PERFORMANCE EVALUATION OF STARTER BROILERS FED PALM KERNEL SHELL ASH AS A MINERAL SUPPLEMENT

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ABSTRACT

This study was carried out to determine the effect of partial replacement of bone ash with palm kernel shell ash (PKSA) supplementation on broilers at their starter stage. 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 corresponding to T1-T4 respectively as partial replacement for bone meal. Proximate and mineral compositions of the experimental feeds were evaluated while performance characteristics were determined at 28 days (starter phase). Results obtained showed that all the growth performance characteristics evaluated were similar up to T3 beyond which a decline was recorded. Thus, PKSA supplementation up to 10kg/ton of feed as partial replacement for bone meal gave similar results as the control diet and could therefore serve as potential sources of absorbable mineral supplements in commercial diets offered to broilers.

Key words: Palm kernel shell, plant ash, performance.

INTRODUCTION

Several studies have suggested that the adoption of non-conventional feed resources (NCFR) as feed ingredient in livestock nutrition, may be the panacea to the increasing cost of feeds and animal protein due to the over dependence of the industry on conventional feed resources. However, while most of the researches on alternative feed resources have focused majorly on protein and energy contents, limited efforts have been made towards identifying alternative mineral sources especially calcium and phosphorus for poultry. Minerals are dietary essential to all classes of livestock and therefore perform structural, physiological, catalytic and reproductive functions in animals (Suttle, 2010). Despite the advantages associated with the use of rock or inorganic mineral substances (calcium phosphates, phytase etc.), as additives for intensively farmed poultry, their high costs unfortunately makes them unavailable and not readily accessible to small-holder farmers that make up the bulk of poultry farmers in low income countries like Nigeria (Ohanaka et al., 2018b). Other sources such as bone meal, oyster shell, and even eggshell although cheaper, are not readily available due to its low output (Alu, 2013).

Plant ash from different sources have lately been reported as good source of absorbable mineral supplement in the diets of pullets (Okoli et al., 2014) and in growing rabbits (Iwu et al., 2013). Similarly, charcoal and (Majewski et al., 2011), and even firewood ash (Saccomani et al., 2016) have been reported to successfully replace limestone in broiler diets.
Palm kernel shell is a readily available agricultural industry residue that has found limited application in the Nigerian industry. It is currently used as biofuel in palm oil processing operations and the ash residue is discarded as waste material. Recent studies using ash derived from palm kernel shell have highlighted its potentials as a mineral supplement in broiler production which caused increased GIT development in chicks (Ohanaka et al., 2017; Ohanaka et al., 2018a) and improved intestinal uptake of Ca, Na, Mn, Fe and P as reflected by their reduced concentrations in the faeces (Ohanaka et al., 2018b).

It is therefore expected that PKSA will be a potential mineral source and may successfully replace intact plant, animal and rock mineral sources in the broiler diets when properly processed.

MATERIALS AND METHODS

Collection and Preparation of Palm Kernel Shells

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).

Experimental animals, diets and design

96 Abov 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 managed intensively as practiced at the Teaching and Research Farm of Federal University of Technology Owerri. The birds were assigned to four treatment diets containing graded levels of PKSA at 0, 5, 10 and 15kg/ton of feed corresponding to T1-T4 respectively to partially replace graded levels of bone meal in the diets. Each sample of the diet was subjected to mineral analysis using the method of AOAC, (1995).

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

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>52.00</td>
<td>52.00</td>
<td>52.00</td>
</tr>
<tr>
<td>Soya bean meal</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>Groundnut cake</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Palm kernel cake</td>
<td>2.95</td>
<td>2.95</td>
<td>2.95</td>
</tr>
<tr>
<td>Fishmeal</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Wheat offal</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Bone meal</td>
<td>4.00</td>
<td>3.00</td>
<td>2.50</td>
</tr>
<tr>
<td>Salt</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Vitamin Premix</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Parameters</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Dry matter content (%)</td>
<td>86.03</td>
<td>87.70</td>
<td>84.70</td>
</tr>
<tr>
<td>Moisture content (%)</td>
<td>14.00</td>
<td>12.30</td>
<td>15.30</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>21.51</td>
<td>20.07</td>
<td>22.50</td>
</tr>
<tr>
<td>Ether Extract (%)</td>
<td>0.51</td>
<td>1.26</td>
<td>0.67</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>7.59</td>
<td>5.44</td>
<td>6.22</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>9.3</td>
<td>5.32</td>
<td>10.33</td>
</tr>
<tr>
<td>ME kcal/kg</td>
<td>2428</td>
<td>2124</td>
<td>2232</td>
</tr>
</tbody>
</table>

**Macro minerals**

- Calcium (mg/kg) | 72.31 | 58.64 | 63.66 | 3.58 |
- Magnesium (mg/kg) | 125.34 | 73.11 | 155.28 | 73.54 | 106.81 | 37.96 |
- Potassium (mg/kg) | 289.01 | 303.26 | 275.10 | 288.68 | 13.30 | 4.61 |
- Sodium (mg/kg) | 76.35 | 82.24 | 76.51 | 76.58 | 5.86 |
- Phosphorus (mg/kg) | 173.07 | 136.89 | 158.84 | 144.46 | 27.90 | 19.31 |

**Vitamin premix contains the following per kg of feed:** Vit A = 5,000,0000IU, Vit D3 = 1,000,000IU, Vit E = 1875IU, Vit K = 1255gm, Thiamin (B1) = 0.6255gm, Riboflavine = 1.875gm, Calcium panthothenate = 2.8kg, Nicotin acid = 5.625gm, Pyridoxin = 0.625gm, Vit B12 = 5gm, folic acid = 0.31gm, Biotin = 0.1gm, Cholin chloride = 150gm, methionine = 75gm, Manganese = 5gm, Iron = 10gm, Copper = 1.5gm, Iodine = 0.5gm, Cobalt = 1.0gm, Selenium = 0.05gm, Antioxidiane 50gm, Antimold = 7.5gm, Nigrovin = 10gm, lysine = 75gm.

*Table 2: Proximate and Mineral Compositions of PKSA based Diets in Starter Broiler Feeds*
Manganese (mg/kg)   3.26  3.15  2.44  2.96  0.36  12.16  
Iron (mg/kg)       12.35 16.32 14.45  1.64  11.35  
Copper (mg/kg)     0.86  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  0.37  0.55  0.45  0.08  17.77  
Na/K ratio         0.27  0.28  0.62  7.41  

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

Performance Determination

The birds initial live weights were ascertained at day 0 and their final weights measured at day 28 of the experiment. Also measured were, feed intake, weight gain, and average daily weight gain and feed conversion ratio (FCR).

Data Analysis

Data obtained were subjected to analyses of variance using SPSS Users Guide, version 20.0 (SPSS, 2012) and the differences between the treatment means were compared using the Duncan Multiple Range Test.

Results and Discussion

The performance data of chicks subjected to 28 days feeding with the experimental diets are presented in table 2. It was observed that by the end of the 4 weeks starter period, T2 and T3 birds had averaged similar growth performance values with T1 especially in final body weight, weight gain, average daily weight gain and average daily feed intake. This is expected following the 7th day growth performance results earlier reported by Ohanaka et al. (2018). Specifically, the values generated from T1 – T3 were statistically similar (p>0.05) and significantly different from the T4 values (p<0.05) with FCR values following the same trend. The reduction in growth parameter values beyond T3 may have been due to the reduced feed intake observed in birds with the highest inclusion level of PKSA in their diet. Earlier studies have shown that feed intake and weight gain decreases with increasing levels of plant ash in the diets of rabbits (Iwu et al., 2013) and pullets (Nwogu et al., 2014). This may be due to some imbalance in the dietary electrolyte content of the T4 diet (Unamba-Opara et al., 2017). According to Mongin (1981) there is a critical effect of changes in the acid-base balance and imbalances in Na⁺+K⁺ - Ca of a diet on appetite, with reduction in weight gain, affecting FCR and mortality rate if not corrected. Dietary electrolyte balance (DEB) has a crucial role in broiler performance, and it is required for proper bone development and litter quality (Oliveira et al., 2010). In the present study we did not calculate DEB of the experimental diets due to the fact that the Ca contents of the feeds could not be assayed (lack of laboratory facility). However, the increasing addition of PKSA to the diets probably altered the DEB of the diets leading to poor appetite, especially in the T4 birds.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1</th>
<th>T2</th>
<th>T4</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight(g)</td>
<td>38.63</td>
<td>38.53</td>
<td>39.90</td>
<td>1.38</td>
</tr>
</tbody>
</table>

Table 3: Performance of broiler chicks fed starter diets supplemented with PKSA

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Final weight (g)  | 848.79<sup>a</sup> | 834.31<sup>a</sup> | 793.03<sup>b</sup> | 693.12<sup>b</sup> | 20.6  
Weight gain(g)  | 808.86<sup>a</sup> | 795.68<sup>a</sup> | 754.50<sup>b</sup> | 654.22<sup>b</sup> | 19.95  
Avg. daily weight gain(g)  | 28.89<sup>a</sup> | 28.42<sup>a</sup> | 26.94<sup>b</sup> | 23.36<sup>b</sup> | 0.71  
Feed intake (g/bird/day)  | 49.34<sup>a</sup> | 51.53<sup>a</sup> | 48.19<sup>b</sup> | 44.66<sup>b</sup> | 0.93  
Feed conversion ratio (FCR)  | 1.71<sup>b</sup> | 1.81<sup>b</sup> | 1.79<sup>b</sup> | 1.91<sup>a</sup> | 0.09  
Growth efficiency ratio (GER)  | 1.50 | 1.53 | 1.39

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

**Conclusion and Recommendation**

All the performance characteristics evaluated were similar up to T3 beyond which a decline was recorded. Therefore, the inclusion of PKSA up to T3 in starter broiler diets is nutritionally safe and could therefore serve as an alternative source of mineral for house hold poultry producers.

**References**


