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ORIGINAL RESEARCH ARTICLE

Growth Performance and carcass characteristics of broiler chickens reared under three different types of feeding programme

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ABSTRACT

A 56-day multi-phase feeding experiment was conducted to investigate the possible benefits over double-phase feeding commercially adopted for broiler production in Nigeria. Ninety (90) day-old Arbor Acre broiler chicks were randomly assigned to three phase-feeding programmes; four-phase feeding (FPF), three-phase feeding (TPF) and conventional double-phase feeding (DPF) in a completely randomized design experiment. FPF consisted of 23, 20, 18 and 16% crude protein fed to a group of broiler chicks at weeks 0-2, 2-4, 4-6 and 6-8 of age respectively. TPF had 23, 20 and 18% crude protein fed to another group of broiler chicks at weeks 0-3, 3-6 and 6-8 of age respectively. DPF had 23 and 20 % crude protein fed to the third group of broiler chicks at 0-4 and 4-8 weeks respectively. At the end of the feeding trial, 15 birds per treatment were randomly selected for carcass characteristics. Results showed that significant (P<0.05) variations existed in the average final live weight, feed conversion ratio, cost/kg feed, and cost of feed/kg live weight gain across the feeding phases. Of all the carcass parameters evaluated only the wings and breast were significantly (P<0.05) different among the treatments. It was concluded that four-phase feeding and three-phase feeding were superior to the conventional double-phase feeding in terms of cost/kg feed and cost of feed/kg weight gain. However, the three-phase feeding programme may be adopted for optimum returns in broiler production.

Keywords: Broiler chicken; Chicken performance; Phase feeding

INTRODUCTION

The development of faster growing strain of modern broiler chickens necessitates the review of feeding patterns of broiler chickens in response to their rapid growth without compromising their nutritional requirements. Therefore, the conventional two-phase feeding adopted by Nigerian broiler farmers might need to be modified or improved upon to accommodate dynamic genetic improvement in broiler strains development. This could bring about better returns on broiler investment. Phase feeding is the feeding of several diets for a relatively short period of time to match an animal's nutrient requirements (Wenger Feeds, 2019). Properly designed phase feeding programme could enhance efficient and profitable broiler production. Hence, such feeding programme should be for optimal nutrient utilization. Detrimental effects of excess nutrients on animal performance and nutrient excretion to the environment need to be avoided. In achieving this, attention should be placed on crude protein level, the major quality and price determinants for various poultry diets. Dietary amino acids in the form of protein constitute approximately 25 % of the cost of practical poultry diets (Borin *et al*., 2002; FAO, 2004) and have positive influence on growth performance of poultry. Hence, asides high cost of protein diets, excess excretion of ammonia and other related compounds are detrimental to human and poultry welfare (Christopher, 2000). Ammonia concentration of 50 to 110 ppm can cause human eye to burn and tear, inducing possible health risks among farm workers and prolonged exposure of chickens to high levels of ammonia can cause keratoconjunctivitis (Ritz *et*

al., 2005). One of the strategies for minimizing nutrient losses into the environment under nonruminant production is by increasing the number of feed phases to better meet the animal's age-related requirements (Ferket *et al*., 2002). Broilers are normally reared on phase feeding programme determined by the varied levels of protein but mostly with constant energy level (NRC, 1994). The existing double-phase feeding (starter and finisher; 0-4 and 4-8 weeks respectively) programme commercially adopted in Nigeria for broiler production is based on phases of development without realising that nutrient requirements could change within a short period in an actively growing broiler chicken (Nargish *et al*., 2010). Therefore, this study examined the effects of three types of feeding programmes on performance and carcass characteristics with a view to optimize benefits.

MATERIALS AND METHODS

Experimental treatments and layout

Four isocaloric, 3000ME (Kcal/kg) diets containing 23, 20, 18 and 16 % crude protein were formulated with conventional feed ingredients as shown in Table 1. The ingredients were mixed manually on the floor. The four diets were then used in three different feeding regimes; as FPF, TPF and DPF (Table 2). Treatment FPF is a four-phase feeding regime with 23, 20, 18 and 16 % crude protein fed to a group of broiler chicken at 0-2, 2-4, 4-6 and 6-8 weeks respectively. Treatment TPF is a three-phase feeding regime with 23, 20 and 18 % crude protein fed to another group of broiler chicken at 0-3, 3-6 and 6-8 weeks respectively. The third treatment tagged DPF is the conventional two-phase feeding regime with 23 and 20 % crude protein fed to the third group of broiler chicken at 0-4 and 4-8 weeks respectively.

Table 1: Gross composition of experimental diets in the phase feeding programme

	Diets (%)			
Ingredients	1	2	3	4
Maize	57.20	59.20	61.27	61.76
Soybean meal	20.70	18.00	11.50	6.50
Groundnut cake	14.00	7.00	7.06	5.00
Fish meal (72%)	3.00	3.00	3.00	3.00
Palm kernel cake	1.10	5.30	6.09	9.88
Rice bran	1.20	4.40	7.74	10.59
Vegetable oil	0.50	0.50	0.50	0.50
Bone meal	1.30	1.40	1.50	1.49
Methionine	0.45	0.50	0.50	0.44
Lysine	0.15	0.30	0.44	0.44
Broiler premix	0.20	0.20	0.20	0.20
Common Salt	0.20	0.20	0.20	0.20
Total	100	100	100	100
Calculated analysis				
Dry matter (%)	91.25	91.57	90.85	90.89
Crude protein (%)	23.02	20.07	18.00	16.00
Crude fibre (%)	4.31	4.19	4.31	4.68
Ether extract (%)	11.00	11.00	10.00	11.00
Ash (%)	6.00	6.00	5.00	6.00
ME (Kcal/kg)	3000.30	3000.44	3000.23	3000.18

Management of experimental birds

Ninety (90) one-day old Arbor Acre broiler-chicks used were bought from Bronco Farm Hatchery Limited, Ring Road, Ibadan, Oyo State, Nigeria. The experimental birds were randomly assigned to three treatments (FPF, TPF and DPF) of three replicates per treatment with ten (10) chicks per replicate in a completely randomized design. The chicks were brooded and raised in a 9 equi-dimensional pens (1m × 1m). The birds under each treatment were fed *ad-libitum* and drinking water supplied without restriction. The routine medication and vaccination programmes as

outlined by the University Teaching and Research Farm were observed for the birds. The trial lasted 8 weeks, during which the records on weekly weight and weekly feed consumption were taken. Average daily weight gain, average daily feed intake and feed conversion ratio were computed.

Carcass parameters

Fifteen birds per treatment were randomly selected for carcass characteristics at the end of feeding trial. The birds were starved overnight, slaughtered, bled, de-feathered and eviscerated. Birds were weighed at different stages of the operation. The carcass parameters measured include live weight, eviscerated weight and dressed weight, thigh, drumstick, wings, head, chest, neck, belly fat, and shank. All the carcass characteristics were expressed as g/kg body weight except the dressed and eviscerated weights, which were expressed as percentages of the live body weights.

Proximate compositions of the experimental diets

The proximate compositions of the experimental diets were calculated with metabolisable energy (ME) calculated as described by Pauzenga (1985).

Table 2: Experimental layout of broiler chicken reared under three different phases of feeding programme

Treatment	Age range (weeks)	Crude protein	Energy (kcal/kg)
FPF	0-2	23	3000.30
	2-4	20	3000.44
	4-6	18	3000.23
	6-8	16	3000.18
TPF	0-3	23	3000.30
	3-6	20	3000.44
	6-8	18	3000.23
DPF	0-4	23	3000.30
	4-8	20	3000.44

FPF= Four-phase feeding, TPF = Three-phase feeding, DPF = Double-phase feeding

Cost and statistical analyses

Cost per kg feed in Nigerian naira (₦) and cost of feed per kg weight gain of the broilers were computed from the prevailing prices of the feed ingredients. Data were subjected to analysis of variance and the treatment means separated by Duncan`s multiple range test using SPSS (2001).

RESULTS

Performance indices of broiler chicken reared under three different feeding regimes

The performance parameters of broiler chicken fed varied feeding regimes is presented in Table 3. All the performance parameters were significantly ($P<0.05$) influenced by the treatments except the average feed intake. The average final live weight of birds under TPF (1285.75±1.00g) and DPF (1284.11±1.00g) were not significant ($P>0.05$) but birds on FPF (1184.27±1.00g) recorded significantly ($P< 0.05$) lower body weight than both TPF and DPF. The average weight gain of birds on FPF (27.44±1.00g/bird/day) was significantly ($P<0.05$) lower than those on TPF (29.86±1.00g/bird/day) and DPF (29.75±1.00g/bird/day) which were however similar ($P>0.05$). Treatment effects on feed conversion ratio (FCR) was significant ($P<0.05$). There was no significant difference between the feed conversion ratio of FPF (3.36±0.10) and TPF (3.21±0.10) while DPF (3.57±0.10) was significantly ($P<0.05$) higher than both FPF and TPF. The cost/kg feed decreased significantly ($P<0.05$) from ₦100.98±1.00 (DPF) to ₦98.54±0.10 (TPF) and ₦95.50±1.00 (FPF). There were significant ($P<0.05$) differences in the cost of feed per kg weight gain of the three feeding phases; FPF (₦320.89±1.00/kg weight gain), TPF (₦316.32±1.00/kg weight gain) and DPF (₦360.48±1.00/kg weight gain).

Carcass characteristics of broiler chickens reared under three different feeding regimes

The carcass parameters of broiler chicken fed varied phases of feeding programme is presented in Table 4. Among the carcass parameters investigated, only the weight of the wings and chest were significantly ($P<0.05$) different among treatments. The weight of the wing across treatments were 90.25±4.77g/kg (FPF), 81.15±0.62g/kg (TPF) and 96.53±5.55g/kg live weight (DPF). The relative weights of chest were 177.36±12.15 (FPF), 202.26±17.06 (TPF) and 215.70±12.12 (DPF).

Table 3: Performance parameters of broiler chicken fed varied phases of feeding programme

	Feeding phases		
Parameters	FPF	TPF	DPF
Average initial live weight(g)	31.67±0.02	31.67±0.02	31.65±0.10
Average final live weight(g)	1184.27^{b}±1.00	1285.75^{a}±1.00	1284.11^{a}±1.00
Average weight gain (g/bird/day)	27.44^{b}±1.00	29.86^{a}±1.00	29.74^{a}±1.00
Average feed intake (g/bird/day)	92.16±50.35	95.89±53.47	106.23±59.80
Feed conversion ratio	3.36^{b}±0.10	3.21^{b}±0.10	3.57^{a}±0.10
Cost /kg feed (₦)	95.50^{c}±1.00	98.54^{b}±0.10	100.98^{a}±1.00
Cost of feed(₦)/kg weight gain	320.89^{b}±1.00	316.32^{c}±1.00	360.48^{a}±1.00

[abc]Mean on the same row with different superscripts are significant (P<0.05)
Mean±SD FPF = Four-phase feeding, TPF = Three-phase feeding, DPF = Double-phase feeding

DISCUSSION

The highest average weight gain in birds under TPF, though similar to DPF could be attributed to the best utilization of feed as revealed by the least value of feed conversion ratio based on three-phase feeding programme (TPF). Birds under treatments FPF and TPF had similar FCR, hence similar utilization of feed. This outcome is in agreement with the report of Tolimir *et al*., (2010) that multiphase nutrition effect on production performances was primarily on level of feed utilization. Therefore, irrespective of the staggered feeding phase; sustainable good quality broiler diets will promote better utilization of feed, reduce environmental pollution and in a long run reduce poultry contribution to greenhouse gas. Generally, all the carcass parameters of the birds under the treatments were not significantly different except the wings and breast. This may indicate that the different feeding programmes contributed similarly to carcass growth. This is in agreement with the report of Warren and Emmert (2000) that economic analysis of phase feeding may facilitate reduced dietary costs without sacrificing growth performance or carcass yield.

The cost implication of these feeding regimes revealed that FPF had the least cost/kg feed while TPF had the least ($p<0.05$) cost of feed/ kg weight gain. Birds on DPF however had the highest ($p<0.05$) cost/ kg feed and cost of feed/ kg weight gain. Thus implying that four-phase feeding (FPF) and three-phase feeding (TPF) programmes types were economically superior to double-phase feeding programme in terms of feed cost and returns on broiler production. However, based on the cost of feed/ kg weight gain; three-phase feeding programme (TPF) will be optimally beneficial and superior to the two other feeding programmes in terms of returns on broiler production. This implies that least cost feed may not necessarily bring about optimum returns on broiler production.

Table 4: Carcass parameters of broiler chicken fed varied phases of feeding programme

	FEEDING PHASES		
Parameter	FPF	TPF	DPF
Live weight (kg)	1.80±0.05	2.32±0.66	2.42±0.28
% Dress weight	62.97±0.87	64.26±2.59	66.64±3.87
% Eviscerated weight	74.09±1.03	74.74±0.66	77.07±2.54
Wings (g/kg body weight)	90.25^{a}±4.77	81.15^{b}±0.62	96.53^{a}±5.55
Head (g/kg body weight)	22.31±1.83	21.13±6.12	20.41±1.91
Neck (g/kg body weight)	42.83±3.51	41.71±5.49	39.86±3.14
Breast (g/kg body weight)	177.36^{b}±12.15	202.26^{a}±17.05	215.70^{a}±12.12
Upper back (g/kg body weight)	60.63±9.17	63.79±12.73	62.58±6.65
Lower back (g/kg body weight)	60.69±1.84	84.34±29.27	68.78±5.46
Thigh(g/kg body weight)	96.86±2.73	95.38±13.51	112.52±17.33
Drum stick (g/kg body weight)	103.13±6.45	98.50±4.33	107.07±8.81
Belly fat (g/kg body weight)	6.09±1.03	17.56±9.44	7.58±5.68

[ab] Mean on the same row with different superscripts are significant (P<0.05)
Mean±SD; FPF = Four-phase feeding, TPF = Three-phase feeding, DPF = Double-phase feeding

CONCLUSION

It was concluded that four-phase feeding (FPF) and three-phase feeding (TPF) programmes were superior to the conventional double-phase feeding programme (starter and finisher) in terms of cost/kg feed and cost of feed/kg weight gain. However, the least value of cost of feed/kg weight gain of three-phase feeding programme made it optimally beneficial.

CONFLICT OF INTEREST STATEMENT

This study was jointly conducted and funded by the two authors. There is no any form of other support towards this work. Therefore, the researchers envisage no conflict of interest from anyone.

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