning of the experiment and weekly thereafter. The ingredients composition of the experimental diets is as shown in Table1.

At the end of the experiment, 3 birds per treatment were randomly selected denied feed for 12 hours then slaughtered and prepared for carcass analysis. The slaughtering method included using a sharp knife to severe the vein of the chicks at the neck region allowing blood to drain out. Scalding was done using hot water at 65^{0}C for 60 seconds. Plucking of feathers was done manually with hands. Parts of chicken including the internal organs were weighed and recorded for analysis.

All data collected were subjected to analysis of variance while the least significant difference (LSD) method (Njoku *et al*., 1998) was used in mean separation. The metabolizable energy intake (MEI) for body maintenance was calculated using the prediction equation, MEI = $0.35W^{0.75}$ MJ/d (Rose, 1997). Where W = Weight of the bird in kilogram. The prediction equation emanated from the fact that in birds the faeces and urine are excreted together through a common opening called cloaca.

Table1: Gross Composition of the experimental Diets (%)

		Starter	Phase Experimental		Finisher Diets	Phase		
Ingredients	1	2	3	4	5	6	7	8
Maize	59.30	42.14	16.22	3.97	67.17	51.71	35.68	14.52
Groundnut cake	30.54	26.11	11.94	3.69	22.40	20.11	15.30	8.37
Brewer's dried grain	0.55	13.36	37.42	42.20	0.90	12.59	26.44	41.08
Soybean meal	0.11	3.89	14.92	24.64	0.03	1.09	3.08	10.53
Palm oil	Nil	5.00	10.00	16.00	Nil	5.00	10.00	16.00
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Common salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
*Premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Vitamin E	-	+	+	+	-	+	+	+
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.	100.
Cost of feed/kg (N)	58.46	59.48	60.00	64.71	58.33	59.07	60.00	61.69

*Vitamin-mineral premix supplied the following per 2.5 kg of the product: Vitamin A 15,000,000 IU, vitamin D_3 3,000,000 IU, vitamin E 30,000 IU, vitamin K 2,500 mg, vitamin B_1 2,000 mg, vitamin B_2 200 mg, pantothenic acid 10,000 mg, folic acid 1,000 mg, biotin 80 mg, choline chloride 500 g, antioxidant 125 g, selenium 240 mg, Mn 96 g, Zn 60 g. Fe 24 g, Cu 6 g, I 4 g, Co 240 mg.

Table 2: Calculated Analysis of the Diets

Experimental Diets	ME (MJ)	CP %	CF %	Ca %	P %
1	12.52	22.82	2.90	1.30	0.63
2	12.52	22.99	5.05	1.32	0.66
3	12.55	23.25	9.42	0.44	0.34
4	12.52	23.01	10.35	1.38	0.77
5	12.88	19.97	2.70	1.28	0.63
6	12.88	19.95	4.68	1.30	0.65
7	12.97	19.76	7.02	0.40	0.27
8	12.88	20.04	9.66	1.35	0.69

RESULTS

The performance of the birds on experimental diets is as shown in Tables 3, 4 and 5. At the starter phase, average daily feed intake of bird on diets 3 and 4 increased significantly ($P<0.05$). This was higher than those on diets 1 and 2. Average body weight at the end of starter phase of the birds on diet 4 appreciated more ($P<0.05$) than those of diets 1, 2 and 3 while average body weight gain of birds on diet 3 was significantly increased ($P<0.05$) better than the ones on diets 1, 2 and 4. Efficiency of feed utilization of birds on diet 3 increased significantly ($P<0.05$) than those of diets 1, 2 and 4. The metabolizable energy intake per day per bird for body maintenance of birds on diet 4 increased significantly ($P<0.05$) than those on diets 1, 2 and 3. Mortality was below 5% at the starter phase.

At the finisher phase, averages of feed intake of birds on diets 7 and 8 surpassed ($P<0.05$) that of the birds on diet 5 except those on diet 6. Mean body weight of birds on diet 8 was enhanced ($P<0.05$) more than those of birds on diets 5 and 6 with those on diet 5 more than those on diet 6 ($P<0.05$). The average body weight gain of birds on diet 7 increased significantly ($P<0.05$) and it was higher than those on diets 5 and 8 while those on diet 6 was less ($P<0.05$) than those of diets 5 and 8. Efficiencies of feed utilization of the birds on diets 5 and 7 were higher significantly ($P<0.05$) than the birds on diet 6 while metabolizable energy intake of birds on diet 8 was higher ($P<0.05$) than those of the birds on diet 6. No mortality was recorded at this phase.

In the analysis of some parts of chicken, parameters measured like averages of back weight of birds on diets 5, 6 and 8 were higher ($P<0.05$) than that of birds on diet 7 while neck weight of birds on diet 7 surpassed those of diets 5, 6 and 8 ($P<0.05$). Also the shank weight of birds on diets 5 and 8 was greater ($P<0.05$) than those of birds on diets 6 and 7. In the organ weights the weight of gizzard of birds on diets 5 and 8 weighed significantly ($P<0.05$) more than those on diets 6 and 7 while birds on diet 6 had a lower value ($P<0.05$) than those on diet 7. The highest weight ($P<0.05$) of proventriculus was recorded with birds on diet 5. There were no significant differences in live, carcass and dressed weights of birds among the diets except nominal increases.

DISCUSSION

The study had in many parameters such as growth, chicken parts and organ weights measured enhanced significant values ($P<0.05$) of the broilers on the test diets than the control diets. This reflected the reports of Moura (2003) that chickens fed with diets containing appreciable amount of oil performed better than those fed without oil. This result obtained of the present study also confirmed the earlier works of Ezeokeke *et* *al*. (2008) on enhanced performance of broilers fed high level of palm oil supplemented with vitamin E and in line with the suggestion made by Oluyemi and Roberts (2001) on broilers fed oil containing diets. High (diet 8) and low (diet 5) fibre and iso-caloric contents of both diets produced enlarged gizzard and proventriculus ($P<0.05$). Animals eat to satisfy their energy requirement. Therefore, there might have been hyperactivity in these organs as high fibre from convention will dilute the energy level and enhanced feed intake, cellular digestion and absorption at these sites. Also with the oil enhanced digestion and absorption at lower part of the alimentary tract (small intestine). On the other hand, low fibre content in diets in the study brought about appreciable intake that might have resulted in increased digestion and absorption at the sites as well as at the small intestine.

In conclusion, graded levels of palm oil supplemented with vitamin E can be used to bridge gap in feedstuff for broilers created by scarcity of maize. Therefore the formulations especially diets 4 and 8 at starter and finisher phases could be recommended to improve performance of broilers.

Table 3: Performance of the birds at the starter phase

Parameters	1	Starter Experimental 2	Phase Diets 3	4	SEM
Average initial body weight (g)	40.00	40.69	43.99	41.00	
Average feed intake (g/d)	92.86^{b}	90.48^{b}	113.17^{a}	114.19^{a}	7.93
Average body weight (g/5wk)	872.92^{b}	827.83^{b}	876.56^{b}	1006.25^{a}	25.28
Average body weight gain (g/d)	25.00^{b}	23.32^{b}	37.27^{a}	28.12^{b}	1.64
Efficiency of feed utilization (gain/feed)	0.27^{b}	0.26	0.33^{a}	0.25^{b}	0.02
Metabolizable energy intake (MJ/d)	0.32^{b}	0.30^{b}	0.32^{b}	0.35^{a}	0.01

Note: Means with superscripts a and b in a row are significantly different ($P<0.05$).
SEM: Standard Error of Mean.

Table 4: Performance of the birds at the finisher phase

Parameters	Finisher Experimental Phase Diets 5	6	7	8	SEM
Average feed intake (g/d)	130.11^{b}	147.35^{ab}	162.22^{a}	152.99^{a}	7.93
Average body weight (g/9wk)	2176.60^{b}	2067.86^{c}	2200.00^{ab}	2330.21^{a}	42.77
Average body weight gain (g/d)	48.32^{b}	26.40^{c}	63.21^{a}	42.11^{b}	5.30
Efficiency of feed utilization (gain/feed)	0.37^{a}	0.18^{b}	0.33^{a}	0.28^{ab}	0.05
Metabolizable energy intake (g/d)	0.63^{ab}	0.60^{b}	0.62^{ab}	0.66^{a}	0.02

Note: Means with a and b superscripts in a row are significantly different ($P<0.05$)
SEM = Standard Error of Mean

Table 5: Means of carcass, chicken parts and organ weights (g) analyses

Parameters	Finisher Experimental Phase Diets 5	6	7	8	SEM
Live weight	1991.67	1983.33	2150.00	2058.33	78.70
Carcass weight	1800.00	1825.00	1983.33	1966.67	85.66
Dressed weight	1316.67	1404.17	1479.17	1616.67	111.15
Chicken Parts					
Back	441.67^{a}	450.00^{a}	287.50^{b}	516.67^{a}	44.10
Breast	325.00	458.33	462.50	450.00	55.28
Drum stick	225.00	253.33	208.33	291.67	25.00
Head	75.00	65.00	58.33	81.67	8.39
Neck	100.00^{b}	91.67^{b}	137.50^{a}	108.33^{b}	6.80
Shank	116.67^{a}	83.33^{b}	87.50^{b}	125.00^{a}	13.61
Thigh	208.33	233.33	245.83	258.33	18.00
Wing	191.67	191.67	204.17	233.33	20.97
Organ weights					
Crop	16.67	10.83	11.67	11.00	2.88
Gall bladder	10.67	9.67	11.67	10.83	0.92
Gizzard	66.67^{a}	41.67^{c}	54.17^{b}	65.00^{a}	1.27
Heart	20.83	20.00	20.83	20.00	3.76
Intestine	66.67	58.33	70.83	83.33	11.79
Liver	46.67	55.00	45.83	48.33	10.23
Lung	27.33	23.33	25.00	26.67	1.60
Proventriculus	33.33^{a}	23.33^{ab}	16.67^{b}	29.17^{ab}	5.02

Note: Means with a, b and c superscripts in arrow are significantly different ($P<0.05$)
SEM: Standard Error of Mean

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