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THE EFFECT OF VARYING ENERGY LEVELS ON ORGAN WEIGHTS, HEMATOLOGY AND SOME BIOCHEMICAL CHARACTERISTICS OF SERUM IN BROILERS

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ABSTRACT

120 Anak broilers were used to determine the effect of dietary energy on the weights of visceral organs, the hematology and some biochemical characteristics of serum in broilers at the finisher phase. After 4 weeks of brooding on deep litter floor on a commercial starter diet offering 23% CP and a ME of 3300 Kcal/kg, they were allotted to three dietary treatments (in groups of 40, with 2 replicates of 20 each), compounded to provide an isonitrogenous CP level of 20% and either low energy (2800kcal/kg), medium energy (3,000 kcal/kg) or high energy (3200 kcal/kg). Results after 5 weeks of feeding *ad libitum* showed only similarities between the treatment groups in all the parameters investigated. These results suggest the adequacy of the low and medium energy diets as well as the safety of the high energy diet where adjustments must be made in dietary energy at the finishing phase depending on the peculiar circumstances of individual farms.

KEY WORDS: Broilers; Energy; Organs; Hematology; Serum.

INTRODUCTION

Optimum energy levels for the production of broiler chickens at the starter and finishing phases have for long been established and documented based on information from temperate regions of the world (Hill and Dansky, 1954; ARC, 1963; NRC, 1971; Farrel, 1974; Moran, 1980; Coon et al, 1991) and also in the humid tropics (Olomu, 1976, Babatunde and Fetuga, 1976; Olomu, 1977; Olomu and Effiong, 1980; Aduku, 1992 and Ayorinde, 1994).

The applications of these feeding standards in the tropics at present show that clear disparities exist in the optional energy levels for finishing broilers especially in Nigeria where broiler production has become popular. While the National Research Council (NRC, 1971) recommended a metabilzable energy (ME) level of 3200k/cal/kg diet at a crude protein (CP) level of 20%, Olomu (1977) proposed a then tentative optimum ME range of 2800 to 3000 Kcal/kg at CP levels of 20% (for rations containing fish meal) and 23 or 26% for rations based on groundnut meal without fish meal).

Many workers have however, since then finished broilers at ME levels either much lower, about the same or much higher (Njoku and Chuke, 1985; Okon and Ogunmodede, 1996; Uchegbu and Udedibie, 1998; Faniyi and Ologhobo, 1999; Iyayi and Yahaya; 1999; Onibi et al,; 2000; Esonu et al, 2001) in the humid tropics.

These differences are actually expected as first – High ambient temperatures are known to depress appetite and as such, slightly less energy is required to stimulate feed consumption here in the tropics. With significant variations in ambient temperatures between locations and between seasons within the locations in the tropics, adjustments in dietary energy are bound to exist.

Secondly – As feed consumption is regulated by energy and birds will first eat to satisfy their energy requirement, the higher the energy content of a diet becomes, the higher the CP level needs to be to allow the birds to obtain more nutrients from the lowered consumption. The ME of a ration would therefore depend to a great extent on the CP level of the ration.

Thirdly – As more and more locally available unconventional (alternative) feedstuff are being utilized in the tropics in practical diets for the various classes of poultry, the differences i. the CP, amino acid profile and crude fibre (CF) of such feed stuff are bound to affect the ME and CP of such diets.

The earlier recommendation of Olomu (1976) that there is a need for constant determination of the optimum protein and energy levels for broilers in the tropics thus appears to be needed now more than ever before, especially here in Nigeria where the ME of many of these unconventional feedstuffs is currently unknown.

Moreover, most of the reports on the levels of energy for broiler production available in the tropics are based only on performance evaluations and carcass characteristics of experimental birds.

This work was therefore proposed to provide information on the optional level of energy for finishing broilers based on some physiological parameters.

MATERIALS AND METHODS

Location of Study: This study was conducted at the poultry unit of the Teaching and Research Farm of the University of Agriculture, Makurdi. Makurdi is situated at latitude 7^0 14N and longitude 8^0 31E.

Animals and Management: 120 unsexed day old Anak broiler Chicks were used for this study. Brooding was done on deep litter floor using a standard commercial broiler starter ration (Guinea Feeds Ltd,) containing 23% CP and a ME value of 3300 Kcal/kg feed. All routine vaccinations were strictly adhered to.

At the end of 4, weeks, the birds were separated into sexes based on comb and wattle development and randomly assigned to either of three dietary treatments with 40 birds per treatment such that each treatment had an equal number of males and females. Each treatment had 2 replicates of 20 birds each.

Experimental Diets (Treatments): Three isonitrogenous diets were formulated to contain ME levels of 2800 Kcal/kg, 3000 Kcal/kg and 3200 kcal/kg and were designated as "low", "medium" and "high" energy diets respectively.

The birds on the respective treatments were fed the diets *ad libitum* with cool clean drinking water supplied always. Floor space, drinking space and feeder space were all within standard recommendations.

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Slaughter of Birds: After a feeding period of 5 weeks, 4 birds from each treatment (2 from each replicate) were randomly selected but equalized in sex. The selected birds were isolated in a separate pen and starved for 12 hours before they were sacrificed. The slaughter method was severing the jugular vein and carotid arteries at the point between the head and neck.

Collection of Samples: Whole blood sample were obtained at slaughter from each bird into two clean dry test tubes with one containing a pinch of an anticoagulant (E.D.T.A).

The carcasses were then wet plucked, cut open and the visceral organs obtained. The weights of the visceral organs were obtained in our laboratory immediately after slaughter using a highly sensitive digital balance.

Hematological and Biochemical Analyses. Hematological evaluations were done (on the samples collected in the test tubes with a pinch of E.D.T.A) by conventional laboratory methods (Baker and Silverton, 1978) as already fully described by Bitto and Gemade (2001).

The sera separated from the samples without an anticoagulant were analyzed for total protein and cholesterol by methods outlined by the Boehringer Mannheim (Germany) diagnostic Assays Manual (1979) and already fully described by Bitto et al. (1999).

Statistical Analysis: The data were analyzed using the one way analysis of variance (ANOVA) as outlined by steel and Torrie (1980).

RESULTS AND DISCUSSION

The compositions of the experimental diets are presented in Table 1, while the effects of low, medium and high energy diets on the weights of visceral organs, the hematology and some biochemical characteristics of serum of the birds are shown in Tables 2,3 and 4 respectively.

There were no significant differences ($P>0.05$) between the diets in all the parameters evaluated.

These results agree with the report of Olomu and Effiong (1980) who found no significant effect of dietary energy on growth rate. These results however disagree with the work of Cartwright (1986) else where who reported a superiority of high energy diets (3236 Kcal/kg; 20% CP) over low energy diets 2610 Kcal/kg; 20% CP) in broilers at the finishing phase using body weight.

It does appear therefore that further work is still needed here in the humid tropic in this regard using a wider criteria for judgment. The results of the present study however imply that increasing energy at the finishing phase of broiler production might not be necessary in our environment from a physiological standpoint as the low energy diets

Table 1: Composition of the experimental diets (%)

Ingredients	Diets		
	2800(Kcal/kg)	3000(Kcal/kg)	3200(Kcal/kg)
Maize	46.20	50.00	51.83
Groundnut cake	40.00	39.00	38.40
Rice bran	6.73	3.00	----
Bone meal	3.80	3.10	3.10
Palm oil	2.80	3.90	5.70
Lysine	0.25	0.26	0.27
Methionine	0.12	0.14	0.15
Premix*	0.30	0.30	0.30
Salt	0.30	0.30	0.25
Calculated analysis			
Crude protein (%)	20.00	20.00	20.00
ME (Kcal/kg)	2800	3000	3200
Calcium (%)	1.20	1.20	1.20
Phosphorus (%)	0.91	0.89	0.86
Methionine + Cystine (%)	0.74	0.77	0.77
Lysine (%)	1.00	1.00	1.00

* Vit A; 800iu; Vit D 12000 iu; Vit E 13 i.u. Vit K_3 2mg, Riboflavin 3mg, Nicotinic acid 10mg, pantothenic acid 7mg, choline 900mg, cabalamin 0.8mg, Folic acid 1.5mg, Biotin 0.25mg, Anti-oxidant 124mg, Fe 25mg, Mn 80mg Zinc 50mg CuO 0.2mg Co 0.2mg Se 0.1mg.

Table 2: The effect of dietary energy on weights of visceral organs of broilers (Means ± s.e.m)

Parameters	Diets 2800(Kcal/kg)	3000(Kcal/kg)	3200(Kcal/kg)
Heart (g)	6.725±1418	7.05±1.299	6.475±0.486
(%)	0.3899±0.829	0.424±0.04	0.3421±0.032
Lungs (g)	8.975±1.167	9.675±1.579	10.8±0.071
(%)	0..5167±0.0357	0.5829±0.04	0.571±0.361
Liver (g)	25.7±6.601	30.925±2.056	31.025±4.825
(%)	0.1455±0.235	0.1883±0.0677	0.1653±0.346
Kidney (g)	6.675±0.444	6.925±0.512	8.25±0.923
(%)	0.3868±0.02695	0.4228±0.0447	0.4342±0.0455
Spleen (g)	2.275±0.871	1.95±0.642	2.15±0.618
(%)	0.299±0.265	0.2749±0.2387	0.5181±0.3834

Table 3: Effect of dietary energy on the Haematology of Broilers (Means ± s.e.m)

Parameters	Diets 2800(Kcal/kg)	3000(Kcal/kg)	3200(Kcal/kg)
Haemoglobin (Hb)	10.10±0.675	10.15±0.602	10.35±0.709
Packed cell Volum (PCV) %	27±1.414	26.5±0.866	28.5±0.5
Red blood cell count (RBC):x10^9/L	27.28±2.380	27.92±1.651	29.19±0.353
White blood cell count (WBC):x10^6/L	14.25±1.558	13.58±1.112	12.41±12.31
Leucocyte differential counts:			
Neutrophils	31.5±4.974	23.5±3.84	32.25±16.41
Monocytes (%)	4.25±1 921	5.5±2.06	3.75±1.299
Eosinophils (%)	2.00±1	2.75±0.829	2.00±2.06
Lymphocytes (%)	62.25±4.264	69.25±26.801	62±16.76
Basoophils (%)	0.00±0.00	0.00±0.00	0.00±0.00

Table 4: The effect of dietary energy on some Biochemical Characteristics of serum in broiler (Means ± s.e.m)

Parameters	Diets 2800(Kcal/kg)	3000(Kcal/kg)	3200(Kcal/kg)
Total Protein (g/100ml)	3.23	2.85	2.99
Cholesterol (g/100ml)	287.838	263.513	264.865

are bound to be cheaper. However, where adjustments based on peculiar situations modulated by factors like temperature, feed ingredients availability and stress conditions are required, high energy diets can still be used as demonstrated in this study.

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REFERENCES

Aduku, A. O., 1992. Practical Livestock Feeds Production in the Tropics. S Asekome & Co. Publisher Samaru Zaria PP. 46.

Agricultural Research Council, 1963. The nutrient requirements of farm livestock no. 1; Poultry summary of recommendations. London, Agricultural Research Council.

Ayorinde; K. L.., 1994. Effects of genotype and dietary energy on performance of broilers. Nig. J. Anim. Prod. 2(1 & 2) : 5 -7

Babatunde G. M. and Fetuga, B. L. , 1976. Determination of the minimum crude protein requirements of broiler starters and finishers in the humid tropics. Nigerian J. Amin. Prod. 3(1): 126 – 138.

Baker, F. J. And Silverton, R. E., 1978. Hematology: In Introduction to Medical Laboratory Technology. Butterworth and Co. (Publishers) Ltd. London 5th Ed.

Bitto, I. I. And Gemade, M., 2001. Preliminary investigations on the effect of pawpaw peel meal on growth, visceral oragn, and endocrine gland weights, testicular morphometry and the hematology of male rabbits. Global J. Pure and Appl. Sci. 7(4): 621 – 625.

Bitto, I. I; Sende, C. T. and Eze, P. U., 1999. Preliminary investigations on the effect of cassava peel meal on testicular morphometry and some biochemical characteristics of serum in cockerels. Global J. Pure and Appl. Sci. 6(2): 161-165.

Cartwright; T., 1986. The influence of dietary energy and amino acid levels on abdominal fat pad development of the broiler chicken Poult. 60: 151.

Coon, C. N. Becker, W. O. and Spencer J. V., 1991. The effect of feeding high energy diet containing supplemental fat on broiler weight gain, feed efficiency and carcass composition. Poult. Sci. 60:1264.

Esonu, B. O., Udedibie, A. B. and Imo, O. I., 2001. The nutritive value of jack bean (carnival ensiformis): evaluation of ferrous sulphate on heat – treated jack bean on the performance of broiler birds. Trop. Anim. Prod. Invest. 4: 177-183.

Faniyi. G. F. and Ologhobo, A. D., 1999. Effect of replacing brewers dried grains with lye and urea treated cowpea and sorghum seed hulls in broiler diets. Trop. Anim. Prod. Invest. 2: 69-82.

Farrel. D. J., 1974. Effects of dietary energy concentration on utilization of energy by broiler chickens and on body compotation determined by carcass analysis and predicted using tritium. Br. Poult. Sci. 15:25-41.

Hill. F. W. and Dansky, L. M., 1954. Studies of the energy requirements of chickens. the effect of dietary energy level on growth and feed consumption. Poultry Sc. 33: 112-119.

Iyayi, E. A. and Yahaya, B. A., 1999. Performance of broilers maintained on diets supplemented with a commercial polysaccharides enzyme in the humid tropics. Trop. Anim. Prod. Invest. 2: 125-130.

Moran, E. T. J., 1980. Impact of reducing finishing feed energy; protein levels on performance, carcass yield and grade of broiler chicken. Poultry Sci. 59: 1304.

National Research Council, 1971. Nutrient Requirements of Poultry 6th ed. Washington. National Academy of Sciences – National Research Council.

Njoku, P. C. and Chuke, G. O., 1985. The effect of sodium chloride on the performance of broiler chickens in a tropical environment. Nig. J. Amin. Prod. 12(2): 147-151.

Okon, B. I. and Ogunmodede, B. K., 1976. Carcass characteristics of broilers fed periwinkle flesh and plam kernel cake. Nig. J. Anim. Prod. 23(1): 16-20

Olomu, J. M., 1976. Determination of optimum protein and energy levels for broiler chicks in the tropics. Nig. J. Amin. Prod. 3(1).:177-183.

Olomu, J. M., 1977. Optimum protein and energy levels for finishing broiler chickens in a tropical environment. Nig. J. Anim Prod. 4(1). 239-253.

Olomu, J. M. and Effiong, S. M., 1980. The effects of different protein and energy levels at time of change from starter to finisher ration on the performance of broiler chickens in the tropics. Poult. Sci. 54.828.

Onibi, G. E.., Laseinde, E. A. O. and Akinyandenu, S., 2000. Influence of housing conditions and type of finishing feeds on the oxidative stability of broiler chicken muscle. Trop. J. Anim. Sci. 3(1): 53-62.

Steel. R. G. D. and Torrie, J. D. H., 1980. Principles and Procedures of Statistics. A Biometrical Approach. 2nd Ed. Mc Graw-Hill Book Co. Inc. New York.

Ucheghu, M. C. and Udedibie, A. B. I., 1998. Marze/sorghum based dried brewers grains in broiler finisher diets. Nig. J. Anim. Prod. 25(1): 13-16.