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ENERGY AND PROTEIN REQUIREMENTS FOR GROWTH OF THE LOCAL DOMESTIC FOWL *(Gallus domestic)*.

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Target Audience: Local farmers, agricultural aid, research agencies three tiers of government,

ABSTRACT

Energy and protein requirements of thirty-six local fowls at 2 weeks old were determined in chick and grower phases. Two levels of energy and three levels of protein tested in each phase. Six dietary treatments were employed and each treatment had three replicates of two birds each. In the chick starter phase, energy and protein combinations included: diet 1, 2,700kcal ME / Kg and 18% CP; diet 2, 2700kcal ME / Kg and 20% CP; diet 3, 2,700kcal ME / Kg and 22% CP; diet 4, 3,000kcal ME / Kg and 18% CP; diet 5, 3,000kcal ME /Kg and 20% CP and diet 6 (control), 3,000kcal ME /Kg and 22% CP. The energy and protein level combinations in the grower phase included the following; diet 1, 2,700kcal ME/ Kg and 13% CP; diet 2, 2,700kcal ME/ Kg and 15% CP; diet 3, 2,700kcal ME / Kg and 17% CP; diet 4, 3,000kcal ME/ Kg and 13% CP; diet 5, 3,000kcal ME/ Kg and 15% CP and diet 6 (control), 3,000kcal ME/ Kg and 17% CP. The experiment lasted 7 weeks for the chick starter phase and 7 to 20 weeks for the grower phase.

The chicks were randomly distributed to the diets in a completely randomized design. In all the parameters measured in both phases, the control diet promoted growth of the birds better than others. For the control diet at the chick starter phase, the average feed intake (AFI) (g/day) was 20.20 while the efficiency of feed utilization (EFU), metabolizable energy intake (kcal/kg/day), average body weight (g/bird/wk) and average body weight gain (g/bird/day) were 0.22, 75.60, 124.40, and 4.48 respectively. The corresponding values for the grower phase were 48.80, 0.11, 91.27, 769.70 and 5.41 in that order. The values for AFI and average body weight per bird were not significantly different ($P > 0.05$) at the chick starter phase but differences were significant ($P < 0.05$) at the grower phase. The diet 3 in the grower phase improved growth with the highest EFU, 0.12, and was better utilized by the birds than in the chick starter phase where it was least utilized. High energy, high protein diet enhanced growth while low energy, high protein diet did not support maximum growth especially in the chick starter phase. The control diet produced birds with the heaviest carcass and best body conformation.

Keywords: Energy, requirement, protein, local fowl, growth, phase.

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DESCRIPTION OF PROBLEM

The economic down turn in Nigeria over the years has affected income adversely and has grossly marginalized the protein intake of the average Nigerian. Food and Agricultural Organization (2) recommended that out of the expected protein intake of 65g/ca put/day by an adult human at least 26g should be of animal origin in contrast to about 53.8g taken by the Nigerian with only 8.4g of animal origin. Thus, there is an urgent need for the improvement of the protein status of the diet of Nigerians since there is a per caput deficiency of about 10g of protein per day. This has created a gap for substitutes especially in poultry subsector for other sources of animal protein. The local fowl if properly managed can bridge this gap.

There is paucity of information on the nutritional requirements of the local fowl. The system of managing our local fowls needs improvement since they are allowed to scavenge in order to feed. Akinwumi et al. (1) estimated that species of domestic fowls accounted for 73.57 percent of poultry species in Nigeria. It was estimated that there were 7.4 domestic fowls per household yielding a total population of 149 million and in the same year these authors reported that only 10 million of this number were exotic breeds. Therefore, the local fowls together with the commercial birds or hybrid breeds constituted the rest. Local fowls can serve as cheaper source of protein to the teeming populace especially for those living in the rural areas.

Local fowl is a native light breed, strain or type of domestic fowl that has undergone mainly the process of natural selection and inbreeding over time for its existence and multiplication in the respective environment it inhabits. However, the local fowl has in the past, been crossbred with imported strains and this mode of breeding is still practiced in a haphazard manner. This has caused doubts on the existence of any distinctive features on the local fowl to justify its recognition as a breed (6). But crossbreeding of the local with imported fowls does not terminate the existence of local fowls but rather, like mutation, gene drift and selection, is a factor of time change in the fowl's gene frequencies (7). On account of selection for many generations, the gene frequencies of the recognized breeds have changed to a greater extent than that of the local fowls. Some genes have been lost while others have been fixed especially for plumage color in the recognized breeds and hence they are phenotypically more uniform.

The local fowls have suffered neglect until now and may likely be extinct in future since there is no plan in place to sustain their existence. Therefore, research efforts need to be directed towards generating information on the nutritional requirements of the local chicken. However, this study is to formulate diets for the local fowl using plant sources of energy and protein.

By so doing, determine the optimum energy and protein levels required for growth of the birds.

MATERIALS AND METHODS

The fowls that were used in this study were obtained from the areas of Oyo State of Nigeria where they were reared by local households on the extensive system of management. Moreover, the chicks were obtained from the villages where probably little or no crossbreeding of the fowl has been practised. The local fowls were either multi-coloured, black or white in plumage color. The fowl is small, early maturing, of rather nervous disposition and produces white shelled eggs. It is notoriously broody. The shank is short, thin and a bit tilted forward. There is no big commercial outlet in Nigeria for local fowls. Therefore, their supply was made through contact to the rural farmers and their agents which took two weeks to conclude. The two weeks old local birds were selected using conventional criteria. This was done by observing the absence or mere presence of the comb without the usual contrasting red colouration.

Aggressiveness and proper co-ordination of movements were almost absent at this stage in the local chicken.

Experimental Design

The study involved the use of six treatment diets and thirty-six local birds at two weeks old. Each treatment had three replicates of two birds each. The diets were formulated such that energy and protein levels in each of them varied from one phase to the other as detailed below. Six diets were formulated to investigate the energy and protein requirements of the local birds at the two phases namely chick and grower phases. Two levels of energy and three levels of protein were tested. The energy and protein combination at each phase were as follows.

1. CHICK PHASE

   Diet 1 – 2,700kcal ME/Kg; 18% CP (Cal.:Prot,150)

   Diet 2 - 2,700kcal ME/Kg; 20% CP (Cal.:Prot,135)

   Diet 3 - 2,700kcal ME/Kg; 22% CP (Cal.:Prot,123)

   Diet 4 - 3,000kcal ME/Kg; 18% CP (Cal.:Prot,167)

   Diet 5 - 3,000kcal ME/Kg; 20% CP (Cal.:Prot,150)

   Diet 6 - 3,000kcal ME/Kg; 22% CP (Control, Cal.:Prot,136)

2. GROWER PHASE

Diet 1 – 2,700kcal ME/Kg; 13% CP (Cal.:Prot,208)

Diet 2 – 2,700kcal ME/Kg; 15% CP (Cal.:Prot,180)

Diet 3 – 2,700kcal ME/Kg; 17% CP (Cal.:Prot,159)

Diet 4 – 3,000kcal ME/Kg; 13% CP (Cal.:Prot,231)

Diet 5 – 3,000kcal ME/Kg; 15% CP (Cal.:Prot,200)

Diet 6 – 3,000kcal ME/Kg; 17% CP (control, Cal.:Prot,177)

The birds were randomly allocated to the diets in a complete randomized design with two levels of protein. Feed and water were given ad libitum and other standard management practices were adhered to. The birds were managed intensively and housed in a deep litter. They were administered with anti-stress preparation on arrival for three consecutive days by mixing it with their drinking water and no vaccines were given. The chick starter phase lasted for seven weeks, the grower phase lasted from seven to twenty weeks. At the end of grower phase, one bird per replicate was chosen randomly and starved for 4 hours and later killed by severing the jugular vein; hand plucked after scalding for carcass analysis.

Many diets were used because of dearth of feeding standards in the literature for the local fowl thus leading to their non-selectivity. Also the use of the same levels of energy for chicks and growers, suggest that as birds are growing, they tend to be more aggressive and mobile which call for higher energy demand rather than the lower value at grower phase which is usual with the commercial birds formula. Most available work done with chickens in Nigeria were carried out not strictly with furnishing optimum nutrient levels in mind but had other main interests such as to know the effect, or extent of utilization of some ingredients in poultry rations or some still to know what levels some of the locally available ingredients could be used to replace some imported or scarce ingredients. The gross composition of the feed is shown in Table 1.

Data Analysis

All data collected were subjected to analysis of variance while Least Significant Difference (3) was used in assessing the significant differences.

Table 1: Gross composition of experimental diets.

	Experimental Diets					
Ingredients (%)	1	2	3	4	5	6
Chicks starter phase						
Maize	59.60	56.40	51.60	72.80	65.60	61.40
Groundnut cake	26.80	32.40	37.00	23.80	29.00	35.00
Bone meal	2.40	2.40	2.40	2.40	2.40	2.40
Salt	0.20	0.20	0.20	0.20	0.20	0.20
Premix	1.00	1.00	1.00	1.00	1.00	1.00
Grower phase						
Maize	71.30	67.20	63.81	81.10	76.40	72.40
Groundnut cake	11.70	18.00	22.60	9.40	15.60	20.50
Bone meal	2.40	2.40	2.40	2.40	2.40	2.40
Salt	0.20	0.20	0.20	0.20	0.20	0.20
Premix	1.00	1.00	1.00	1.00	1.00	1.00

Vitamin mineral premix contained (g/kg diet): Thiamine (0.02), riboflavin (0.00035), niacin (0.10), amino/aminobenzoic acid (0.10), retinyl acetate (0.04), ergocalciferol (0.04), chlorine HCL (200), $Caco_2$ (15.258), $Cocl_2\ 6H_2O$ (1.078), $CuSo_4\ 5H_2O$ (0.019), $FeSo_4\ H_20$ (1.0787), $MgSo_4$ (2.292), $MnSo_4\ 2H_20$ (0.178), KIO (0.032), K_2PO_4 (15.559).

RESULTS AND DISCUSSIONS

The average daily feed intake (AFI) values (Table 2) were not significantly different (P>0.05) at the chick starter phase.

However, significant differences were obtained for the AFI at the grower phase. This trend was observed for the average body weight. The highest average body weight, efficiency of feed utilization (EFU) (at chicks starter stage) and metabolizable energy (ME) intake were recorded for birds on the control diet i.e. the high energy, high protein diet with calorie: protein ratio Of 136. Diet 3 i.e. the low energy, high protein diet recorded the least average body weight at chicks starter phase with the lowest calorie:

However, significant differences were obtained for the AFI at the grower phase. This trend was observed for the average body weight. The highest average body weight, efficiency of feed utilization (EFU) at chicks starter stage and metabolizable energy (ME) intake were recorded for birds on the control diet i.e. the high energy, high protein diet with calorie: protein ratio Of 136. Diet 3 i.e. the low energy, high protein diet recorded the least average body weight at chicks starter phase with the lowest calorie: protein ratio of 123 which was below the recommended level for commercial birds. Control diet was the best utilized of all the diets which gave rise to appreciable body weight gain. The recommended calorie: protein ratio for commercial chicks lies between 132 and 140 while that of growers lies between 155 and 169 (5). High protein and low energy diets tend to

Table 2: Performance of birds on experimental diets.

Parametres	Experimental Diets						
	1	2	3	4	5	6	+/-S.E.M
Chicks starter phase							
AFI (g/bird/day)	18.10ᵃ	19.90ᵃ	16.40ᵃ	13.90ᵃ	15.90ᵃ	20.20ᵃ	2.23
EFU	0.17ᵃ	0.19ᵇ	0.14ᵃ	0.17ᵃ	0.16ᵃ	0.22ᵇ	0.03
ME intake (Kcal/kg/day)	46.47ᵃ	57.86ᵃ	35.53ᵃ	38.79ᵃ	41.85ᵃ	75.60ᵇ	13.72
Avg. bodywt. (g/bird/wk)	102.90ᵃ	118.30ᵃ	76.20ᵃ	86.40ᵃ	80.50ᵃ	24.40ᵃ	18.48
Body wt.gain (g/bird/day)	3.06ᵃ	3.81ᵃ	2.34ᵃ	2.30ᵃ	2.48ᵃ	4.48ᵇ	0.82
Grower Phase							
AFI (g/bird/day)	37.90ᵃ	47.50ᵇ	35.70ᵃ	38.80ᵃ	39.50ᵃ	48.80ᵇ	4.95
EFU	0.10ᵇ	0.10ᵇ	0.12ᵇ	0.08ᵃ	0.09ᵃ	0.11ᵇ	0.01
ME intake (kcal/kg/day)	57.32ᵃ	74.41ᵃ	62.69ᵃ	53.06ᵃ	57.70ᵃ	91.27ᵇ	13.12
Avg. bodywt (g/bird/wk)	422.09ᵃ	519.40ᵇ	402.01ᵃ	357.94ᵃ	357.58ᵃ	578.25ᵇ	82.40
Body wt. Gain (g/bird/day)	3.78ᵃ	4.90ᵇ	4.13ᵇ	3.15ᵃ	3.42ᵃ	5.41ᵇ	0.80

suppress growth (4). In the growers stage the best overall performance of the birds was obtained with a calorie: protein ratio of 177. This calorie: protein ratio was slightly above that recommended for commercial birds. The calorie: protein ratio obtained in this study for local fowls was probably due to the more aggressive and mobile nature of the local fowls which comparatively are more energy demanding and produced higher rate of wear and tear in the birds than in the docile and sedentary commercial birds. Birds on diet 3 utilized feed better (EFU, 0.116) in the grower phase than in chick starter phase (EFU, 0.143). This is mainly due to better calorie: protein ratio of 159. The growth rate improved but this could not adequately compensate for loss in chick starter phase with calorie: protein ratio of 123. Thus, culminating in the overall decrease in body weight of the birds. Also the ME intake (62.691kcal/kg/bird/day) appreciated and contributed to the marked recovery in the average body weight and body weight gain of birds in diet 3 at the grower phase. ME computes the most apparent feed energy resource that was utilized by the animal after taken care of wastages. Metabolic processes in the body of an animal require energy in order to proceed. Therefore, the higher the energy available, the healthier the animal and this is likely to affect the average body weight positively. Moreover, animals eat first of all to satisfy their energy needs.

Lean meat and cheaper cost of production are derived mostly from feed formulated using plant sources of energy and protein. Fat is avoided by most people because of its obvious negative health implication. Amount of meat (Table 3) obtained was highest considering the dressed and eviscerated carcasses in the birds maintained on the control diet ($P<0.05$). This was followed by those on diets 2,1,3 though both 2 and 1 almost had the same eviscerated carcass weight, 4 had a better eviscerated weight but not dressed weight than 5 ($P>0.05$). The slaughter was done after twenty weeks. At this stage growth was expected to have been completed in the local chicken.

Table 3: Average weight of different parts of the birds (g)

Parameters	Experimental Diets						
	1	2	3	4	5	6 (control)	+/- S.E.M
Breast	67.00^{a}	103.20^{b}	98.40^{b}	73.40^{a}	67.00^{a}	123.20^{b}	21.10
Dressed weight	528.70^{a}	602.80^{b}	498.30^{a}	417.70^{a}	463.30^{a}	718.30^{b}	98.68
Empty gizzard	36.80^{a}	44.00^{a}	25.70^{a}	28.30^{a}	31.70^{a}	49.30^{a}	8.42
Eviscerated Weight	385.40^{b}	385.40^{b}	367.10^{a}	274.10^{a}	250.00^{a}	460.00^{b}	71.40
Full gizzard	44.00^{a}	6.00^{a}	39.00^{a}	43.00^{a}	46.30^{a}	51.70^{a}	3.84
Head		11.20^{a}	32.90^{b}	9.30^{a}	11.70^{a}	30.70^{b}	46.00^{b}
13.78							
Heart and lung	6.90^{a}	7.00^{a}	1.50^{a}	0.90^{a}	2.70^{a}	5.30^{a}	2.47
Intestine	40.70^{a}	48.70^{b}	44.00^{a}	50.00^{b}	46.30^{a}	51.70^{b}	3.72
Kidney and liver	8.40^{a}	18.20^{a}	7.30^{a}	6.70^{a}	9.30^{a}	14.00^{a}	4.12
Leg	42.10^{a}	64.90^{a}	61.80^{a}	46.10^{a}	42.10^{a}	77.50^{a}	13.27
Neck	22.20^{a}	35.50^{a}	20.00^{a}	21.70^{a}	33.00^{a}	46.00^{a}	9.35
Shank	9.60^{a}	31.30^{b}	10.00^{a}	9.70^{a}	45.00^{b}	43.00^{b}	15.60
Wing and back	78.30^{b}	76.20^{b}	72.70^{b}	54.20^{a}	49.40^{a}	90.90^{b}	17.05

S.E.M= Standard error of mean.

Means in a row with the same superscript are not significantly different at 5 percent DMRT.

CONCLUSIONS AND APPLICATIONS

From the result of the study; low energy and high protein diet 3 (2,700kcalME/kg) and 22% CP at chick starter phase did not support maximum growth, mainly due to inappropriate calorie: protein ratio which was far below the ideal as recommended in the results and discussions.

High energy and high protein (3,000kcal ME/kg) and 22% CP for chicks and 3,000kcal ME/kg and 17 percent crude protein for growers) control diets, overall enhanced growth of the birds more than the other diets.

Low energy and high protein diet 3 (2,700kcal ME/kg and 17% CP) at grower phase appeared better utilized than in the chick starter phase maybe because of the improved calorie: protein ratio of 159 from 123. Thus, higher ME intake and EFU resulting in increased body weight and enhanced performance.

At the same low energy (2,700, kcal ME/kg, for chicks and growers) but different protein levels (18/20 percent for chicks and for growers 15/17%) of the diets, eviscerated weight was approximately equal. But it was greater on high protein levels (17 and 22%, for growers and chicks respectively). Further more, these rations were prepared bearing in mind what a local farmer can easily afford and formulate with less supervision. Also it took cognizance of those on diet with minimum fat consumption. The implementation of this poultry project and further improvement of local fowl might need collaborative effort of state governments.

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