Use of qualitative feed restriction as a management strategy for finishing broilers

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Abstract

A 5-week experiment was conducted to investigate the effects of qualitative feed restriction through the use low-quality diet on finisher broiler performance, and to determine if sufficient compensatory growth can be achieved at that phase of broiler production. Seventy-two (72) 4 weeks old broiler chicks of Anak strain weighing of the average 1.0kg were randomly distributed into two groups, A and B, using completely randomized design. Each group was replicated 3 times with 12 broiler chicks per replicate and each replicate housed in a pen measuring 1.5 m x 2 m. Broilers in group A were given a standard broiler finisher diet continuously for 5 weeks while broilers in group B received a low-quality cheap diet based mainly on palm kernel cake and wheat offal for the first two weeks and then placed on the standard diet for the remaining three weeks of the trial. The birds were weighed at the beginning of the trial and weekly thereafter. At the end of the feeding trial, 4 birds were randomly selected from each group, weighed, sacrificed, de-feathered, eviscerated and their internal organs as well as the abdominal fat, weighed. There was no significant difference in feed intake between the groups ($P>0.05$) at the end of the trial but the group on the high fibre low-quality diet consumed significantly ($P<0.05$) more feed during the 2 weeks. Daily body weight gain of the birds on the low-quality diet was lower than that of their counterparts in the control diets in the first 2 weeks but remarkably and progressively increased up to the end of the feeding trial. There was, however, no significant difference between the groups ($P>0.05$) in the final body weights. There were no significant differences in internal organ weights of the groups ($P>0.05$). However, abdominal fat weight was significantly ($P<0.05$) reduced by qualitative feed restriction. Feed cost of production (N/kg weight gain) were N348.69 and N343.78 for the control and qualitative feed restricted groups, respectively. The results have shown that sufficient compensatory growth can be achieved in broiler production even when the period of production is just 5 weeks.

Keyword: Finisher broilers, qualitative feed restriction, low-quality diet, compensatory growth.

Introduction

The development of poultry industry as an animal protein source in the diets of humans in developing countries has been receiving a great deal of attention, particularly in Nigeria. Unfortunately, the supply of feeds has lagged behind the rapid and enthusiastic growth of the industry. The increasing demand for energy and protein feedstuffs and their subsequent spiraling cost, particularly of protein supplements, is already having adverse effect on the supply and, more importantly, on the quality of commercial feeds. This is partly because non-ruminants compete with humans for grains.

Soybean (*Glycine max*) and groundnut (*Arachis hypogaea*) currently play key roles in the feeding of poultry in Nigeria as major plant protein sources. However, with the increasing unavailability of these materials coupled with the high cost of imported ingredients, the prices of commercial poultry feeds increased by

about 2000 % between 1985 and 2003 (Udedibie, 2003). This has resulted in a crisis situation in the industry. There is the need therefore to search for alternative sources of feedstuffs or methods of feeding poultry in the country. One possible way to reducing cost of poultry production in the country may be the application of compensatory growth phenomenon. According to Payne and Wilson (1999), considerable commercial use has been made of the phenomenon of compensatory growth particularly in the rearing of beef cattle because it is associated with greater efficiency in the use of stock feed. Compensatory growth is a phenomenon that enables an animal with retarded growth to catch up with the final live weight of the contemporary unretarded animal (Lawrence and Fowler, 1997). It has been used in Britain to enhance the efficiency of growing heavy weight turkeys (Lesson and Summers, 1978). Their reports showed better body weight, feed utilization and meat yield for early restricted birds as compared to the control at 20 weeks of age. In the 80's, Israeli workers (Plavink and Hurwitz, 1985) investigated the possibility of utilizing a compensatory growth programme to improve the efficiency of market weight broilers. The result of the programme showed enhanced feed utilization and evidence of compensatory growth associated with fat deposition. This was confirmed by the work of Lee and Lesson (2001) and Summers (2002) who remarked that the potential benefits of feed savings and hence economic returns with the compensatory growth programme warrant serious consideration by the broiler industry. According to McDonald *et al.* (1995), nutrient intake might be kept relatively low in early life and high thereafter as a way of achieving compensatory growth.

Limited work has been done on the phenomenon of compensatory growth in Nigeria. Recent work by Meremikwu (2009) showed that restricted growth for 4 – 12 weeks with low nutrient intake was more efficient than continuous growth with appropriate calorie/protein ratios in the production of heavy weight broilers.

The study herein reported was therefore designed to compare the performance and economics of production of finisher broilers fed temporarily on low-quality cheap diet with that of the group fed continuously on conventional broiler finisher diet.

Materials and Methods

Experimental Site

The experiment was carried out in the Poultry Unit of the Teaching and Research Farm of the Federal University of Technology, Owerri, Imo State-Nigeria. Owerri is in the south-eastern agro-ecological zone of Nigeria and lies between latitudes $4^0\ 4^1$ and $6^0\ 3^1$ and longitudes $6^0\ 15^1$ and $8^0\ 15^1$ with mean annual rainfall, temperature, relative humidity of 2500 mm, 26.5 -27^{0}c and 70 – 80 %, respectively. The duration of the dry season (number of months with less than 65 mm of rainfall) is 3 months and the annual evapotranspiration is 1450 mm. The vegetation is tropical rain forest (Atlas of Imo State, 1984; Adeyemi, 2011).

Experimental Diets

Two broiler finisher experimental diets were compounded. Diet I was the standard balanced diet for finisher broilers (NRC, 1994) while diet 2 was a high fibre low-quality diet based mainly on palm kernel cake and wheat offal, not ideal for finisher broilers. Ingredient composition of the diets is shown in Table 1.

Table 1: Ingredient composition and cost of the experimental diets

Ingredient (%)	Diet 1 (standard)	Diet 2 (low-quality)
Maize	60.00	30.00
Soya bean meal	18.00	10.00
Fish meal (65%)	2.00	2.00
Blood meal	2.00	4.00
Palm kernel cake	4.00	30.00
Wheat offal	10.00	20.00
Bone meal	3.00	3.00
Vitamin/mineral premix*	0.25	0.25
Common salt	0.25	0.25
L-lysine	0.25	0.25
L-methionine	0.25	0.25
Calculated Chemical Composition (% DM)		
Crude protein	19.26	18.38
Crude fibre	4.28	8.78
Ether Extract	3.94	4.76
Ash	3.20	4.31
ME (Mcal/kg)	2.92	2.40
Feed cost (₦/kg)	89.87	71.86

*To provide the following per kg of feed: Vitamin A, 12100 iu; Vitamin D_3, 2,500 iu; Vitamin E, 8 mg; Vitamin K, 2 mg; Vitamin B_1, 3 mg; Vitamin B_2, 5 mg;, Niacin, 15 mg; Pantothenic acid, 6 mg; Folic acid, 4 mg; Manganese, 8 mg; Zinc, 0.05 mg; Iron, 29 mg; Copper, 3 mg; Iodine, 1.2 mg; Selenium, 0.16 mg; Cobalt, 2 mg.

Experimental Birds and Design

A total of 72 four weeks old broiler chicks of Anak strain were used for the experiment. They were selected from a group of 200 broiler chicks raised from day-old to 4 weeks on a commercial broiler starter mash. They were divided into two (2) groups of 36 birds each (A and B) and each group randomly assigned to one of the experimental diets, using completely randomized design (CRD). Each group was further sub-divided into three (3) replicates of 12 birds each and each replicate housed in a pen measuring 1.5 m x 2 m. The birds were distributed in such a way that the initial average weights of the groups (1015.90g vs 1011.81g) were about the same. The group on diet 1 (group A) was fed the diet continuously for 5 weeks while the second group (B) was fed the low-quality diet for 2 weeks and then placed on the standard diet (diet 1) for the remaining three weeks. Water and feed were provided *ad libitum*. The birds were weighed at the beginning of the trial and weekly thereafter. The experiment lasted 35 days (5 weeks).

Data Collection and Analysis

Data were collected on feed intake, body weight gain, feed conversion ratio and feed cost of production. Feed intake was obtained by subtracting the weight of left-over feed from the weight of the feed offered the previous day. Feed conversion ratio which is the amount of feed used to achieve a unit gain in weight was obtained by dividing daily feed intake by daily body weight gain. Feed cost of production (N/kg body weight gain) was determined by multiplying cost of feed (N/kg) by feed conversion ratio. (ie cost of feed (N/kg) x FRC = feed cost (N) per kg weight gain)

At the end of the feeding trial, 4 birds were randomly selected from each group,

weighed, sacrificed, de-feathered, eviscerated and their internal organs as well as the abdominal fat weighed. The weights of the carcasses and the organs were expressed as percentage of the live-weights.

Data collected were subjected to statistical analysis, using studentised t–test as outlined by Snedecor and Cochran (1978).

Results and Discussion

Data on the performance of the treatment groups are presented in Table 2. Carcass and internal organ weights at the end of the experiment are presented in Table 3. The average daily feed intakes of the groups in the first 2 weeks of the feeding trial were 116.56 g and 128.24g, respectively. The birds on poor quality feed consumed significantly ($P<0.05$) more feed than those on the control diet. This is understandably so since diet 2 had low energy density and birds eat to satisfy their energy need (Oluyemi and Robers, 2002). The daily feed intake of the groups in the last 3 weeks when both of them were on the same diet were similar (160.90 g vs 158.10 g).

The average body weight gain of the birds on low-quality diet was relatively smaller than that of the group on the standard diet in the first 2 weeks (1,655.23 gm vs 1,538.54 gm) but increased progressively and even tended to do better than their counterparts at the end of the experiment. The average body weight gains of the groups at the end of the trial were 1,464.64 and 1,474.99gm for standard balanced diet and low-quality cheap diet groups, respectively. The group on low-quality diet compared very favourably with that on standard balanced diet. The average daily body weight gain of the groups at the end of the trial were 41.84 and 42.14 gm, respectively. There was no significant difference between the groups ($P>0.05$).

The feed conversion ratios (FCR) of the groups in the first 2 weeks of the trial were 2.54 and 3.36, respectively. The control group had significantly ($P<0.05$) superior feed conversion ratio in view of significantly higher feed intake of the group on poor quality diet. There was, however, no significant difference in overall feed

Table 2: Performance of the Experimental Birds

Parameters	Group A	Group B	SEM
Av. initial body weight (g)	1,015.90	1,011.81	28.73
Total feed intake in 1st 2 wks (g)	1532.40[a]	1792.34[b]	15.48
Av. daily feed intake in 1st 2 wks (g)	116.56[a]	128.24[b]	3.52
Av. body weight at 2 weeks (g)	1,655.33	1,538.54	19.38
Av. daily weight gain in 1st 2 wks (g)	45.67[a]	37.62[b]	2.52
Feed conversion ratio in 1st 2 wks	2.54[a]	3.36[b]	0.24
Av. final body weight (g)	2,480.54	2,480.86	46.94
Av. body weight gain (g)	1,464.64	1,468.99	18.22
Av. daily weight gain (g)	41.84	42.14	0.52
Total feed intake in last 3 wks	3379.19	3319.48	21.16
Av. daily feed intake in last 3 wks (g)	160.90	158.10	3.02
Feed conversion ratio (g feed/g gain)	3.88	4.02	0.22
Feed cost (₦/kg)	89.87	71.86	-
Feed cost of production (N/kg gain)	348.69	343.78	-
Mortality (%)	5.60	2.80	-

[ab]Means within a row with different superscripts differ significantly ($P<0.05$)

conversion ratio of the 2 groups (3.88 vs 4.02).

It was based on this type of performance that Attamangkune (2006) recommended quantitative nutrition as the best and proper way to deliver adequate amounts of nutrients to animals than qualitative nutrition. According to this author, quantitative nutrition is a huge advantage.

The costs of the diets per kg were N89.87 and N71.86 for standard diet and low-quality diet, respectively. This was so because of the high cost of maize and soybean meal compared to that of palm kernel cake and wheat offal which were the major feed ingredients in the low-quality diet. The feed cost of production per kg of broiler (feed conversion ratio x cost of feed per kg) for the two groups were N348.69 and N343.78, respectively. The low-quality diet was therefore very efficient in achieving compensatory growth desired in producing finisher broilers. A small saving of about N5.00 (five naira) per bird was achieved by the use of the concept in this study. Lawrence and Fowler (1997) recommended a sensible utilization of this concept as it yields greater economic efficiency to the animal owner.

The average dressing percentage of the groups were 64.48 and 65.91 %, respectively. There was no significant difference between the groups ($P > 0.05$). The values are in agreement with the range of 62 - 72% recommended by Austin and Neshiem (1990) as ideal carcass yield of broilers.

The weights of the internal organs (hearts, livers, gizzards and spleens) were not affected by the treatments ($P>0.05$). There was, however, significant difference between the groups ($P<0.05$) in the weights of the abdominal fat. The group placed temporarily on low quality diet accumulated significantly ($P<0.05$) smaller abdominal fat possibly as a result of the low energy density of the diet. This was in agreement with the earlier observations of Plavnik and Hurwitz (1985) that compensatory birds did not equal the control in fat deposition at the market weight. Mortality of 2.78% was recorded in group B while group A recorded mortality of 5.56% . post-mortem examination could not ascertain cause(s) of their death.

Discussion

For several decades past, the concept of compensatory growth in poultry production was applied mainly in the production of heavy turkeys (Aukland and Morris, 1971),

Table 3: Carcass and Internal Organ Weights of the Experimental Birds (% LW)

Parameters	Group A	Group B	SEM
Av. live-weight (g)	2,428.60	2,464.50	70.47
Av. dressed weight (g)	1,566.00	1,624.25	47.16
Av. dressing percentage (%)	64.48	65.91	0.84
Weights of Internal Organs (% of LW)			
heart	0.45	0.52	0.05
liver	1.75	2.11	0.34
spleen	0.12	0.11	0.06
gizzard	1.93	2.00	0.25
Abdominal fat	2.38[a]	1.23[b]	0.14

[ab]Means within a row with different superscripts differ significantly ($P<0.05$); LW = Live-weight

the reason being that more time is needed for the concept to work effectively. It was for that reason that Meremikwu (2009) decided to investigate the impact of the concept in the production of heavy broilers, the reason being that heavy broilers would require longer time to produce.

The result of the present study has shown that sufficient compensatory growth can be achieved in broiler production even when the period of production is just five weeks. Although the economic gain may not be as high as that expected from long-time application as in beef and heavy turkey production, a saving of N5.00 (five naira) per bird achieved in this study can be considered fairly significant in a large scale broiler production.

An interesting observation from this study was the low abdominal fat that the birds on compensatory growth feeding programme accumulated. This is in agreement with the report of Plavnik and Hurwitz) (1991) that turkeys on compensatory growth programme tended to show better body weight, feed utilization and meat yield as compared to the control at 20 weeks of age. There is a general consumer preference for fatless broilers, so application of the concept of compensatory growth in broiler production in Nigeria and elsewhere will attract huge advantage in that regard. Gous and Morris (2005) reported that poor quality feed ingredients reduce heat increment from a broiler diet, thereby reducing heat stress and its associated lethal effects. The concept of compensatory growth programme also allows for higher use of PKC in broiler diets in Nigeria since it is readily and commercially available during all seasons in the humid tropical zone of the country.

Conclusion and Recommendation

The results of the experiment have shown that restricted feeding (through feed quality reduction) followed by compensatory growth results in relatively better performance than *ad libitum* feeding of high quality feed in the production of finisher broilers, indicating that it is more efficient than continuous growth economically and biologically. Locally available and cheap feed resources such as palm kernel cake and wheat offal can be used to operate the system since it seems that the anti-nutritive factor, B-mannan, in palm kernel cake did not appear to constitute a health hazard to the birds.

It is therefore recommended that broiler farmers can use the concept of compensatory growth to enhance their economic returns in the business.

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