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Effect of varying levels of energy and protein on performance of Ross breed broiler chickens

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Target Audience: Animal nutritionist, Breeders, Farmers, Scientists

Abstract

Experiment was carried out to ascertain the effect of feeding combination of high, normal and low energy and protein respectively, on the performance of broiler chickens. Six diets of different combinations of energy and protein namely; high energy and high protein (HEHP), high energy and low protein (HELP), normal energy and high protein (NEHP), normal energy and low protein (NELP), low energy and high protein (LEHP) and low energy and low protein (LELP) were fed to broiler chickens of Ross breed for a period of 60 days. A 2 by 3 factorial arrangement in a complete randomised design was used. Results indicated a significantly ($p<0.05$) reduced feed intake as the energy content of feed increased with LEHP having the highest feed intake of 1261.71g/bird while the final weight were similar for birds LEHP, LELP, NEHP and HEHP respectively during the starter phase. Those fed HEHP however performed better during the finisher phase with significantly higher final and body weight gain. The study showed that low energy and low protein diets could be fed to broilers chicken as long as proper management practices are put in place.

***Keywords**:* Energy; Protein; Performance; Broiler.

Description of Problem

The ever increasing human population especially in developing countries is becoming a major problem to nutritionists, agriculturists, as well as governments of many countries around the globe; owing to the fact that various countries are not meeting up with the their country's nutritional requirements. A major concern of modern poultry enterprise is to reduce feed cost for optimal economic returns because feed constitutes approximately 70% of the total production cost (1). One way of reducing the feed cost is through improvement in the feed efficiency of birds. While formulating a broiler's diet, the main emphasis is placed on the crude protein (CP), because it is one of the major cost components of the poultry diets. Broilers have high dietary CP needs. Dietary protein level, therefore, has major effect on growth performance and overall cost of finished product. Dietary CP level could possibly be reduced if there were adequate minimum levels of amino acids needed to support growth and muscle of broilers (2).

Protein and energy are the key important nutrients that affect poultry production. Studies on economical and efficient ration for broilers have increased the interest of poultry farmers and research workers over the years to see the effect of lowering and increasing the level of the protein and energy of rations (2).

The objective of the study was to determine the effect of varying levels of energy and protein respectively, on the performance of Ross breed broiler chickens raised from day old to eight weeks under the same condition and to determine the best combination of energy and protein levels.

Materials and Methods

Experimental site

The experiment was carried out at the Poultry Unit of Animal Science Department, Ahmadu Bello University, Zaria. Zaria is located within the northern guinea savannah zone of Nigeria: latitude 11^0 12'N and longitude 7^0 33'F at an altitude of 640 meters above sea level (3). The climate is characterised by a well defined dry and wet seasons. The dry season last from mid-October to April and consist of a period of low relative humidity with strong, cold and dry weather followed by overcastting dust particles. The wet season begins in late April/early May and ends in late September to early October. The total annual rainfall is from 617-1365mm with a 50 year average of 1041mm and most of rainfall is between July and September.

Table 1: Composition of broiler starter diets containing varying levels of energy and proteins

ME(Kcal/kg)	**2700**		**2900**		**3100**	
CP (%)	**22**	**24**	**22**	**24**	**22**	**24**
Maize	33.00	32.70	54.50	49.00	54.00	50.00
Maize offal	25.00	21.00	7.00	6.50	2.00	2.00
Rice offal	2.00	2.00	1.00	1.00	1.00	-
SBM	17.50	19.00	16.00	18.00	17.00	19.00
GNC	17.00	20.00	17.00	21.00	19.00	20.00
Palm oil	-	-	-	-	3.00	5.00
Fish Meal	2.20	2.00	1.20	1.20	0.70	0.70
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Analysis						
MEKcal/kg	22.21	2700.06	2904.00	2900.88	30096.68	3097.40
CP	23.25	24.04	21.92	24.04	21.94	23.35
CF	1.04	3.54	3.50	3.75	3.69	3.35
Ca	0.90	1.03	0.96	0.95	0.93	0.94
Ph	0.63	0.89	0.76	0.77	0.71	0.71
Methionine	1.38	0.63	0.57	0.59	0.56	0.57
Lysine	1.38	1.44	1.24	1.35	1.25	1.31

SBM= Soybean meal, GNC= Groundnut cake, CP= Crude protein, CF= Crude fibre, Ca= Calcium, Ph=Phosphorus, Premix: each 2.5kg of Biomix broiler finisher contains; vitamin A 8,5000,000 (iu); vitamin D3 1500000 (iu); vitamin E 10000 (mg); vitamin K 1500 (mg); vitamin B1 1000 (mg); vitamin B2 4000 (mg); Naicin 20000 (mg); Pantothenic acid 5,000 (mg); vitamin B6 1,500 (mg); vitamin B6 10 (mg); folic acid 500 (mg); biotineH2 750 (mg); chlorine chloride 175000 (mg); cobalt 200(mg); copper 3000 (mg); iodine 1000 (mg); iron 20000; manganese 40000(mg); selenium 200 (mg); zinc 30000 (mg);anti-oxidant 1250 (mg).

Experimental Materials

Two hundred and seventy (270) broiler of Ross breed, conical feeders, drinkers, weighing scale, Stoves, charcoal pots, kerosene lamps, bulbs, wood shavings, buckets ropes for hanging feeders, brooms, dust parkers, lab coats.

Experimental plan

Two hundred and seventy (270) broiler day old chicks of the same breed Ross were raised using a deep litter system under the same environment but placed on diet with varying levels of protein and energy. A 2 by 3 factorial arrangement in a complete randomized design, the birds were placed under six treatments with each treatment having three replications with 10 chicks per replicate.

Table 2: Composition of Broiler finisher Diets Containing varying levels of energy and protein

ME (Kcal/kg)	**2700**		**2900**		**3100**	
% CP	**19**	**21**	**19**	**21**	**19**	**21**
Maize	35.70	34.00	56.00	57.50	62.00	59.00
Maize offal	26.00	25.70	7.00	5.00	4.70	4.70
Rice offal	4.00	3.00	3.70	1.50	1.00	1.00
SBM	14.00	16.00	14.00	14.20	14.00	14.00
GNC	15.00	16.00	14.00	16.50	14.00	17.00
Palm oil	2.00	2.00	2.00	2.00	1.00	1.00
Fish Meal	2.00	2.00	2.00	2.00	1.00	1.00
Bone Meal	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.30	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**	**100**
Calculated Analysis						
MEKcal/kg	2708.02	2701.28	2900.82	2918.54	30096.85	3094.88
CP	19.18	21.26	19.26	21.04	19.01	20.99
CF	3.78	3.51	4.13	3.7	3.4	3.36
Ca	1.03	1.03	0.97	0.97	0.93	0.94
Ph	0.91	0.91	0.79	0.76	0.72	0.73
Methionine	0.61	0.62	0.56	0.57	0.55	0.55
Lysine	1.26	1.32	1.17	1.20	1.12	1.17

SBM= Soybean meal, GNC= Groundnut cake, CP= Crude protein, CF= Crude fibre, Ca= Calcium, Ph=Phosphorus,Premix: each 2.5kg of Biomix broiler finisher contains; vitamin A 8,5000,000 (iu); vitamin D3 1500000 (iu); vitamin E 10000 (mg); vitamin K 1500 (mg); vitamin B1 1000 (mg); vitamin B2 4000 (mg); Naicin 20000 (mg); Pantothenic acid 5,000 (mg); vitamin B6 1,500 (mg); vitamin B6 10 (mg); folic acid 500 (mg); biotineH2 750 (mg); chlorine chloride 175000 (mg); cobalt 200(mg); copper 3000 (mg); iodine 1000 (mg); iron 20000; manganese 40000(mg); selenium 200 (mg); zinc 30000 (mg);anti-oxidant 1250 (mg).

Brooding

Before the arrival of the day old chicks, the pens were cleaned and disinfected, covered with wood shavings, the brooding house was covered with feed bags as well as nylon bags. Temperature of 30-35^{0}C was maintained in the brooding house using coal pot, lanterns and stoves. The brooding temperature was maintained up to 2weeks of age after which the pen was well ventilated by removing the feed bags and nylon.

Feeding and management of experimental birds

On arrival, the birds were weighed and also vaccinated against newcastle diseases. Glucose was added to their water to relieve them from stress. Throughout the experimental period (0-8weeks) birds were fed with the 6 experimental diets. The ration was formulated with appropriate composition as shown in Tables 1 and 2. Birds were also given antibiotics and multi-vitamins (Neocryl and keprocryl) anti-stress (vitalyte and vitamin c) with proper vaccination against (common poultry diseases) ensure good health and better production throughout the experimental period.

Parameters measured

The parameters measured include final weight, weight gain, mortality rate, cost/kg gain, feed consumed, while feed conversion ratio was calculated as the ratio of weekly feed intake to weekly weight gain, and number of birds.

Proximate analysis

The experimental feeds were sampled and analyzed for crude protein (CP), crude fibre (CF), ash, dry matter (DM), and ether extracts (EE) as described by (4). The analysis was carried out in the Biochemical Laboratory, Department of Animal Science, Ahmadu Bello University.

Statistical analysis

All the data collected were analyzed by ANOVA using (5) and means separated by the application of least squared mean test.

Results and Discussion

Table 4 shows the performance of broiler chicks fed varying levels of energy and protein at starter phase. Final weight (FW), total feed intake (TFI), weight gain (WG) and feed conversion (FCR) ratio were all significantly ($p<0.05$) affected by experimental diets. FW, and WG were significantly ($p< 0.05$) higher in birds fed 2700MEkcal/kg thus Low energy (LE) having 24% CP thus High protein (HP) than those being fed with higher energy levels 3100MEkcal/kg having low protein (LP) thus level of 22% CP. The highest combination (LEHP) is similar to LELP and HEHP in terms of cost/kg. Total feed intake is significantly ($p< 0.05$) higher in birds fed LEHP than in those fed HEHP. Though LEHP was the highest but similar with LELP as NELP, NEHP, HELP, and HEHP were similar with each other. While FCR was significantly ($p<0.05$) higher for birds fed 2900MEkcal/kg thus normal energy (NE) having low protein (LP) level. Initial weight across treatment groups was not significant ($p>0.05$). Total feed intake in birds fed with LEHP significantly ($p<0.05$) gave the highest though similar to LELP.

The result of the experiment at the starter phase with regards to FW and WG was in agreement with the findings of (6) who reported that the final weight and the weight gain of birds fed with HEHP were significantly higher than those fed with LELP. (6) reported that different levels of protein use had little or no effect on the rate of feed consumption. (6) further explained that the LELP contained relatively high level of maize offal content in the feed and hence the low feed intake. The voluntary feed intake of monogastrics has been

established as a function of dietary fibre characteristics (7). Feed intake of experimental birds at 0-4weeks was influenced by the dietary levels of energy and protein. Feed intake was significantly ($p<0.05$) higher for birds fed with lower energy (2700kcal) than those with higher energy. This high feed intake in birds fed low energy level feeds with protein may be due to their need to meet up with their energy requirement at starter phase.

Table 3: Proximate Analysis of diet fed from 0-8weeks

(ME Kcal/kg)	**2700**		**2900**		**3100**	
% CP	**22**	**24**	**22**	**24**	**22**	**24**
% DM	92.36	94.86	94.12	93.13	92.70	94.18
% CP	23.84	23.76	24.07	23.96	23.86	23.90
% CF	9.77	9.19	8.37	10.01	10.12	8.76
% EE	5.39	6.02	5.88	5.39	6.03	6.20
% Ash	6.38	5.72	6.18	7.40	7.39	6.90
% NFE	54.52	55.31	55.50	53.24	52.59	54.24
Finisher Phase						
Protein level % CP	**19**	**21**	**19**	**21**	**19**	**21**
% DM	95.11	94.20	95.13	93.68	93.17	93.15
% CP	20.46	20.31	19.88	19.69	20.11	20.20
% CF	10.56	9.87	10.03	9.36	9.87	8.57
% EE	4.56	4.39	4.70	4.38	7.52	59.05
% Ash	7.28	6.36	7.20	4.00	6.91	59.11
% NFE	57.14	59.07	58.39	54.18	7.05	60.00

DM: Dry matter, CP: Crude Protein, CF: Crude Fibre, EE: Ether Extracts, NFE: Nitrogen Free Extracts

Table 4: Performance of broiler chickens fed varying levels of energy and proteins at starter phase (0-4 weeks)

ME Kcal/kg)	**2700**		**2900**		**3100**		**SEM**	**LOS**
% CP	**22**	**24**	**22**	**24**	**22**	**24**		
Initial weight(g)	45	45	45	45	45	45		NS
Final weight(g)	780.77^{a}	805.76^{a}	661.07^{b}	734.13^{b}	682.78^{b}	775.23^{a}	20.51	*
Total Feed intake(g)	1202.72^{a}	1261.71^{a}	1128.92^{b}	1103.81^{b}	1018.28^{b}	1097.46^{b}	33.36	*
Weight gain (g)	735.77^{a}	760.76^{a}	616.07^{c}	689.13^{b}	637.78^{bc}	730.23^{a}	20.51	*
Cost/kg((₦/kg))	147.86	160.72	153.31	147.86	155.49	157.77	36.26	NS
Mortality (%)	0.00^{a}	9.52^{c}	17.78^{e}	4.45^{b}	13.33^{d}	14.29^{d}	2.60	*
FCR	1.64^{bc}	1.67^{bc}	1.87^{c}	1.61^{b}	1.60^{b}	1.50^{a}	0.09	*

$^{abcde:}$ Means on the same row with different superscripts differ significantly ($p< 0.05$).SEM; standard error of mean *:significance ($p<0.05$). LOS: Level of significance, NS: No significance ($p>0.05$), FCR: Feed conversion ratio.

Table 5 shows the performance of broiler chickens from 5 to 8 weeks (finisher phase). The result shows that Final weight (FW), total feed intake (TFI), weight gain (WG) and feed conversion (FCR) ratio were all significantly ($P<0.05$) affected by levels of experimental diets. FW and WG were significantly ($P< 0.05$) higher for birds fed with high energy-high protein thus 3100MEkcal/kg-21% CP (HEHP), than for those fed with LEHP which are significantly ($p> 0.05$) the lowest. FCR is significantly ($P< 0.05$) higher for birds fed on LEHP than for those fed with HEHP. While birds fed LEHP and NEHP are similar with each other. Birds fed LELP, NELP, HELP and HEHP are similar with each other. (8) and (9) reported that as dietary energy level increases, birds satisfy their energy needs by decreasing feed intake. Decrease in feed intake with high energy levels in the diets of broiler chickens has also been reported by (10). (11) showed that broilers feed intake increases linearly with decreasing dietary energy. Increase in feed intake observed in this present experiment can be attributed to the fact that broilers reared on low protein diets, tend to increase their feed intake in an attempt to meet their protein and amino acid requirements (12). In a similar experiment carried out, (6) reported that birds fed with HEHP were significantly higher than those fed with LELP in most of the parameters measured. (6) reported no significant difference amongst birds fed HENP, low calcium, HEHP, medium calcium. (6) reported that when compared with the starter phase, broiler chickens fed HELP had the highest feed intake while LELP had the lowest feed consumption.

Table 5: Performance of broiler chickens fed varying levels of energy and proteins at finisher phase (5-8 weeks)

(ME Kcal/kg)	2700		2900		3100		SEM	LOS
% CP	19	21	19	21	19	21		
Initial weight(g)	739.70	739.70	740.37	739.70	739.70	740.37		NS
Final weight(g)	1748.67^{a}	1553.78^{c}	1745.68^{b}	1810.39^{a}	1708.77^{b}	1837.20^{a}	47.12	*
TFI (g)	2322.67^{a}	2243.80^{ab}	2260.81^{ab}	2329.48^{a}	2099.93^{b}	2282.65^{a}	91.59	*
Weight gain (g)	1008.97^{a}	814.08^{c}	1005.52^{a}	1070.69^{a}	969.07^{b}	1097.20^{a}	47.19	*
Cost/kg((₦/kg)	142.86	155.72	148.31	143.03	150.42	152.77	31.76	NS
FCR	2.33^{ab}	2.81^{b}	2.25^{ab}	2.18^{ab}	2.17^{ab}	2.09^{a}	0.11	*

^{abc}: Means on the same row with different superscripts differ significantly ($p < 0.05$), SEM: standard error of mean, *:Significance ($p<0.05$), LOS: Level of significance, NS: no significance ($p>0.05$), FCR: Feed conversion ratio, TFI: Total Feed intake.

Conclusion and Applications

1. The broiler chickens did well in terms of performance, even when given low energy and protein diets in terms of their feed consumption, low mortality, final and body weight gain.
2. The broiler chickens fed on low dietary levels had best feed conversion ratio which is good for meat production while in the finisher phase, final body weight and body weight gain, birds fed on higher energy and protein performed well but their

counterparts fed with normal or low energy and proteins levels also did well in terms of the total feed intake, taking note of their feed conversion ratio.

3. Farmers can adopt or use low dietary levels of energy and proteins at the starter phase and use higher dietary levels of energy and proteins during the finisher phase.

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