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Effect of Different Proprietary Poultry Feeds on Performance Carcass Characteristics and Serum Protein Metabolites in Broiler

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Abstract:
The effect of two different proprietary poultry feeds, one obtained from a manufacturer and the other from a distributor were compared with a control farm formulated ration. Performance characteristics, carcass traits and some protein metabolites of broiler chicks fed on these rations in a complete randomized design were studied. Results showed that Diet 1 promoted better (P<0.05) live weight gains than the other two rations during the starter phase. This was closely followed by Diet 3 which was also better (P<0.05) than Diet 2. During the finishing phase, there were no significant differences in live weight gains among the three Diets (P>0.05). The feed/gain ratio, final average body weight and protein efficiency followed the same trends as obtained for growth rates. The average carcass and dressed weight among birds were significantly different (P<0.05) with best response from those of Treatment 1 and least from Treatment 2. Average dressing parentage was higher on treatment 1 (P<0.05) than others. The serum creatinine and serum albumin were similar in all treatments with very low values for the former. Serum urea was inversely proportional to serum protein levels for the various dietary treatments while total serum protein followed the same trend as the protein levels for the three diets. Production economics data however, show that Diet 2 compares favourably with the control ration.

Keywords*: Proprietary feeds, broiler, performance*

1. Introduction

The poultry industry in Nigeria is a huge success in augmenting the animal protein shortage occasioned by the fast-declining cattle production (Idachaba, 2004). However, the industry like those of many sub-saharan tropical countries, has been facing a grim shortage of inputs in recent times. The most critical is the short supply of feed ingredients. Feed resources in Nigeria have seen a decline due to stagnant or diminishing output of certain traditional crops. Recent statistics shows that the country increasingly relies on imports to meet the needs of an expanding livestock industry. The growth and expansion of the industry is confronted by high cost of feed and drugs (Amarah, et al, 2007). This has result in the production of feeds which do not meet the requirements of birds for satisfactory economic performance. There is also a lack of adequate quality control in the Nigerian livestock feed industry, thereby leaving poultry producers at the mercy of feed millers (Green Revolution Report, 1983). Current estimate put chicken population in Nigeria at between 140-150 million. More than 75% of the household in Nigeria has chickens (Atteh, 1990; Hassan et al, 1990; Eshitte and Okere, 1990). The agro-based industry which developed as a specialized enterprise enjoyed a good measure of commercialization such that the number of farms increased from 350-5,000 and feed mills from 25-303 between 1963 and 1983 (PAN, 1985). The industry however began to experience some setbacks from the end of the seventies. Importation of cheap poultry meat made domestic production very favourable. It is however ironical that in spite of huge government expenditure in agriculture, Nigerians consume less than 10g of protein daily with 3.2g of this amount coming from animal source (FAO, 2006). It becomes necessary under this situation to compare the biological productivity and production economics of birds on feeds obtained from commercial feed millers with standardized rations. The efficiency of utilization of the feed, that is the amount of feed required to produce a unit of product as meat or egg is the index of a good ration formulation. Least cost formulation is designed to be economical but it may not necessarily be the best formulation in a given set of circumstances.

The study reported here compares the performance, carcass characteristics, serum metabolites and production economics of broilers on different proprietary feeds and a standard compounded ration. Results are discussed in light of its implication in poultry.

2. Materials and Methods

Two hundred and twenty-five-day old broiler chicks obtained from a reputable hatchery in Ibadan, Oyo State were assigned to nine litter-floor pens under the same management conditions. Each pen had twenty-five chicks which were all weighed before commencement of the experiment. The nine pens were randomly divided into three treatment groups of three pens each. Two of the treatment groups of broiler birds were fed on two different proprietary poultry feeds, one obtained from a manufacturer and the other from a distributor. The third treatment group had a control ration as detailed in Table 1.

An eight-week period of study was undertaken during which "broiler starter" mash was fed to the chick for the first four weeks (starter phase) and subsequently "broiler finisher" mash for the last four weeks (finisher phase). Feed and water were made available adlibitum. Routine vaccinations and proper medications were given all through the trial. Weekly feed intake and body weight of birds were recorded in all the treatments groups.

2.1. Blood Collection and Carcass Analysis

At eight weeks of age, five birds randomly selected from each of the replicates of the Dietary treatments were bled by neck decapitation. The blood was left overnight in bottles and serum was subsequently separated and stored at -20^{0}C until needed for analysis.

Following a hot water scald, feather was mechanically removed. Defeathered carcasses were weighed and organs removed and oven-dried for 48 hours at about 100^{0}C. after drying, they were reweighed for moisture content.

2.2. Analytical Techniques

The stored blood sera were analysed for some protein metabolites: total protein, urea, creatinine and albumin. Total serum protein was determined by the biuret methods as described by Weighelbaum (1946). Serum urea was determined by the method described by Fawcett and Scott (1960) with modification by Kaplan and Szabo (1979). Serum creatinine determination was by the method of Slot (1965). The proximate composition of the Diets was determined by the methods of the Association of Official Analytical Chemist (A.O.A.C, 2000). Gross energy of the Diets was determined using the Gallenkamp bomb calorimeter.

2.3. Statistical Analysis

The parameters measured were subjected to analysis of variance as described by Steel and Torrie (1990). The routine T-test statistics was used to compare significance between treatment means.

3. Results

Results of the proximate analysis of Diets used in the study are shown in Table 2. Dietary treatments had significant effects on the weight gains, final body weight and feed efficiency of the birds only during the starter phase of the experiment (Table 3). Generally, feed consumption tended to increase with increasing protein level. As shown in Table 4, the average carcass and dressed weights were significantly affected by Dietary treatment ($P<0.05$), but the carcass dressing percentages were similar ($P>0.05$). Protein and fat percentage of the liver was higher on the proprietary feeds than on the control. The organ fresh weights when expressed as percentage of live weight showed no significant difference ($P>0.05$) among the treatments. No significant effect was observed in mortality of birds on the different treatment groups throughout the length of the study production economics of birds on the three dietary treatments showed highest profit margin from treatments 1 and 2 which had a net-profit of N220.00 and N80.00.

The serum protein metabolites: total protein, urea, creatinine and albumin from birds under the three Dietary treatments were not significantly different ($P>0.05$) (Table 6).

4. Discussion

The study reported here shows marked effects of Diet on the performance of broilers on the various treatments. The effects on the performance were more pronounced in the starter than in the finisher phase (Table 3). The better performance of birds on the control Diet as compared to others is attributable to the better quality of feed in terms of higher protein (as compared to Diet 2) and lower crude fibre (as compared to the two commercial rations). The balance of amino acid in Diet 1 probably also contributed to the better response. As the components of the commercial feeds are not known, definite statements cannot be made on their protein quality. It should be noted however, that the cost of production of a kilogram of feed on the control ration is higher than the selling price per kilogram of the commercial rations (Table 5).

Carcass characteristics of the broilers (Table 4) show that the criteria of measurement were better on the control Diet than on the commercial rations. However, a comparison of the two commercial rations reveal that the final live weight did not absolutely reflect the trend of the dressing percentage. While the final live weight of birds on Diet 3 was better than those on Diet 2, the dressing percentage was better on the latter. The better dressing percentage is largely due to the higher proportional weight of offals on Diet 3 than on 2.

The effects of Diets on serum urea reflect the protein adequacy of the different rations. Higher serum urea levels recorded on the commercial rations (Table 6) reflect a poorer efficiency of protein utilization on these Diets since Eggum (1976) has reported a linear correlation between protein quality and total serum urea concentrations. This might have been due to the lower Dietary crude protein content of the commercial rations. The levels were however not significantly different ($P>0.05$) on the different treatments. Indeed, similar values of total proteins and creatinine indicate that the differences in Dietary protein might not be sufficient to significantly affect protein metabolism in the experimental birds.

The cost/benefit analysis presented in Table 5 clearly indicates the necessity to ensure an adequate supply in quality and quantity of nutrients to broilers if satisfactory economic performance must be obtained. The control Diet which recorded the highest cost per tonne of feed gave a high net profit/kg live weight of broilers at the end of the trial. The observation that Diet 2 which gave the poorest performance in terms of growth rate had the highest profit margin as revealed by cost analysis (Table 5) raises some fundamental questions regarding the levels of nutrients to adopt for economic efficiency of broiler production in the warm humid tropical climate.

Diet 2 had lower protein levels in the starter phase and higher crude fibre levels in starter and finisher phases than optimal levels recommended for broilers by the National Research Council (NRC) (2000). The levels were even lower than those previously recommended for the tropics by Fetuga (1984). Inspite of the lower feed quality than these recommended values, the profit margin on the commercial Diet (Diet 2) was superior to that on other Diets.

Evidence from literature indicates that energy levels of rations that are 10% lower than recommended for temperate countries by the NRC gave the best economic efficiency in pigs reared in the tropical environment of India (Rao, Khan and Ranjhan, 1976). This compliments results obtained in Nigeria by Tewe and Oke (1983) which showed that metabolizable energy levels of 10% less than NRC requirements gave the best economic efficiency in growing pigs. These show clearly that lowering the calorie levels of Diets in the tropics as compared to those used in temperature countries will not necessarily reduce the economic efficiency. Okosun (2017) also revealed that lowering the energy level for cockerel do not affect its biological and economic productivity.

Feed cost is estimated at 70% of total cost in poultry production in Nigeria (Oyedeji 2010). The major constraint to the manufacture of feeds in Nigeria is the shortage of maize which usually constitutes between 50-60% of the rations. This energy component can therefore be lowered with satisfactory economic efficiency (Okosun and Obasoyo, 2017). This will explain at least in part, the superior profit margin on the commercial ration (Ration 2).

In conclusion, this study reveals the need to re-evaluate the requirements of broilers in Nigeria and other sub-saharan tropical countries not only for satisfactory biological productivity but also for improved economic efficiency.

Ingredients (%)	Starter Phase (0-4 weeks)	Finisher Phase (5-8 weeks)
Yellow maize	55.25	62.75
Groundnut cake	23.00	18.00
Blood meal	3.00	4.00
Fish meal	5.00	2.00
Brewer's dried grains	5.00	7.00
Bone meal	2.00	2.00
Oyster shell	1.00	1.00
Palm oil	5.00	2.50
Vitamin-mineral premix	0.50	0.50
Common salt	0.25	0.25
Calculated ME (Kcal/g)	3.16	3.09

Table 1: Gross Composition of Control Rations

Treatments	Moisture %	DM (%)	Total Ash (%)	CP (%)	CF (%)	EE (%)	NFE (%)	Energy (Kcal/g)
1 A	12.00	88.00	6.50	24.34	4.91	2.44	49.81	4.74
B	13.00	87.00	8.75	20.59	5.29	2.68	49.69	4.19
2 A	13.00	87.00	6.50	19.25	5.66	2.85	52.74	4.98
B	13.25	86.25	7.75	20.13	10.53	3.93	44.41	4.82
3 A	14.00	86.00	6.75	23.08	7.18	3.55	45.44	5.00
B	14.00	86.00	8.00	20.78	8.76	3.42	45.04	5.01

Table 2: Gross Energy and Proximate Composition of Experimental Diets

- A = Starter
- B = Finisher
- DM = Dry matter
- CP = Crude protein
- CF = Crude fibre
- EE = Ether extract
- NFE = Nitrogen free extract

Performance Characteristics	Starter				Finisher			
	1	2	3	Mean	1	2	3	Mean
Av. Initial body wt. (g/bird)	30.00a	28.80c	29.60b	29.82	614.40d	419.19f	489.70e	507.76
Mean feed consumed (g/bird/day)	33.60a	26.80c	31.70b	30.70	94.22	96.05	88.25	92.84
Mean weight gain (g/bird/day)	15.92a	10.51c	12.67b	13.03	28.82	29.13	24.32	27.42
Feed efficiency	2.06a	2.46b	2.57b	2.36	3.39	3.64	3.80	3.61
Mean protein efficiency	2.22a	2.33ab	1.94b	2.94	2.48	1.48	1.32	1.44
Mortality (%/week)	-	0.34	0.34	16.75	16.73	16.73	16.64	12.67
Av. Final body wt. (g/bird)	446640a	294.97c	355.43b	363.60	253.27d	1110.50de	1036.47e	1133.41

Table 3: Performance Characteristics of Broilers Fed Different Proprietary Poultry Food

Parameters	Treatments		
	1	2	3
Average live weight (kg)	1.58	1.25	1.51
Average carcass weight (kg)	1.56^{a}	1.21^{b}	1.24^{b}
Average plucked weight (kg)	1.45^{a}	1.13^{c}	1.14^{b}
Average dressed weight (kg)	1.09^{a}	0.81^{b}	0.81^{b}
Average dressing percentage	68.99	64.80	53.64
% lung/live weight	0.24	0.27	0.29
% liver/live weight	0.74	0.78	0.79
% heart/live weight	0.18	0.19	0.21
% spleen/live weight	0.04	0.04	0.04

Table 4: Carcass Characteristics of Broilers at 8 Weeks of Age
Expressed on DM Basis
Mean Values with Different Superscripts Are Significantly Different from Each Other (P<0.05)

Parameters	Treatments		
	1	2	3
Initial average body weight (kg/bird)	0.030	0.028	0.03
Final body weight (kg/bird)	1.25	1.11	1.04
Total live weight gained (kg/bird)	1.22	1.08	1.01
Total feed consumed (kg/bird)	3.58	3.44	3.36
Cost/tonne of broiler feed (₦)	160000.00	121056.00	116784.00
Total cost of feed consumed/bird (₦)	572.80	416.43	392.38
Gross revenue from sales of broiler at 1000kg (₦)	1220.00	1080.00	1010.00
Cost of broiler chick/kg live weight (₦)			
Net profit/kg live weight of broiler (₦)	1000.00	1000.00	1000.00
	220.00	80.00	10.00

Table 5: Cost Analysis of the Different Proprietary Poultry Feeds

Parameters	Treatments		
	1	2	3
Total protein (g/100ml)	2.96	3.17	3.12
Uric acid (mg/100ml)	7.82	8.32	10.67
Creatinine (mg/100ml)	0.31	0.31	0.17
Albumin (g/100ml)	1.02	1.12	0.93

Table 6: Serum Protein Metabolites of Broilers on Different Proprietary Feeds

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