SEVENTH – DAY PERFORMANCE EVALUATION OF BROILER CHICKS FED STARTER DIETS CONTAINING PALM KERNEL SHELL ASH AS A MINERAL SUPPLEMENT IN BROILER RATION

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Abstract

The seventh day performance evaluation was carried out to determine the effect of partial replacement of bone ash with palm kernel shell ash (PKSA) supplementation on broilers. Ninety-six Arbor Acre Day old chicks were randomly assigned in triplicates of eight birds per replicate to four experimental diets containing graded levels of PKSA at 0, 5, 10 and 15kg/ton of feed respectively. At the seventh day of life, a bird from each replicate was randomly selected and assessed for performance, Results obtained showed that there were statistical differences across the treatment groups in almost all parameters except in the FCR. Therefore, the seventh day performance data as an indicator could be used to determine the value of a feedstuff at the early stages of broiler feeding to determine its continued or optimal inclusion levels in feed formulations.

Key words: Broilers, Seventh day Performance, PKSA

INTRODUCTION

Broiler chickens have been extensively and successfully selected over the years for rapid growth rate and decrease in grow- out period in pens (Rynsburger, 2009). Because of the rapid increases in growth rate, market age and production cost has also considerably decreased. As the growing period of the broilers continues to shorten, the early nutritional management of chicks becomes increasingly important. The first week of the broiler's life therefore represents a significant proportion of the total production period (Ravindran, 2003). Several reports have consistently suggested the importance of the first seven days of broiler chicken's life, its influence on the overall performance of the bird and the need to provide adequate nutrition and management at this period. Earlier findings of Nitsan *et al*. (1991) had reported a 14% daily increase in body weight on the first day post hatch, which reaches a peak of 22% daily increase by the 11th day before it declines to about 9% by day 17. However, the bird's intestinal growth represents most of these body weight increases at this stage of development (Croom *et al.*, 1999). This is to ensure development of nutrient supply functions, which are necessary for subsequent growth of demand tissues, such as muscles (Ravindran, 2003). Therefore, the evaluation of broiler performance at age seven, using specific measurement parameters such as, live weight, growth rate, feed intake, crop fill, body temperature, liveability and mortality rate, as a means of assessing chick quality while monitoring pre-placement and brooding conditions becomes paramount in modern intensive poultry production systems. Again, broiler chicken has been used extensively as model animals for investigating the dietary values of many 'novel' candidate feedstuff in monogastric animal feeding because of their ease of handling and relatively short grow out period. In such studies, it is usually desirable to determine the early impact of such novel feedstuffs on bird performance to make necessary adjustments in their inclusion as early as possible (Omede *et al*., 2013). This study evaluated the seventh day performance of broiler chicks fed starter diets containing palm kernel shell ash.

Materials and methods

The palm kernel shells (PKS) were collected from a local oil mill, washed with water, sun – dried, weighed and ashed in a bread oven after which the resultant product was ashed again using a porcelain pot till the ash produced became red hot (Iwu *et al*., 2013). A total of 96 Abor acre day old chicks were purchased from a reputable local hatchery and were divided into four groups of 24 birds with each of the group further replicated three times with 8 birds per replicate in a Completely Randomized Design. The birds were assigned to four treatment diets containing graded levels of PKSA at 0, 5, 10 and 15kg/ton of feed to partially replace graded levels of bone meal in the diets respectively (Table 1). Each sample of the diet was subjected to mineral analysis using the method of official analytical chemist (AOAC, 1995) with the aid of atomic absorption spectrophotometry.

Table 1: Nutrient composition of the PKSA based diet for broiler chicks

Ingredients g/100g	T1	T2	T3	T4
Maize	52.00	52.00	52.00	52.00
Soya bean meal	12.00	12.00	12.00	12.00
Groundnut cake	20.00	20.00	20.00	20.00
Palm kernel cake	2.95	2.95	2.95	2.95
Fishmeal	4.00	4.00	4.00	4.00
Wheat offal	4.00	4.00	4.00	4.00
Bone meal	4.00	3.50	3.00	2.50
Salt	0.30	0.30	0.30	0.30
Vitamin Premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
PKSA	0.00	0.50	1.00	1.50
Total	100	100	100	100

Growth Performance Determination

On the seventh day of life, one bird each was collected from each replicate to determine its growth performance. The birds' initial live weights were ascertained at day 0 and their final weights measured at day 7 of the experiment. Also measured were, feed intake, weight gain, average daily weight gain, feed conversion ratio (FCR) and the growth efficiency ratio (GER). The GER was derived as a ratio of the percentage increase in initial weight of the birds within a specific time frame to the total feed intake of the birds over the same period. This was calculated to better explain the effects of PKSA on the relationship between body growth and feed intake of the broilers.

GER = Percentage increase in body weight of birds over a period

Total feed intake over the same period

Data Analysis

Data obtained were subjected to analyses of variance using SPSS version 20. (SPSS, 2012) and the differences between the treatment means were compared using the Duncan Multiple Range Test.

RESULTS AND DISCUSSION

Mineral composition of the starter diet of broilers fed PKSA as a mineral supplement:

The mineral concentrations of the starter diets are summarized in table 2. The most abundant macro minerals in the starter diets were K>P>Mg>Na>Ca while the order of micro mineral abundance was Fe> Mn> Zn> Cu.

Table 2: Mineral concentration of experimental starter diets

Parameters	***T1***	***T2***	***T3***	***T4***	***Mean***	***SD***	***CV***
Macro minerals							
Calcium (mg/kg)	72.31	63.44	58.64	60.25	63.66	6.10	9.58
Magnesium (mg/kg)	125.34	73.11	155.28	73.54	106.81	40.55	37.96
Potassium (mg/kg)	296.35	280.01	303.26	275.10	288.68	13.30	4.61
Sodium (mg/kg)	71.23	76.35	82.24	76.51	76.58	4.49	5.86
Phosphorus (mg/kg)	173.07	136.89	158.84	109.05	144.46	27.90	19.31
Micro minerals							
Manganese (mg/kg)	3.26	3.01	3.15	2.44	2.96	0.36	12.16
Iron (mg/kg)	14.91	12.35	16.32	14.23	14.45	1.64	11.35
Copper (mg/kg)	0.34	0.86	0.32	0.69	0.55	0.26	47.27
Zinc (mg/kg)	2.99	2.46	2.84	3.12	2.85	0.28	9.82
Mineral ratios							
Ca/P ratio	0.42	0.46	0.37	0.55	0.45	0.08	17.77
Na/K ratio	0.24	0.27	0.27	0.28	0.27	0.02	7.41
Proximate							
ME Kcal/kg	2081	2428	2124	2295	2232	160.05	7.17
Crude protein (%)	21.51	20.07	23.94	22.50	22.00	1.63	7.41

ME Metabolizable energy, SD = Standard deviation, CV = Coefficient of variation

These values are however below the recommended values for broiler starter ration. The study also shows that partial replacement of bone ash with PKSA in broiler starter diets will result in mild lowering of Ca and K values of treated diets below the control diet values. Magnesium and phosphorus values were drastically lowered in all treatment diets below control diet values, except in T3 where a significantly higher magnesium value was recorded. Such low mineral inclusion levels may result to suboptimal production (Ceylan *et al*., 2007).

The mean calculated Ca/P ratio of the experimental diets indicated that only 0.45 mg of calcium was available in the broiler starter diet for every mg of phosphorus. Technically, such a feed may not be adequate for the growing birds since extra calcium needed to balance for phosphorus will have to be recruited from elsewhere, especially bone (Reinhart and Mahan, 1986). There is therefore the need to improve calcium supply in broiler starter diets by including other ingredients such as limestone and oyster shell, which are better sources of calcium. PKSA inclusion also tended to improve the Na/K ratio of treated diets over control diet value.

Growth performance of broilers fed PKSA as a mineral supplement:

The seventh day performance characteristics evaluated indicated statistically different effects in all parameters except for the FCR (Table 3). The best indicators were the 7th day weight gain, daily weight gain and daily feed intake in which the control values were similar to all ash treatment groups (P>0.05). There was no significant difference in final body weight between T2 group and the control. T2 also had significantly higher (p<0.05) 7th day weight gain and average daily weight gain than T4, while T3 consumed significantly more food than T4 on daily basis but there was no recorded statistical difference when compared to T1 and T2 groups (P>0.05). Though the crude protein of the experimental starter diets may have been within the lower limit of 22% recommended range for Abor acre broiler starters, the energy level obtained in the study was below the specified range and thus may have also contributed to the low 7th day weight across the means.

Table 3: Seventh day growth performance characteristics of broilers fed PKSA

Parameters	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)	SEM
Initial weight (g)	38.83	38.63	38.53	39.90 1.38	
Final weight (g)	123.47^{a}	120.20^{a}	113.13^{b}	111.20^{b}	2.58
Avg. Daily feed intake (g)	24.62^{ab}	16.25^{ab}	19.78^{a}	14.44^{b}	1.21
Weight gain (g)	84.64^{ab}	81.56^{a}	74.60^{ab}	71.30^{b}	2.51
Avg. Daily weight gain (g)	18.09^{ab}	11.65^{a}	10.66^{ab}	10.31^{b}	0.36
Feed conversion ratio	1.61	1.40	1.59	1.42	0.07
Growth efficiency ratio (GER)	2.18	2.74	2.12	2.76	

Means with different superscript on the same horizontal row are significantly different @ (p<0.05)

GER was derived to better explain the effects of PKSA on the relationship between body growth and feed intake of the broilers. It was shown that at the end of 7 days of feeding, one gram of T4 diet have caused a 2.76% increase in the body weight of the birds, while the control diet produced a 2.18% increase in body

weight. Earlier works on ash reported similar reductions in feed intake with increasing inclusions of plant ash in diets of rabbits and pullets (Iwu, *et al*., 2013; Nwogu, 2013). This reduction in feed intake was initially attributed to the high alkalinity of the plant ashes used in these studies. However, in our study PKSA yielded a mild alkaline ash, which also caused a reduction in feed intake of broilers chicks.

Minerals are usually found in their carbonate, bicarbonate, oxide and hydroxide states (Naylor and Schmidt, 1986). The alkalinity of plant ash however depends basically on its carbonate, bicarbonate and hydroxide content. It is therefore possible that the reduced feed intake associated with plant ash inclusion in the diet of livestock is due to the unpalatability of the feed because of increased bicarbonate, hydroxide and sulphate forms of ash minerals.

CONCLUSION AND RECOMMENDATION

The order of minerals in the PKSA in the feed it was K> P> Mg> Na> Ca> Fe> Mn> Zn> Cu. The seventh day weight gain, feed intake and FCR of all birds were similar, while Growth efficiency ratios (GER) of the treated birds were superior to that of the control birds. Feed intake was generally lowered by increase in inclusion level of PKSA in the diets.

Seventh day performance indices could be used to determine the value of a novel feedstuff at the early stages of broiler feeding to determine its optimal inclusion levels in feed formulations.

GER derived in this study could be used in determining growth performance alongside the traditional feed conversion ratio.

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