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Response of Broiler Chickens to Different Dietary Crude Protein and Feeding Regimens

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ABSTRACT

Five isocaloric (3200kcal/kg) diets were used in an experiment designed to investigate the effects of dietary crude protein (CP) and feeding regimens on broiler performance. Day-old broilers were randomly distributed into four groups using a completely randomized design. Each group was replicated three times with ten broiler chicks per replicate. The experiment lasted for eight weeks. Broilers in group 1 received 23% CP from 0 to 3 weeks, 20% CP from 3 to 6 weeks and 18% CP from 6 to 8 weeks, while broilers in group 2 received 23% CP between 0 and 6 weeks and 18% CP between 6 and 8 weeks. Besides, broilers in group 3 were fed 23% CP from 0 to 4 weeks and 16% CP from 4 to 8 weeks, whereas group 4 was given 18% CP from 0 to weeks. Water was supplied *ad libitum* for broilers in the different dietary groups. A metabolic trial was carried out on the third week of the experiment using a total collection method. Proximate analyses of diets and faecal samples were performed according to the methods outlined by the Association Of the Official Analytical Chemists. Results at market age showed that broiler performance with respect to feed intake, weight gain, feed to gain ratio and water intake were not significantly influenced by CP regimens ($p>0.05$). Furthermore, CP regimens did not significantly influence broilers liveability ($p>0.05$). Protein retention, fat utilization and available fiber were not significantly influenced among treatments ($p> 0.05$). Economic data showed that cost to benefit ratio of producing broilers was comparable among broilers for all CP regimens used in this trial ($p>0.05$). It was concluded that a single diet of 18% CP and 3200kcal/kg metabolizable energy would be most suitable and convenient for farmers who are engaged in on-farm feed production for broilers as compared with the standard feeding regimens of broiler starter and broiler finisher diets.

INTRODUCTION

Satisfying the nutritional requirements of a particular class of livestock is rapidly becoming a difficult task. This is due to scarcity and high cost of feed and feed ingredients. Meeting the protein needs of broilers represents a very substantial part of the cost of feeding (Oyedeji & Atteh, 2003). Although National Research Council (NRC, 1984) recommended a feeding standard for broilers among other classes of livestock under temperate climatic conditions, this has not been totally practicable in the tropics for the obvious reasons of environmental differences and type and quality of available feed ingredients. Efforts have been made to determine feeding standards for broilers under tropical environments (Aduku, 1992 and Olomu, 1995). However, due to high cost and scarcity of feed and feed ingredients poultry farmers still occasionally and haphazardly mix one or two ingredients together

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without due consideration for age and nutrient requirements of the class of birds involved. Also, most of the farmers operate in the rural and sub-urban areas with bad and inadequate access roads and transportation. Thus, it is difficult to reach areas where complete feed can easily be found on time; hence the practice of on-farm feed production.

This study was designed to investigate the effects of different dietary protein regimens on broiler performance with the main objective of finding the most suitable and convenient feeding standard for farmers who want to practice on-farm feed production.

MATERIALS AND METHODS

One hundred and twenty (120) day-old Anak broilers were housed in an electrically heated battery brooder and fed the first, the second or the third of the experimental diets described in Table 1. The experimental diets were formulated to be isocaloric, each containing 3200kcal/kg of metabolizable energy. Therefore treatments consisted of variations in the levels of dietary crude protein (CP). There were four (4) treatment groups, each with three (3) replicates of ten (10) birds per replicate. Broilers in Group 1 were fed diets with 23% CP from 0 to 3weeks, 20% CP from 3 to 6weeks and 18% CP from 6 to weeks, while those in Group 2 were fed diets with 23% CP from 0 to 6 weeks and 14% CP from 6 to 8 weeks. Broilers in Group 3 were fed 23% dietary CP from 0 to 4 weeks and 16% CP from 4 to 8 weeks, whereas those in Group 4 were fed 18% CP from 0 to 8 weeks. Feed and water were supplied *ad libitum* throughout the study. Weekly data of feed intake, weight gain and water intake were collected. A metabolic study was conducted during the 3rd week of the experiment. Weighed quantities of feed were supplied and faecal samples collected over a 72-hour period using a total collection method. The collected fecal samples were oven-dried at 60°C for 24 hours, weighed and ground prior to chemical analysis. The proximate compositions of nutrients in the feed and fecal samples were determined using methods of AOAC (1980).

The considered economic parameter was determined using the prevailing market prices of the diets used, costs of medication and that of broilers on live weight basis.

The data collected were analyzed using analysis of variance (ANOVA). Significant test was conducted using Duncan's Multiple Range Test (Duncan, 1955). All statistical analyses were done in accordance with the methods of Steel and Torrie (1980).

Table 1 - Ingredient composition (%) and proximate analysis of different diets fed to broilers from 0 to 8 weeks of age.

	3200 kcal/kg				
Ingredients	**23% P**	**20% P**	**18% P**	**16% P**	**14% P**
Yellow maize	40.00	40.00	45.00	53.00	53.99
Soybean (full fat)	31.84	20.92	18.47	13.81	11.00
Brewers Dry Grain	10.00	14.00	14.00	14.00	14.00
Wheat offal	5.55	9.88	9.88	8.67	8.67
Blood meal	3.26	2.94	2.94	—	—
Fish meal	2.43	2.00	—	1.3	—
Palm Oil	3.66	6.54	6.00	4.92	6.49
Bone meal	2.40	2.16	2.16	2.17	2.17
Oyster shell	0.26	0.15	0.15	0.15	0.15
Salt	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.10	0.10	0.10	0.10	0.10
* Vit. Min. Premix	0.25	0.25	0.25	0.25	0.25
Grit	—	0.81	0.80	0.80	0.93
Total	100.00	100.00	100.00	100.00	100.00
Analyzed Nutrient Content					
Dry matter %	95.61	96.20	95.73	95.49	96.10
Crude Protein %	22.82	19.95	17.87	15.92	13.91
Crude Fat %	5.63	7.83	7.35	6.32	7.28
Crude Fibre %	4.96	4.95	5.36	5.28	4.87
ME kcal/kg (Calculated)	3200	3200	3200	3200	3200

*Provided per kg of diet, Vitamin A (8000 IU), Vitamin D3 (1200IU), Vitamin E (3IU), Vitamin K3 – kastab (2mg), Vitamin B2 – Riboflavin (8mg), Vitamin B3 - Nicotonic acid (10mg), Vitamin B5 – Pantothenic acid (150mg), Copper (Cu) (2mg), Iodine (I) (1.2mg), Colbat (Co) (0.2mg), Selenium (Se) (0.1mg).

RESULTS

Data on feed intake, growth performance, water intake, cost:benefit ratio and mortality percentage as affected by CP regimens are summarized in Table 2. Feed intake, weight gain and feed to gain ratio were not significantly affected by CP treatment ($p<0.05$). Water intake was also similar among treatments ($p>0.05$). CP treatment did not affect broilers liveability significantly ($p>0.05$). Cost:benefit ratio was not significantly influenced by any of the CP regimens ($p>0.05$).

The effect of dietary protein regiments on nutrient utilization is as shown in Table 3. Results showed that protein retention, fat utilization and available fiber were not significantly influenced by any of the dietary protein treatments ($p>0.05$).

DISCUSSION

The reduction in body weight gain and feed intake as recorded in this study among broilers subjected to different crude protein regimens appeared not to be significant. However, a cursory look at the trend of results observed for both feed intake and body weight would show that with one more replicate and more birds per replicate these data might be statistically

Table 2 - Effects of Dietary Crude Protein (CP) and feeding regimens on performance, mortality (%) and cost : benefit ratio of broiler chickens (0 – 8 weeks).

* Treatment Group	Feed Intake (g)	Weight gain (g)	Feed/gain ratio	Water intake (Litre)	Mortality %	Cost Benefit ratio
1. 23% CP (0-3 wk)	NS	NS	NS	NS	NS	NS
20% CP (3-6 wk)	4323	1683	2.62	11.10	4.17	0.31
18% CP (6-8 wk)						
2. 23% CP (0-6 wk)	4393	1628	2.80	11.51	0.00	0.32
14% CP (6-8 wk)						
3. 23% CP (0-4 wk)	4125	1489	2.78	11.56	4.17	0.32
16% CP (4-8 wk)						
4. 18% CP (0-8 wk)	4043	1511	2.68	10.00	0.00	0.30
S E M	270.20	145.35	0.16	1.68	4.86	0.02

SEM - Standard error of mean. * - All diets formulated to be isocaloric (3200 kcal/kg) NS -. means not statistically significant p>0.05.

Table 3 - Effects of Dietary Crude Protein (CP) and feeding regimens on nutrient retention of broiler chickens.

* Treatment Group	Protein %	Fat %	Fibre %
1. 23% CP (0-3 wk)	NS	NS	NS
20% CP (3-6 wk)	72.35	79.94	40.28
18% CP (6-8 wk)			
2. 23% CP (0-6 wk)	75.68	38.19	
4% CP (6-8 wk)			
3. 23% CP (0-4 wk)	72.89	41.24	
16% CP (4-8 wk)			
4. 18% CP (0-8 wk)	70.28	75.35	39.64
S E M	1.16	2.93	1.28

SEM - Standard error of the mean. * - All diets formulated to be isocaloric (3200 kcal/kg). NS - means not statistically significant p>0.05.

different among treatments. It is however interesting to note that the feed intake in broilers subjected to 18% CP from day-old to market age was 350g lower than the feed intake of 4393g recorded for one of the other regimens in which CP was subdivided into periods. However, this difference in feed intake, which could become economically significant in a commercial broiler production, was also accompanied by a decrease of 172 g in body weight gain compared to the 1683g recorded for the treatments in which starter, grower and finisher broiler diets were used. This study however showed a comparable efficiency in the utilization of the available nutrients in the feed consumed. This observation is further confirmed by the results of protein retention and fat utilization as determined by the total collection method. Boekholt *et al.* (1994) postulated that live weight gain is mainly deposition of fat, protein and water. The bird ability to digest fiber is very limited; hence fiber as a nutrient contributes almost nothing to growth in birds except for assisting gizzard in the grinding process. There have not been consistent reports on the effects of CP levels on the performance of broilers. Garcia *et al.* (2000) reported that reducing dietary CP down to 19% did not have a significant effect on broiler performance when compared with birds fed on higher protein diets. Babu *et al.* (1986) also reported comparable feed intake, weight gain and feed:gain ratio for broilers subjected to low CP diets compared with those on higher CP diets. Other findings differ from those mentioned above. For example, Plavnik and Hurwitz (1980) reported that broilers fed low CP diet gained the least body weight and did not recover body weight as measured at 56 days of age. Morris (1971) also reported 25% growth retardation by feeding low CP diets. Furthermore, reduction in feed intake was also reported by Morris (1971) and Plavnik & Hurwitz (1990). Differences in the severity of protein restriction and also perhaps differences in experimental designs could be responsible for the variations observed.

Water consumption among broilers is in line with the reported values that broilers would drink 2g of water for each 1g of feed (Lacy, 2002). Broilers in different groups had comparable water intake, which is an indication that none of the dietary protein regimens investigated in this study predisposed broilers to water stress. Besides, birds were raised under the same environmental conditions, thus blocking the effects of environment on water consumption.

Data on mortality percentage did not show any significant influence of crude protein regimens on broilers liveability. Oyedeji & Atteh (2003) did not report any significant effect of diets containing varied protein and energy levels on the liveability of broilers.

However, though non significant, the apparent difference in cost to benefit ratio among broilers subjected to 18% dietary CP from one day of age to market age as used in this study could become economically significant in commercial broiler production.

In conclusion, there are many adjustments in the feeding programme of broilers that could be beneficial. A shift from the conventional regimented feeding program of broilers would be desirable, although not yet clearly proven in this trial despite the apparent similarity in performance between broilers subjected to a single diet of 18% protein and 3200 kcal/kg of

metabolizable energy and the other age-related CP formulations. However, a single diet would be more straightforward for farmers who are operating on- farm feed production since there would not be the inconvenience of changing from one diet to another in the course of 8 or 9 weeks when broilers are expected to attain market weight.

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