Effects of time of change from broiler starter to broiler finisher diet on the performance of meat-type chicken

V. K. LAMPTEY & S. AFFEDZIE-OBRESI
CSIR-Animal Research Institute P. O. Box AH 20 Achimota

ABSTRACT

A study was conducted to determine the effect of time of change from broiler starter ration (BSR) to broiler finisher ration (BFR) on growth performance and economy of gain of meat-type chickens. Six hundred Abor Acres broiler chickens were used in an 8-week study in which same starter and finisher diets were fed but at different times. There were four treatments, indicating the time of change from broiler starter to boiler finisher rations. The starter and finisher diets had the same energy levels (12.0 $MJkg^{-1}$) but different crude protein content; 23 per cent and 21 per cent for starter and finisher diets, respectively. The experimental birds had free access to feed and water throughout the period of study. There were no significant difference ($P < 0.05$) between treatments with respect to feed intake, feed efficiency and average weight gain. Apart from gizzard weight which was significantly ($P < 0.05$) affected by the treatments, all other carcass characteristics measured were not influenced ($P > 0.05$) by the time of changing the feed. Economic analysis revealed that T2 was the most economic, having a value of GH¢ 7.59 with the others having values of GH¢7.98; GH¢8.16 and GH¢ 7.92 for T1, T3 and T4, respectively. The result from the study suggests that the optimum time for changing BSR to BFR is 3 weeks, as this tended to give the best growth performance and had a reduced economy of gain.

Original scientific paper. Received 21 Jun 13; revised 02 Jul 15.

Introduction

Chicken production can be used to solve the protein deficiencies in developing countries. This is because broiler production requires less time (8 weeks), space and skill. Broiler growth potential has increased by 400 per cent over a 50 year period (Zuidof *et al*., 2014) reducing the time required to reach market weight (Azarnik *et a*l., 2010), and the type and amount of nutrient supplied affect the growth rate of birds. Nutrient requirement is defined as the minimum quantity of that nutrient which when supplied in adequate quantities will maintain and support normal growth and reproduction and, at the same time, prevent the development of symptoms of nutritional deficiency (Olomu & Ofori, 1980).

It is generally known that growth involves physiological changes such as changes in body weight and body function. These changes require different nutrient intensities at different ages for normal body development and function. Younger growing animals, for example, require more tissue-forming nutrients such as protein whilst

adult animals require higher energy and less protein for increased work relative to other nutrients. This theory underlines the prescription of nutrient requirement for animals and drives nutritional and feeding trials.

In general, meat-type chickens are produced under three main feeding regimes. These are single stage, double stage and triple stage feeding regimes. In the single stage feeding regime, birds are fed a single diet of "average" composition of protein and energy. In the multiple stage (double and triple) feeding regime, birds are fed more diets differing in protein and energy levels at different ages. The protein levels are reduced and the energy levels increased as the birds grow (Skinner-Noble *et al*., 2001).

Cheng *et al*. (1997), however, recommended that the optimum time for feeding broiler starter ration (BSR) should not be more than 14 days, whilst the broiler finisher ration (BFR) should be fed earlier than 35 days of age. The quest to finish broilers in the shortest possible time so as to maximize profit has led to the manipulation of the time of change of these conventional diets. In Ghana, meat-type chickens are commonly fed two diets with increasing energy and decreasing protein contents as birds grow older (Skinner-Noble *et al.*, 2001). Most feed millers, in Ghana, market feed based upon the double stage feeding systems in which BSR is fed for 5 weeks followed by the BFR for 3 week. However, since modern broilers grow much faster than those of yesterday, the study was conducted to evaluate the effect of time of change from BSR to BFR on the performance of meat–type chickens.

Materials and methods

A total of 600 unsexed Arbor Acres day-old broiler chicks purchased from a local hatchery were used in an 8-week growth performance study. The birds were weighed, wing banded and randomly distributed among four treatments with three replicates of 50 birds each. All replicates had similar initial average body weight. The completely randomized design was used with time of change from BSR to BFR diet as treatment.

Treatment 1 (T1). Birds fed BSR for 2 weeks followed by BFR for 8 weeks. Treatment 2 (T2). Birds fed BSR for 3 weeks followed by BFR for 8 weeks. Treatment 3 (T3). Birds fed BSR for 4 weeks followed by BFR for 8 week. Treatment 4 (T4). Birds fed BSR for 5 weeks followed by BFR for 8 weeks.

The diet composition and calculated analysis of the broiler starter and finisher diets are presented in Table 1. Feed and water were provided for *ad libitum* consumption. The birds were housed in open-sided poultry pens with floor space allowance of 0.14 m^2 per bird. Mortality records were kept daily. Weekly records were kept for body weight gain and feed consumption. Four birds per replicate were randomly selected and used to determine carcass traits at the end of the feeding trial. The selected birds were starved for 18 h before they were slaughtered.

Growth Performance parameters measured included: Feed intake (FI) measured as the amount of feed consumed by a bird during the 8-week experimental period; live weight gain (LWG) measured as the difference between the final live weight at the end of the experiment and initial live weight; feed conversion efficiency (FCE) was determined as a ratio of feed intake (FI) to live weight gain (LWG); mortality refers to the number of experimental birds that died dur-

Table 1

Diet Composition (As Feed Basis)

Ingredients	*Starter (%)*	*Finisher (%)*
Maize	58.50	52.00
Wheat bran	4.00	5.00
Fish meal	14.00	8.00
Soya bean meal	21.00	22.00
Maize offal	0.00	10.00
Oyster shell grit	1.50	2.00
Di-calcium phosphate	0.50	0.50
Vitamin premix	0.25	0.25
Common salt	0.25	0.25
Total	100.00	100.00
Analysis		
Crude protein (%)	24.87	21.98
Metabolizable energy (MJ kg^{-1})	12.12	12.11
Calcium (%)	1.40	1.19
Phosphorus (Available %)	0.46	0.35
Crude fat (%)	4.20	4.13
Crude fibre (%)	2.63	2.96

ing the study. Economy of gain (EG) is a parameter that is influenced by the cost of feed, the amount that is consumed and its impact on bird growth. Thus, it was determined as the product of average kilogram feed cost (FC) and feed conversion efficiency (FCE).

Carcass parameters measured were gizzard percentage, expressed as weight of gizzard as a percentage of the final live weight; liver percentage expressed as weight of liver as a percentage of final live weight and abdominal fat percentage was expressed as weight of abdominal fat as a percentage of final live weight. The data collected were subjected to ANOVA, and the difference between the means was assessed using the least square means (SPSS, 2007).

Results

Growth parameters. With the exception of FI, the treatment or feeding regime did not significantly ($P > 0.05$) affect any of the growth parameters in the study (Table 2). T4 significantly ($P < 0.05$) depressed FI. T2 tended to have a slightly higher weight gain and lowered FCE. Again the treatment had no significant effect on EG (Table 2).

Carcass traits. The treatment had no significant ($P < 0.05$) effect on the carcass, liver and abdominal fat (Table 3). Chickens on T2 had the heaviest ($P < 0.05$) gizzard than those on T4.

Discussion

The results obtained from the growth parameters showed that FI dropped significantly in T4 birds, whilst birds on T1, T2 and T3 had similar intakes which were higher than that of T4. This may be because the T4 birds stayed longer on the starter ration which had a high crude protein (CP). The CP requirements were probably exceeded and the increase in protein yield had no further impact. This observation agrees with that of Olomu & Offiong (1980) who evaluated the performance of broiler chicks and reported that, 23 per cent CP with either 11.72 or 12.55 MJ of metabolizable energy (ME) was an adequate requirement for starter broiler birds. Onwudike (1983) had also recommended 22 per cent CP and 12.1 MJ. High protein for finishing broilers is detrimental and results in reduced FI and feed efficiency. It is also not economical since it increases the production cost due to high FC.

Though body weight gain was not significantly different for all the treatments, T2 birds were slightly heavier than the rest and weight gain was depressed after 4 weeks. This agrees with work done by Gehle, Powell & Arends (1974), who noted that there

Table 2

Effects Of Time Of Change On Performance Of Meat-Type Chicken

Response criteria	*Time of change* *T1*	*T2*	*T3*	*T4*	*SEM*
Feed intake (g)	5695.40a	5722.99a	5775.98a	5365.36b	93.04
Final body weight (g)	2164.70	2250.00	2148.00	2050.67	40.87
Initial body weight (g)	40.00	40.00	40.00	40.00	-
Body weight gain	2124.70	2215.00	2108.00	2010.67	41.86
Feed : Gain ratio	2.69	2.56	2.75	2.67	0.04
Mortality	0.67	0.00	1.00	0.67	
Feed cost /kg weight gain(¢)	7.98	7.59	8.16	7.92	0.12

Means within a row with difference superscript are statistically difference ($P < 0.05$); T1; 2 weeks, T2; 3 weeks, T3; 4 weeks, T4; 5 weeks

Table 3

Carcass Performance

Response criteria	*T1*	*T2*	*T3*	*T4*	*SEM*
Gizzard (%)	2.93ab	3.08a	2.75ab	2.56b	0.23
Carcass (%)	64.05	64.51	66.63	66.12	1.24
Liver (%)	2.35	2.51	2.44	2.25	0.11
Abdominal fat (%)	1.76	1.57	2.04	1.71	0.20

Means within a row with different superscripts are statistically different ($P < 0.5$)

was no additional growth response from feeding the starter diet longer than 28 days. This could be due to the high level of protein in BSR. O'Neil *et al*. (1962) & Onwudike (1983) reported that increasing the protein from 18 per cent to 22 per cent improved weight gain of broilers, but there was no extra benefit from increasing the protein beyond 24 per cent. There was no significant difference in FCE among the treatments, but the T2 birds improved slightly their utilisation of feed. The results suggests that feeding high protein diets to finishing birds has no benefit to the broilers and farmer and could, therefore, be avoided to reduce production cost.

The results showed a significant ($P < 0.05$) increase in the gizzard weight of the T2 birds compared to T4 birds. Gizzard enlargement could be due to increased fibre intake as a result of the high dietary fibre of the finisher diet which was introduced earlier to birds on T2 than those on T4. This is consistent with the observations of Onwudike (1983) who reported significant increase in gizzard size on birds fed high fibre than those fed low fibre diets. Gizzard is a delicacy and is now packaged for premium value. Dietary combination in T2 could be employed by farmers to improve revenue from gizzard. The other carcass traits considered showed no significant differences for all the treatments,

indicating that the time of change did not affect these internal organs.

The economy of gain indicates how cheaply birds would be produced using a diet. Farmers being rational would expect to maximise profit and, therefore, would adopt feeding technologies that would improve their profits. Lowering of feeding cost would lead to increasing profit *ceteris paribus*. Thus, a lower feed cost giving better growth performance (FCE) tends to reduce production cost leading to high profits. Birds on the T2 tended to have the least value of GH¢ 7.92, giving GH¢0.33 per kilogram body weight gain less than the next best diet. Though not statistically significant, a small reduction in production cost can enhance farmers' gross profit.

Conclusion

From the study, feeding broilers on high protein diets for longer periods is not only detrimental to their body weight but also economically unprofitable. It is evident that fibrous diets enlarge the gizzard of broilers. Feeding broiler starter diet to the 3rd week and changing to broiler finisher diet tended to give the best results in terms of weight gain, feed efficiency and economics of production. It can, therefore, be concluded that Arbor Acres broiler birds could be fed the broiler starter diet for 3 weeks before changing to broiler finisher diets.

REFERENCES

Azarnik, A., Bojarpour, M., Eslami, M., Ghorbani, M. R. & **Mirzadeh, K.** (2010) The Effect of different levels of dietary protein on broiler performance in *ad libitum* and feed restriction methods. *Journal of Animal and Veterinary Advance* **9**(3), 631– 634.

Cheng, T.K., Melvin, L., Hamre, & **Coon, C. N.** (1997) Effect of environmental temperature, dietary protein, and energy levels on broiler performance. *Journal of Applied Poultry Research.* **6**, 1 1 – 17.

Gehle, M. H., Powell, T. S. & **Arends, L. G.** (1974) Effect of different feeding regimes on performance of broiler chickens reared sexes separate or combined. *Poultry Science* **53**,1543 – 1548.

O'Neil, J. B., Brely, J., Hodgson, C. C., Aitken, J. R. & **Rubbkee, A. R.** (1962) Protein – energy relationships in the diets of the chicken. *Poultry Science* **4**, 739.

Olomu, J. M. & **Offion, S. A.** (1980) The effects of different protein and energy levels and time of change from starter to finisher ration on the performance of broiler chickens in the tropics. *Poult Sci*. **59**(4), 828 – 35.

Onwudike, O.C. (1983) Energy and protein requirements of broiler chicks in the humid tropics. *Tropical Animal Health and Production.* **8**, 39 – 44.

Skinner-Noble, D. O., Berry, J. G. & **Teeber, R. G.** (2001) *Use of simple feeding programs for broilers.* 2001 Animal Science Research Reports. Department of Animal Science, Oklahoma State University, Stillwater, Oklahoma, USA.

SPSS (2007) Statistical Package for Social Scientist version 16.

Zuidof, M. J., Schneider, B. L., Carney, V. L., Korver, D. R. & **Robinson, F. E.** (2014) Growth efficiency and yield of commercial broilers from 1975, 1978 and 2005. *Poult. Sci.* **93**, 2970 – 2982.