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INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol.10, pp.059-063, November, 2010

ISSN: 0975-833X

RESEARCH ARTICLE

PERFORMANCE OF BROILER CHICKS FED SUPPLEMENTAL THIAMIN AND RIBOFLAVIN IN GROUNDNUT CAKE AND PALM OIL BASED DIETS

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ARTICLE INFO

Article History:
Received 13th September, 2010
Received in revised form
16th October, 2010
Accepted 24th October, 2010
Published online 1st November, 2010

Key words:
Broiler chicks,
Thiamin,
Riboflavin,
Palm oil,
Groundnut cake.

ABSTRACT

320-day-old Hubbard broiler chicks were used to determine the interaction of supplemental thiamin (vit. B_1) and riboflavin (vit. B_2) and and palm oil on the performance of broilers fed practical diets based on groundnut cake. The diets were isocaloric and isonitrogenous and contained 2% or 4% palm oil, 0 or 0.05mg/kg thiamin and 0 or 0.10mg/kg riboflavin supplementation in various combinations to produce a total of 8 duplicate treatments of 20 birds per replicate. Daily feed intakes, weekly live weight and weight gains were measured and at the end of the 9th week two birds per replicate were slaughtered for carcass studies. Birds on treatment 5 with 2.5mg/kg thiamin, 5.0mg/kg riboflavin and 4% fat grew faster. It is suggested, from the observation, that 2.5mg/kg thiamin, 5.0 mg/kg riboflavin and 4% palm oil was adequate for optimum broiler performance when diets contain groundnut cake and further supplementation with these vitamins would not be beneficial.

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INTRODUCTION

Feed cost continues to constitute the greatest disincentive to successful poultry Production in Nigeria. Consequently, the livestock sector is characterized by high prices of poultry products (Agwunobi, 1990), especially now with the current inflationary trend. Profitable poultry production always requires an efficient conversion of feed into animal products, and this can be achieved if the chicken obtains from the feed a substantial margin of nutrients over the inevitable losses during metabolism. However, in all productive systems, the ultimate limit of nutrient intake is set by the voluntary intake of the animal.

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Many attempts to improve performance have centered on the manipulation of nutrients to arrive at the best dietary combination that would off-set the largely unavoidable losses during metabolism (Orr and Hunt, 1984; Aletor *et al.,* 1989). Vitamins of the B-group, especially thiamin (Vitamin B_1), riboflavin (Vitamin B_2), Pantothenic acid and niacin have long been known to serve important functions in connection with the utilization of nutrients – functions which reveal themselves through profound disturbances of metabolism and attendant symptoms when the supply of these vitamins in the diet are inadequate (Hulen *et al*, 1990). There is also evidence that vitamin are not required in isolation, that the requirement will be influenced by the intake of others as well as other ingredients (Chou *et al,* 1971 and Wellers and

Chevan, 1975). Palm oil, an extraction from the oil palm fruit (*Elaeis guiness Jacq*) is popular as a supplemental source of fat in broiler production in Nigeria (Babatunde and Fetuga, 1976, Ogunmodede, 1977 and Ndifon *et al,* 1994). And although the importance of fat and the interrelationship of fats and vitamins in poultry nutrition has been established, the standard values of the levels of inclusion of these nutrients under practical conditions, in diets intended to contain adequate amounts of other ingredients is still subject to further investigation. This study was, therefore, conceived and carried out to determine the effect of the interaction of thiamin, riboflavin and palm oil on the growth response, organ weights and fat content of organs in broilers fed diets containing groundnut cake. It is hoped that the outcome of this study will contribute information to the establishment of optimum level of thiamine, riboflavin and fat in broiler diets.

MATERIALS AND METHODS

Animals and management

A total of 320 day old Hubbard broiler chicks were weighed and assigned to eight treatments of 40 birds per treatment. Each treatment had a replicate of 20 birds each. The diets contained two levels of palm oil, 2% for diets 1 to 4, and 4% for diets 4 to 8. No thiamine or 0.05mg/kg thiamine (vit B1) and no riboflavin and no riboflavin 0.10 mg/kg riboflavinin various combinations were supplemented. The composition of 100kg of the experimental diets formulated to be isocaloric and isonitrogenous, is shown on table 1. The birds were reared on deep litter and given water *ad libitum* for nine weeks. Weekly weights and daily feed intakes of birds were recorded.

Carcass Evaluation

On the 9th week, birds were starved for 12 hours and two birds were randomly selected per replicate (i.e. four birds per treatment), weighed and slaughtered by decapitation as described by Adams *et al*. (1986). The birds were bled and dressed. The following weights were also taken: abdominal fatpad, gizzard, liver, thigh and breast muscles. The abdominal fat that was removed and weighed represented the fat surrounding the gizzard and lay between the abdominal muscles and intestine, the layer of fat extended within the ischium and surrounded the bursa of fibricus and cloaca (Becker *et al.,* 1979). The weighed gizzard, livers and kidneys were subsequently analyzed for fat content or percentage ether extract according to the methods of the Association of Official Analytical chemists (A. O. A. C, 1990).

Statistical Analysis

Data was subjected to Analysis of Variance (ANOVA).The experiment was laid out in a 2x2x2 factorial arrangement in accordance with procedures stipulated by Steel and Torie (1990). Significant means were separated by the multiple range test of Duncan (1955).

RESULTS AND DISCUSSION

Mean values of feed intake, live weight, weight gain, feed efficiency, selected carcass cuts as well as abdominal fat pad are presented on table 2. Feed intake was not significantly different (P>0.05). Birds receiving dietary treatment 5 with 4% palm oil but no supplementary thiamin and riboflavin grew faster and had a final live weight that was significantly (P<O.05) superior to birds on treatments 1, 2 and 8. As with feed intake, there were no significant differences (P>0.05) in live weight gains and feed efficiency among treatment means and their pattern of response was not consistent. Much of the previous investigations regarding the use of fat in broiler diets have made use of different approaches, different fat sources and levels and dietary mixtures as well as various metabolizable energy levels and their results were not always in entire agreement with one another. However, the general improvement in live weight, weight gain and feed efficiency with increasing dietary fat in this study agrees with the reports of Babatunde and Fetuga (1976) and Coon *et al.* (1981). The weight gain values also compare although slightly higher than those reported by Oloyo (2002). There was no significant difference (P>0.05) in the weight of thigh muscles. Breast muscles weighed more than thigh muscles and this agrees with earlier observations of Akpet (2003) and the report of Okon and Ayuk (2006). Birds fed dietary treatment 5 had significantly heavier

Table 1. Gross composition of 100kg of experimental diets

	DIETS							
1	2	3	4	5	6	7	8	
Ingredients:								
Maize	54.75	54.75	54.75	54.75	50.75	50.75	50.75	50.75
Groundnut Cake	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Blood Meal 3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	
Fish Meal	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00
Bravers Dried Grains	7.50	7.50	7.50	7.50	5.50	5.50	5.50	5.50
Oystor Shell 1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	
Bone Meal	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00
Palm Oil	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00
* Vitamin / Mineral (Zoodry VN101)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine 0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total	1000	1000	1000	1000	1000	1000	1000	1000
Supplemental Vitamins (mg/kg):								
Thiamin (Vit B_1)	0.00	0.05	0.05	0.00	0.00	0.05	0.05	0.00
Riboflavin (Vit B_2)	0.00	0.00	0.10	0.10.	0.00	0.00	0.10	0.10
Calculated Analysis of Diet:								
ME (Kcal kg^{-1})	2940	2940	2940	2940	2965	2965	2965	2965
Crude Protein (%)	22.5%	22.5%	22.5	22.5	22.3	22.3	22.3	22.3
Protein: Energy (CPP) ratio 130.67	130.67	130.67	130.67	130.27	130.27	130.27	130.27	

* The following were present per kg: Vit A, 520000014; Vitamin D_3, 10400001. U; Vitamin E, 4001U; Vitamin K, 800mg, Vitamin $B_{1,}$ 1000mg, Vitamin $B_{2,}$ 2000mg; Vitamin $B_{6,}$ 1600mg; Nicotinic acid, 14000mg; Calcium d-pentothenate, 4000mg; Biotin (Vitamin H), 20mg; Vitamin $B_{12,}$ 8mg; Foloc acid, 400mg; Choline Chloride, 200,000mgmg; Chlortetracycline, 10,000mg; Manganese, 60,000mg; Iron, 20,000mg, Zinc, 18,000mg; Copper, 960mg; Iodine, 560mg; Cobalt, 80mg; Selenium, 32mg; Methionene, 80,000mg; Ethoxyquinine, 40,000mg. ME=Metabolizable Energy.

Table 2. Performance of broilers fed thiamin and riboflavin supplementation

	TREATMENTS							
Measurements	1	2	3	4	5	6	7	8
Feed Intake (g/bird/day) 16.23	16.17	16.52	17.19	16.44	16.41	16.29	16.06	
Live weight at 63 days (g/bird)	1046.5^{c}	1842.0^{b}	1821.0^{ab}	1882.5^{b}	2060.0^{a}	1718.5^{ab}	1926.5^{a}	1831.5^{b}
Live Weight gain (g/bird/day)	28.57	28.46	29.73	29.06	31.89	29.63	29.78	28.29
Feed efficiency (gain/feed) ratio	1.76	1.76	1.80	1.69	1.94	1.81	1.83	1.88
Weight of thigh Muscles (g/bird)	98.89	110.37	105.62	100.25	97.50	89.25	98.62	91.87
Thigh muscles as % if live weight	5.35	5.99	5.50	5.32	4.73	4.65	5.12	5.02
Weight of breast muscles (g/bird)	325.00^{ab}	319.25^{b}	341.75^{a}	333.75^{a}	362.75^{a}	304.25^{ab}	336.75^{a}	295.75^{b}
Breast muscles as % of live weight	17.60^{a}	17.33^{a}	17.76^{a}	17.73^{a}	17.12^{a}	15.86^{a}	17.50^{a}	16.26^{a}
Weight of Abdominal fatpad (g/bird)	47.25^{b}	63.50^{a}	48.75^{b}	43.50^{b}	49.25^{b}	27.50^{c}	57.50^{ab}	46.75^{b}
Abdominal fat pad as % of live weigh	2.56^{a}	3.45^{a}	2.53^{a}	2.3^{a}	2.40^{a}	1.43^{b}	2.98^{ab}	2.55^{a}

($P<0.05$) breast muscles than those on treatments 1 and 8. This was expected because birds on treatment 5 had the highest live weight and it does appear that most of the tissue deposit was in the breast muscle. In general, the values compare with those obtained by Akpet (2003) and Okon and Ayuk (2006). Abdominal fat pad weights were slightly higher when expressed in grams, but compared well when expressed as a percentage of live weight with values reported by Malbray and Worldroupe (1981) and Oloyo (2008). Abdominal fat pad as a percentage of live weight did not exceed 3%, and this is consistent with the report of Oloyo (2002) and earlier workers. And the lack

Table 3. Weight and fat content of livers, gizzards and kidneys of broilers

	TREATMENTS							
Measurements	1	2	3	4	5	6	7	8
Weight if livers (g/bird)	30.50^{b}	54.75^{a}	44.25^{a}	46.25^{a}	55.50^{a}	46.25^{a}	49.00^{a}	45.75^{a}
Fat content of livers (%)	16.98^{ab}	16.68^{ab}	18.70^{ab}	10.90^{c}	19.23^{a}	17.64^{ab}	16.62^{b}	11.83^{bc}
Weight of gizzards (g/bird)	31.00^{bc}	38.00^{bc}	34.50^{bc}	36.00^{bc}	55.00^{ac}	25.75^{c}	41.00^{a}	35.75^{ab}
Fat content of gizzards (%)	10.22^{ab}	11.39^{ab}	8.50^{bc}	8.54^{bc}	9.15^{bc}	11.07^{ab}	14.35^{a}	5.84^{c}
Weight of Kidneys (g/bird)	15.50	17.50	20.25	17.50	18.50	15.50	17.25	14.00
Fat content of Kidneys (%)	15.78^{a}	16.77^{a}	12.07^{a}	17.64^{a}	5.35^{b}	7.73^{b}	8.46^{b}	13.11^{a}

Mean values in the same row bearing the same superscripts are not significantly different (P>0.05).

of significant difference in abdominal fat pad weights among treatments appears to be due to the identical caloric and protein content of the diets this agrees with the observations of Mabray and Worldroupe (1981), Okon and Ayuk (2006). Inspite of the wide range in values, the weights and fat content of organs did not differ statistically (P>0.05). The almost consistently high values of organ weights for birds in treatment 5 is understandable since these birds weighed more. The slightly higher fat content of livers could be due to the fact that the liver is the main organ of lipogenesis in the chicken and the first organ to receive absorbed dietary fat before they are stored or sent to other tissues to serve as metabolic substrates as reported by Leveille *et al*, (1975). Clearly, the observed pattern of response of the birds to the dietary treatment could be attributed to the fact that the experimental diets were formulated to be isocaloric and isonitrogenous as traceable to the level of crude protein (% CP) or amino acid, especially DL-Methionime, the level of metabolizable energy (ME)as well as the Caloric: Protein (C:P) ratio as reported by Marion and Woodroof (1965) and Akpet (2003).

CONCLUSION

It follows from the results obtained that supplementation of the diets with 0.05 mg/kg thiamin (vit B_1) and 0.1mg/kg riboflavin (vit B_2) containing 2% and 4% palm oil and groundnut cake did not significantly influence the performance of the broilers. Similarly, abdominal fat weights and fat content of selected organs were also not affected. The experimental diets prior to supplementation already contained 2.5mg/kg (Vit B_1) and 5.0mg/kg (Vit. B_2) which is above the recommended levels of 2.4mg/kg Vit B_1 and 3.6mg/kg Vit B_2 by NRC (1971) and confirm the values of 5.1mg/kg Vit B_2 recommended for broilers in the tropics by Ogunmodede (1977). Therefore, diets containing 2.5mg/kg of thiamin (Vit B_1), 5mg/kg riboflavin and 4% palm oil and groundnut cake, formulated to be isonitrogenous and isocaloric would satisfy optimum performance and further supplementation would not be required. It is suggested that further studies with other fat sources and oil meal cakes be undertaken to confirm this observation.

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