

CARCASS YIELD AND QUALITY OF BROILER CHICKEN FED VARYING PROTEIN LEVELS

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ABSTRACT

This work was undertaken to evaluate the effect of varying protein concentrations on the performance and carcass yield of broiler chickens. One hundred and twenty day old Hubbard Golden Comet broiler chicks were used in this feeding trial. They were randomly distributed into 3 dietary groups of 40 birds each. Three isocaloric (12.13MJME/kg) diets varying in protein concentrations (18, 21 and 24%) were fed to the groups of 40 birds in diets 1, 2, and 3 respectively. The experiment lasted 8 weeks. The result showed that birds fed 18 and 21% protein diets had significantly ($P < 0.05$) lower body weights compared with birds fed 24% protein. The percent carcass yield was also significantly ($P < 0.05$) influenced by the treatment diets. Birds fed 18%CP gave the least (2.77%) abdominal fat, followed by birds fed 24% and 21% respectively. Birds fed 18%CP gave the highest gross margin (N) and carcass quality while 24% dietary protein with 12.13MJ/kg metabolizable energy enhanced growth rate and carcass yield.

Keywords: Broiler chicken, protein levels, carcass yield.

INTRODUCTION

Protein in the feed represents the most costly nutrient particularly for young, rapidly growing animals and for high producing mature animals. Optimal uses of protein is essential in any practical feeding system and since protein sources are usually more expensive than energy sources, wasteful usage will increase the cost of production. It is because of this, that numerous works (Babatunde and Fetuga, 1976; Oluyemi, 1979; Njike, 1979; Onwudike, 1983; Olomu, 1995) have determined the protein level that would meet the broiler chick requirement and ensure positive nitrogen balance. In spite of this noble achievement, there is also the need for production of feed which will not only meet their growth and maintenance requirements but will also produce good carcass yield. Poultry meat composition is influenced by a number of factors. Some may be genetic in origin but quite a number are associated with environment including food. It is therefore, possible for the farmers to improve the yield of poultry meat if the different factors concerned can be made to work together. Energy and protein levels and the ratio of energy to good quality protein in broiler diets had been found (Yamashita *et al.*, 1975; Orlov and Grigor'ev, 1978; Mcleod, 1982) to influence carcass composition.

And because the consumer is becoming far more health conscious, there is the need for producers to pay more attention to the composition of the

end-product.

It is on this premise that this study was carried out to determine the effects of dietary protein concentrations on growth and carcass yield at marketing.

MATERIALS AND METHODS

Composition of Diets

Three isocaloric (12.13MJME/kg) diets varying in protein concentrations (18, 21 and 24%) were formulated. Maize was the major energy source while Groundnut cake, Fish meal and Blood meal were the major protein sources. The diets were fortified with synthetic amino acids such as lysine and methionine. The calculated lysine and methionine for all the diets averaged 1.30% and 0.55% respectively. The composition of the diets is shown in Table 1.

Experimental design

One hundred and twenty day-old Hubbard Golden Comet broiler chicks were used in this feeding trial. They were randomly distributed into 3 dietary groups of 40 birds each. Each of the groups were sub-divided into 4 replicates having 10 birds each. The experimental period was divided into 2 phases viz: starter (0-4 weeks) and finisher (5-8 weeks). The birds having an initial weight which ranged between 46.77 and 47.50g were reared in electrically heated battery brooders for the first four weeks and on deep litter for the finishing period.

Table 1: Percentage Composition of Experimental Diets Varying in Protein Contents

Ingredients (%)	Diet 1	Diet 2	Diet 3
Yellow maize	61.11	58.61	56.40
Groundnut cake	11.30	20.30	29.30
Fish meal	5.00	5.00	5.00
Blood meal	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50
Bone meal	2.80	2.80	2.80
Salt	0.25	0.25	0.25
Vit. Mineral Premix ¹	0.25	0.25	0.25
Lysine	0.46	0.36	0.27
Methionine	0.21	0.20	0.19
Total	100	100	100
Calculated analysis			
Metabolizable Energy (MJ/Kg)	12.13	12.13	12.13
Crude protein (%)	18	21	24
Calorie: Protein ratio	161.10	138.1	120.8
Lysine (%)	1.30	1.30	1.30
Methionine (%)	0.55	0.55	0.55
Calcium (%)	1.50	1.52	1.48
Phosphorus (%)	0.71	0.76	0.73
Determined composition			
Dry matter (%)	88.48	89.33	89.27
Crude protein (%)	18.62	21.68	24.26
Crude fibre (%)	4.90	4.67	4.50
Ether extract (%)	4.09	4.83	4.12
Ash (%)	4.47	4.67	5.00
ME (MJ/kg)	12.09	12.18	12.22

Zoodry; a Pfizer product supplying the following per kg of diet; 800i.u. Vit. A; 1200 I. U. Vit. D₃; 13mg; Vit. E; 2mg; Vit. K₃; 3mg Riboflavin, 0.06mg Ciobolamin. 1.5mg Folic acid, 0.25mg Biotin; 125mg Santoguin; 25mg Fe; 80mg; Mn; 50mg Zn; 2mg Cu; 0.2mg Co and 0.1mg Se.

Birds were fed the 3 diets *ad-libitum* both at the starter and finisher phases respectively. Apart from feeding the birds, other management practices such as routine vaccination, drug administration and maintenance of cleanliness in and out of the Poultry house were observed. The mean weekly liveweight and mean weekly feed intake were recorded, while the mean daily weight gain and feed conversion ratio were calculated from the data obtained on the farm.

Carcass Evaluation

At 8 weeks of age, 2 bird (having weights closest to the mean) from each of the replicates (i.e. 8 birds per treatment) were randomly selected, starved for 24 hours, weighed and slaughtered by severing the jugular vein. Birds were bled, dipped in hot water, de-feathered and head, neck, feet and viscera were separated. The wings were removed by cutting anteriorly, severing at the humero-scapular joint, the cut being made close to the body line. Lateral cuts were made through the rib-heads to the shoulder girdle and the breast was removed

intact by pulling anteriorly. Thighs, drums, and backs were also dissected from each carcass and weighed separately. Meat from the yield was separated from the bone to obtain meat: bone ratio.

Statistical analysis

All data were subjected to analysis of variance according to procedures described by Steel and Torrie (1960). Duncan's multiple range test (Duncan, 1955) was employed to compare treatment means found to be statistically significant.

RESULTS

The performance characteristics of the broilers offered varying levels of dietary protein during the starter phase are presented in Table 2. The average initial body weights of the broiler chicks at the beginning of the experiment were 47.50, 46.77 and 47.35g for the groups on diet 1, 2 and 3, respectively. At the 4th week of age the average liveweights were 393.18, 413.59 and 496.87 respectively for each groups. The table shows that at the end of 28 days, bird fed

Table 2: Performance of the Broiler Chickens fed varying levels of Dietary protein through the starter

Starter phase:	18%	21%	24%	SEM.
Mean Initial Wt. (g)	47.50	46.77	47.35	0.08*
Mean Final Wt. (g) (at the 4 th week)	393.18 ^a	413.59 ^b	496.87 ^c	0.67*
Mean daily feed Consumed (g/bird)	32.19 ^{ab}	30.71 ^a	30.95 ^a	0.06*
Mean daily Weight gain(g)	12.35 ^a	13.10 ^b	16.08 ^c	0.02*
Feed/gain ratio	2.61 ^b	2.34 ^b	1.93 ^a	
Mean Protein Intake (g/day)	5.79 ^a	6.45 ^b	6.50 ^b	0.01**
Mean ME intake (MJ/day)	0.48 ^a	0.50 ^{ab}	0.50 ^{ab}	0.00**

Table 3: Performance of the Broiler Chickens fed varying levels of Dietary protein through the finisher phase

Finisher phase	18%	21%	24%	SE
Mean daily feed consumed g/bird (5-8 week)	108.03	105.06	102.29	0.93*
Mean daily feed consumed g/bird (0-8wks)	69.17	68.34	66.73	0.12*
Mean total feed consumed (g/bird) (0-8weeks)	3873.75 ^b	3827.25 ^b	3736.75 ^a	26.60*
Mean final weight (at 8 weeks in g)	1353.50 ^a	1372.75 ^a	1571.25 ^b	14.46*
Mean weight gain (g) (at 8 weeks)	1306 ^a	1326 ^a	1524 ^b	13.43*
Mean Daily Weight gain g/bird (0-8weeks)	34.29 ^a	34.25 ^a	38.37 ^b	0.51*
Feed/gain ratio (0-8 weeks)	2.02 ^b	2.00 ^b	1.74 ^a	0.02*
Feed/gain ratio (5-8weeks)	2.97 ^b	2.89 ^b	2.44 ^a	0.04*

Table 4: Effects of varying levels of Dietary protein on the Economic production of Broiler chickens

Parameter	18%	21%	24%	SEM
Mean Final Weight(g)	1353.50 ^a	1372.75 ^a	1571.25 ^b	14.46*
Cost/kg ^{feed} (N)	22.47	23.44	23.90	0.43*
Mean Weight gain (g)	1306 ^a	1326 ^a	1524 ^b	13.43*
Relative Cost (%)	100 ^a	104.30 ^a	106.36 ^{ab}	0.38*
Cost/kg weight gain (N)	45.16 ^a	46.88 ^a	41.59 ^b	0.54*
Gross margin (N)	132.44 ^a	126.38 ^b	100.68 ^c	0.48*

Table 5: Carcass characteristics of Eight-week-old Broiler chickens fed varying protein concentration

Parameter	18%	21%	24%	SEM
Liveweight (g)	1350.72 ^a	1369.55 ^{ab}	1574.54 ^b	16.37**
Dressed Weight (%)	67.12 ^a	67.67 ^{ab}	69.12 ^b	0.69**
Meat (P. D. W)	52.85 ^a	55.85 ^{ab}	55.85 ^{ab}	0.76*
Skin (P. D. W)	15.85 ^a	17.10 ^b	15.21 ^a	0.24*
Bone (P. D. W.)	28.59 ^a	23.46 ^a	26.09 ^b	0.51*
% Abdominal Fat	2.77 ^a	3.53 ^b	2.86 ^{ab}	0.62*
Flesh-to-Bone ratio	1.95 ^a	2.51 ^b	2.37 ^b	0.15*
Cut Parts (P. D. W)				
Drumstick	13.92 ^a	15.10 ^b	16.27 ^c	0.31*
Thigh	17.46 ^a	20.59 ^b	20.94 ^b	0.46*
Breast	26.45 ^c	19.96 ^a	21.39 ^b	0.48**
Wing	13.06 ^a	13.40 ^a	16.80 ^b	0.23**
Back	29.08 ^b	30.95 ^b	24.86 ^a	0.61*

P. D. W.- Percentage of Dressed Weight.

18 and 21% protein diets had significantly ($P < 0.05$) lower body weights compared with birds fed 24% protein. The same pattern was reflected in the mean daily gain of the birds during the same period. Birds fed 24% protein had a mean daily gain of 16.08g while birds fed 18% and 21% protein had significantly ($P < 0.05$) lower daily gain.

Table 3 shows that the mean daily weight gain was significantly ($P < 0.05$) affected at the finisher phase (5-8 weeks) too. Birds on 24% gave the best mean daily weight gain (38.37g) and having a weight of 1571.25g at the 8th week.

Table 2 shows that the mean daily feed consumed by the birds during the first 28 days of the experiment were not significantly ($P > 0.05$) influenced by the treatment diets; which is an indication that feed intake was not affected by the varying protein concentrations. Mean daily feed consumption by the birds was in this order: 30.71 (21%), 30.95(24%) and 32.19(18%). Feed-to-gain ratio shows that birds

on 24% differed significantly ($P < 0.05$) from birds on either 18 or 21% protein. Birds on 24% protein showed the best (1.93) feed-to-gain ratio while birds fed 18% protein gave the poorest (2.61) feed-to-gain ratio. During the finisher phase (Table 3) birds fed 24% protein gave the least mean daily feed consumed (102.29g). The feed-to-gain ratio of the birds during the same period ranged from 2.44 to 2.97. In all, the total feed consumed by the birds through 0-8 weeks were significantly ($P < 0.05$) influenced by the dietary treatments.

All the different cut-up parts (Table 5) were significantly ($P < 0.05$) influenced by the varying dietary protein concentrations. Values for drumstick, thigh and breast ranged from 13.92-16.27; 17.46-20.94; and 19.96-26.45 respectively. Others include the back and wing which also ranged from 24.86-30.95 and 13.06-16.80 respectively. The treatment diets significantly ($P < 0.05$) influenced the percent carcass yield of the birds. It ranged from 67.12-69.12, having a direct relationship with the

liveweight of the birds.

Table 4 shows the effects of varying dietary protein concentration on the economic of production. It was found that diet 1 (18%CP) had the lowest cost per kg feed (N) while diet 3 (24%CP) had the highest cost per kg feed. On relative basis, the cost per unit (kg) of treatment 2 (21%CP) was 104.30% of cost per unit (kg) of treatment 1 (18%CP). Treatment 3 (24%CP) was 106.36%. Birds on treatment 2 (21%CP) had higher ($P < 0.05$) cost (N) per kg weight gain than birds on diet 3 (24%CP) while that of treatment 1 did not differ from that of treatment 2.

Treatment 1 which encouraged the best carcass quality eventually resulted to the highest ($P < 0.05$) gross margin from the sales of the birds.

DISCUSSION

This study suggests that increasing dietary protein up to 24% for broiler chicks during the starter and finisher phases improved weight gain. Birds fed 18% and 21% protein had lower body weights compared to those fed 24% dietary protein. This is in agreement with Elvery (1983) and might be due to inadequacy of protein to meet maintenance and growth requirements especially at the starter phase. In considering the feed consumption pattern of the birds during the starter phase, results are in agreement with the work of Mark and March (1985) who found no change in feed intake with increasing concentrations of dietary protein. Energy rather than protein concentrations would seem to be the major determinant of feed intake. This further confirms the work of Hill and Dansky (1950) which showed that the protein requirement for maximum growth appeared to be a relatively constant quantity of intake. As a percentage of a diet, the protein required for maximum growth depended on the productive energy of the diet. For the birds on 18 and 21%, it was apparently impossible for them to significantly increase their feed intake in order to increase their protein intake because of the energy level (12.13MJ) of the diets which was supposed to be very adequate for the bird in the humid tropics (Olomu and Offiong, 1978). At the finisher phase, the weight gain pattern was not different from what was observed at the starter phase. This disagrees with the result of Francher and Jensen (1989) who demonstrated that maximum growth of broilers from 21 to 42 days of age was obtainable with low but amino acid supplemented protein. The result obtained in this trial might be due to the fact that the protein concentrations of 18 and 21% seems inadequate for starting broilers in the tropics.

The percent carcass yield showed a

significant but direct relationship with the liveweight. This disagrees with the finding of Sell *et al.* (1989) who observed that dietary protein had little effect on yields of eviscerated carcass whether yields were expressed as weights per carcass or as percentages of eviscerated carcass. The percent skin and bone also did not follow a particular trend. The observed differences therefore are probably not related to variation in dietary protein contents. The results showed that some of the cut-parts (drumstick, thigh, and wing) bore a relationship with the carcass weight-supporting the view of Walters *et al.* (1963) that weights, volumes and dimensions of broiler parts were directly related to the carcass weight.

Poultry industry is a big business, and the goal of every business is to make profit. In poultry business, as in any other business, minimization of input or maximization of output results in "higher profit" (Ukachukwu and Anugwa, 1995). In the present experiment, Diet 1 (18%CP/12.13MJME/kg) proved to be more economical than the other 2 dietary treatments.

In conclusion, 24% dietary protein with 12.13MJ/kg metabolizable energy was adequate for productive performance while 18% dietary protein with 12.13MJ/kg metabolizable energy produced a high quality carcass (with the least percent abdominal fat) and the highest gross margin (N) for the consumer and producer respectively.

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