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The effect of phase feeding on broiler performance

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Abstract
This study was conducted to assess the effects of phase feeding on growth performance of broiler chicks. The experimental work consisted of a 7-week feeding trial, in which three different feeding programmes were fed to day-old broiler chicks (Hubbard).The chicks were reared on deep litter in an open experimental poultry house. The experiment was arranged in a completely randomized block design consisting of three rows (blocks) with three pens (experimental units) each, with 10 chicks per pen. Three experimental diets were formulated to contain different levels of ME and Crude protein; namely a broiler starter diet containing approximately 3072 Kcal ME/kg and 23.9% crude protein, a grower diet containing 3118 Kcal ME/Kg and 21.8% crude protein, and a finisher diet containing 3200 Kcal ME/kg and 18% crude protein. The three feeding programme were randomized within each block giving three replicates per treatment. The first programme (treatment I) consisted of feeding the starter diet throughout the whole experimental period (7 week), the second feeding programme (treatment II) consisted of feeding the starter diet for the first two weeks followed by feeding the grower diet for the following two weeks, followed by the finisher diet for the remaining three weeks of the experiment. the third feeding programme (treatment III), the starter diet was fed for three weeks followed by the finisher diet for four weeks. Records were kept for weekly feed consumption, weekly live weight and live weight gain, feed conversion ratio, daily mortality and dressing percentage at the end of the experiment. The collected data was subjected to analysis of variance to assess statistical differences among the experimental treatments. The results diets not reveal any significant differences in productive parameters, but indicated marked trends in differences among the experimental treatment. These differences showed that the highest feed consumption and live weight gain were attained by the group of birds fed the starter diet throughout the experimental period. Feeding the starter diet followed by the finisher diet for four weeks resulted in the lowest total feed consumption, reasonably high body weight gain, lowest feed conversion ratio and highest dressing percentage. It can, however, be considered under the conditions of the present experiment that the three experimental feeding programmes supported similar productive performance of broiler, indicating a slight economic advantage of feeding the starter diet followed by the finisher diet.

Keywords: indicating, blocks, performance

Introduction
Feed constitutes approximately 60-70%of total broiler production costs N.Saveewonlop *et al* (2019) The broiler industry has been developed into the most efficient animal production sector. This development has been brought about through development and advancement of research in the fields of poultry science and related subjects. The most significant of these developments were in the fields of genetics and nutrition, which lead to the breeding of commercial broiler chicks capable of rapid growth and efficient utilization of feed (Anonymous, 2013) Since feed cost constitutes the major cost item of producing broiler meat, considerable research effort was concentrated in improving nutrition and efficiency of feed utilization of the broiler chicks. The broiler chicks are known to be exacting in their nutrient requirements for rapid growth and development, and that they need to be supplied with adequate diets capable of satisfying these requirements in a utilizable form (Skinner *et al*, 2000). The nutrient requirements of boiler chicks have been almost precisely established and the capacity of various feed ingredients to supply these nutrients has been identified, and consequently the formulations of adequate diets became possible. The broiler chick has an extremely high nutrient requirements, particularly during the early stages of its growth. The capacity of the digestive system of the chick is very limited during this period, and it became important to feed them diets highly concentrated in metabolizable energy and protein of high quality, beside high levels of vitamins and essential minerals during the early stages of the growing period. Such diets have been commercially established and used world- wide. These high density broiler diets were recommended to be fed as a sole diet for the whole 6-7 weeks growing period (Skinner *et al*,2001). Further research development indicated that the nutrient requirements of the broiler chicks vary with its advancement of growth according to the increase in body weight and nature of growth. The growth curve established that young broiler chicks during the first 3-4 weeks of life are at their most active phase of growth,

and the nature of growth during this period is mostly in the form of tissue protein and very little fat. Accordingly, it has been indicated to vary the composition of broiler diets during the growing period according to the actual nutrient requirements for the changing nature of growth. In this context, different feeding programmes with varying dietary nutrient composition have been developed for the growing broilers as a means for economy of feed and efficient nutrient utilization, and ultimate reduction of the cost of feeding. In this respect, different diets of variable nutrients composition have been advocated for phase feeding of broilers, based on increasing the energy content of the diet and reducing its crude protein content with the advancement of age (Roush2004). It is intended in this study to assess the effect of phase feeding using different feeding programmes, on the production performance and carcass yield of broilers.

Materials and methods

Experimental Diets

Three types of diets namely, the starter, grower and finisher broiler diets. They were formulated from the local feed ingredients and an imported super concentrate which was used to complement the dietary protein, amino acids, vitamins and minerals. The composition of the super concentrate is described in table (I). The diets were formulated according to the recommended nutrient composition of the diets commonly used in phase feeding of broiler chicks. In this respect, the starter diet was relatively high in ME and crude protein content, which were reduced in the grower diet; and the protein content was further reduced in the finisher diet with increasing the ME content. The formulation of the experimental diets is shown in table (2). The calculated and proximate analyses were shown in tables (3) and (4) respectively. Each diet was analyzed for its content of dry matter, crude protein, ether extract and crude fiber according to the procedure of AOAC.(1980)for proximate analysis. The metabolizable energy (ME) content of the diets were calculated according to the equation of Lodhi et al (1976) based on the determined proximate analyses values of the diets

* This equation is as fallow: M.E (Kcal kg-1= (1.549+0.102(Cp) +0.275(EE)
+0.148(N.F.E)-0.034(C.F) X239.

The calculated analyses of the diets were made according to the tables of NRC
(1994) for ingredients composition.

Birds and management

Hundred and twenty unsexed day-old broiler chicks of commercial strain (Hubbard) were purchased from a local hatchery (Coral CO.) The birds were reared on deep litter in an open sided house. The experimental house was aportioned in to 9 pens of equal area (I x I m). The pens were arranged in three rows, each row containing three pens, each pen was equipped with a tube feeder and a fountain waterer. In the middle of each pen 60 –watt electric bulb. Upon arrival, the chicks were immediately given sugar in drinking water to reduce the transportation stress. At the age of two weeks the chicks were vaccinated against Newcastle Disease.

Experimental procedure

Randomly assigned to the experimental pens at the rate of 10 chicks per pen. The experimental house consisted of three rows of pens and each row contained three pens. The three experimental treatments were randomly assigned to each row of pens (block), thus giving a Randomized Complete Block Design arrangement. Treatment I consisted of feeding the starter diet from day-old to 7weeks of age (end of the experiment). Treatment II consisted of feeding the starter diet for the first 2 weeks of age, fallowed by the grower diet for 2 weeks and then the finisher diet to the end of the 7th week of the experiment. Treatment III consisted of feeding the starter diet from day old to 3 weeks of age followed by the finisher diet to the 7th week of the experiment. Feed consumption and liveweight were weekly determined for each pen, and mortality was recorded as it occurred. At the end of the experiment the birds were fasted for over night except for water, three birds from each replicate (pen) were randomly selected, wing tagged and individually weighed. They were then slaughtered by jugular severing and left for an appropriate time to bleed. They were then scalded in hot water and plucked manually, and the head and shanks were removed. The birds were then eviscerated and the hot dressed carcass weight was recorded. The data for weekly feed consumption, live weight gain, feed conversion ratio and dressing percentage were collected. They were then analyzed statistically for treatment differences by analysis of variance for the randomized complete block design according to Steel and Torrie (1980).

Result and Discussion

The present study was conducted to assess the effect of phase feeding in supporting performance of broiler chicks. The results of performance did not show significant differences in total feed consumption, live weight gain or feed conversion efficiency among the experimental birds. These results are in line with several reports on the effects of phase feeding of broiler chicks, which include reports by Skinner et al (2000), Warma and Emmert (2000), Pope and Emmert (2001) and Roush (2004). These workers indicated that phase feeding can support similar feed intake growth, carcass yield and feed efficiency to that of feeding a single starter diet based on NRC recommendations. Despite the insignificant differences in performance among the different feeding programmes, the results revealed certain trends in insignificant differences in performance among the experimental feeding programmes. The highest feed intake and live weight gain were attained by feeding the single starter diet throughout the experimental period; while feeding the starter diet accompanied by the grower and finisher diets resulted in the lowest body weight gain; and feeding the starter diet followed by the finisher diet to the end of the experimental period resulted in the lowest feed intake and lowest feed conversion ratio. These trends in performance generally follow the pattern of nutrients intake, resulting from the differences in feed consumption of the experimental diets. In this respect, the intake of all essential nutrients was highest under programme (I), where the chicks were fed the nutrient dense starter diet during the whole experimental period. This was followed by the birds reared on

programme (2), and was least on phase feeding programme (3). No differences in feed intake, body weight gain, or feed conversion efficiency were observed among the experimental birds during the three weeks starting period. This can be attributed to the fact that all the birds during this period received the same starter diet and almost consumed the same amounts of feed and nutrients. The amount of feed consumed during this period was only a small fraction of the total feed consumed by the birds over the 7 weeks growth period. Consequently, the highest amount of feed and nutrients were consumed during the grower and finisher periods, thus having a greater impact on body weight gain and feed utilization during the later phases of the growth period. These effects were clearly marked in the work of Warma and Emmert (2000) and Skinner *et al* (2001) and Rouch (2004) and N.Saveewonlop *et al* (2019). These workers indicated that body weight and feed conversion were not sensitive to the grower diet feeding in a three- diets phase feeding programme. On the other hand increasing the starter diet feeding period had the strongest effect on increasing body weight and decreasing feed conversion ratio; while decreasing the feeding period of the finisher diet increased the body weight and decreased the feed conversion ratio,. It has also been indicated that broiler performance under phase feeding programmes is influenced by the length of the growing period and the proportion of time that the starter, grower and finisher diets are fed, as well as the stage of growth at which these diets are introduced. The absence of significant differences among the results of the present study indicates that the three tested feeding programmes were capable of supporting similar productive performance of broilers. This is irrespective of the marked differences in nutrients intake, particularly crude protein and lysine. This, however, did not reflect any differences in the cost of feed consumed under the different feeding programmes, due to the unexceptionally high prices of grain sorghum in the particular season, which was used at high percentages in the grower and finisher diets. Under normal price conditions, the cost of feeding will be lowest in the programme which consisted of feeding the starter diet followed by the finisher diet. The same programme seemed to be more appropriate for supporting broiler production in the light of the attained lowest feed consumption, reasonably high live weight gain and lowest feed conversion ratio among the experimental treatments. It can be considered that the conditions of the present experiment though limited, reflects the advantage of phase feeding of broiler chicks, particularly the programme of feeding the starter diet followed by finisher diet.

Table 1: The chemical composition of the super concentrate used in the formulation of the experimental diets. (LNB Concentrate 5%)

Analysis	Min.	Max.
Crude protein%	40.00	
Metabolizable Energy kcal/kg	2100	
Crude fiber %	2100	3.00
Calcium %	10.00	
Phosphorus total %	4.00	
Lysine %	12.00	
Methionine %	3.00	
Methionine + cystine %	3.20	

Table 2: The formulation of the experimental diets (percent as fed).

Experimental diets			
Ingredient	**Starter**	**Grower**	**Finisher**
Sorghum	60.0	67	76.41
groundnut meal	18.0	14	10
sesame meal	14.85	11.8	6
Super- concentrate	5.0	5	5
Crushed osyster shell	1.5	1.5	1.5
Common salt	0.3	0.3	0.3
Methionine	0.1	0.15	0.21
Lysine	0.25	0.25	0.25
Vegatable. Oil	-	-	0.33
Total	100.0	100.0	100.0

Table 3: The calculated analyses of the experimental diets (percent as fed)

Experimental Diets			
Items	**Starter**	**Grower**	**Finisher**
Metabolizable energy (kcal/kg)	3072	3118	3200
Crude protein (%N%X6.25)	23.9	21.8	18.9
Lysine %	1.34	1.25	1.20
Methionine %	0.60	0.60	0.59
Calcium %	1.4	1.3	1.2
Av. Phosphorus %	0.69	1.39	0.313

Table 4: Proximate analysis of the experimental diets (percent)

Items	Experimental Diets		
	Starter	Grower	Finisher
Dry matter %	9486	90.45	93.87
Crude protein %	22.25	20.98	19.58
Crude fiber %	6.19	6.02	6.03
Ash %	8.57	13.87	6.64
Fat %	6.94	6.45	5.72

Table 5: Summary table of performance of the experimental birds during 0-7 weeks of age (g/bird/7week)

Experimental parameters	Treatments			
	1	2	3	SE
Number of bird/treatment	30.0	30.0	30.0	-
Initial body weight (g/bird)	40.90	43.60	42.30	-
Total feed consumption	3306.60	3080.6	3021.6	90.68NS
Final live body weight (g/bird	1390.0	1317.0	1349.0	95.87NS
Live body weight gain (g/bird/ 7	1349.1	1253.4	1306.7	39.96NS
Feed conversion ratio (g feed/ g	2.45	2.45	2.31	.055NS
Dressing percentage	68.30	69.80	72.7	2.92 NS
Cost of feed consumed (SD)	291.80	297	296.1	NS

Values are means of 30 birds/treatment NS= not statistically significant., SE= Standard error of means

Table 6: Total nutrients consumption of the experimental birds (g/bird/ 7week)

Item	Treatments		
	1	2	3
ME Kcal	10132	9575	9587
Crude protein	788	669	566
Lysine	44	38	35
Methionine	19	18	17
Calcium	48	42	37
Av. Phosphorus	11	10	9

1= starter diet
2= starter diet + grower diet + finisher diet
3= starter diet + finisher diet

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