NINETEENTH BIENNIAL CONFERENCE

THEME:
CLIMATE CHANGE AND LIVESTOCK DEVELOPMENT

UNIVERSITY OF CAPE COAST, GHANA

5 - 8 August, 2015
Performance and Blood Metabolites in Broiler Chickens Fed Heat-Treated Jatropha Seed Cake-Based Diets

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Abstract

The study was carried out to investigate the utilization of heat-treated Jatropha Seed Cake (JSC) in the diets of broiler starter chickens and its effects on performance characteristics, serum biochemistry and haematology. In a 28-day feeding trial using a completely randomized design, two hundred seven-day old Arbor Acre broiler chicks were weighed and randomly allotted to 4 dietary treatments, each with 5 replicates of 10 birds each. Treatment 1 was the basal diet (corn-soyabean meal) with no JSC. Treatments 2, 3 and 4 contained the basal diet plus 5, 10 and 15% JSC respectively. Weekly weight gain, feed intake and percentage mortality of birds were assessed. On day 28, blood samples were collected from the jugular vein of two birds from each replicate, for haematological and serum biochemical analyses. Data were analyzed using descriptive statistics and ANOVA at α<0.05. The results showed that the highest final live weight (FW) (1002g/b) and weight gain (WG) (872.1g/b) were recorded on the control diet; while the least FW (685.38g/b) and WG (553.98g/b) were in birds on 15% JSC diets respectively; birds on 5 and 10% JSC had similar FW and WG values. Identical feed intake was observed in birds on the 10 and 15% JSC diets; these were significantly (P<0.05) lower than those recorded for birds on the control and 5% JSC diets. A similar trend was recorded in Feed Conversion Ratio (FCR) of birds on the various dietary treatments. FCR in birds on the control, 5% and 10% JSC-based diets were significantly (P<0.05) improved compared with those on the 15% JSC diet. There was no mortality recorded for birds on the experimental diets. There were no significant differences in the creatinine, total protein, albumin, globulin, albumin:globulin ratio, and urea levels in blood for birds on the experimental diets. It was also observed that dietary treatments had no effect on packed cell volume, red blood cell, white blood cell, lymphocyte, heterophil, monocytes, eosinophils, basophils and platelets counts in birds fed the control and jatropha seed cake based diets. In conclusion, heat treated jatropha seed cake at varying levels of inclusion (up to 15%) did not elicit any deleterious effect on the growth and blood profile of broiler starter chickens. It can therefore be considered as a potential feed resource in broiler nutrition.
Key Words: Jatropha seed cake, heat treatment, performance, blood parameters, broilers

Introduction

One of the main obstacles to growth of the livestock industry in most developing countries is the high cost of feed which often accounts for 60-80 percent of the total cost of production (Lawrence et al., 2008). A pragmatic approach being explored by animal scientists to solve this problem is the use of cheap and readily available, but less utilized waste products of agro-industries, to replace conventional feedstuffs, in order to reduce feed costs. The Jatropha plant, *Jatropha curcas*, is a multipurpose drought resistant shrub belonging to the family *Euphorbiaceae*. It is extensively cultivated in Central and South America, Africa, and Southeast Asia (Schmook and Seralta-Peraza, 1997). The oil from jatropha is mainly converted into biodiesel. After extraction of the oil however, the residue including the seed cake or kernel, is regarded as waste. Improper disposal of this by-product can lead to environmental damage. Jatropha seed cake (JSC) contains 48-60% crude protein, high levels of essential amino acids (excluding lysine), and substantial amounts of energy and minerals (Chivandi et al., 2005). However, it contains anti-nutrients like tannin, saponin, lectin and a toxic principle (phorbor esters) which hinders its utilization in livestock feeding. JSC can be used in broiler diets as replacement for soyabean meal if properly detoxified. Many processing methods have been explored to detoxify JSC but with inherent limitations. The objective of this study therefore was to determine the effect of heat-treated jatropha seed cake on the performance and blood profile of broiler chickens.

METHODOLOGY

Experimental Site

The research work was conducted at the Poultry Unit of the Teaching and Research Farm, University of Ibadan, Oyo state, Nigeria.

Management of Birds and Experimental Diets

Two hundred (200) seven-day old Arbor Acre broiler chicks were used for this study; the chicks had previously been brooded for one week after delivery, and
then allotted to 4 dietary treatments consisting of 5 replicates of 10 birds each, in a completely randomized design. The jatropha seeds were sourced from a jatropha plantation in Ibadan, Oyo State, Nigeria. The processing method was done to simulate the technique used by local farmers. The experimental diets were offered *ad libitum* and birds had free access to clean drinking water. Four diets were formulated with varying inclusions level of jatropha seed cake (JSC) to substitute for soyabean meal (SBM) to meet the requirements of broiler chickens (NRC, 1994). Treatment 1 was the basal diet (corn-soyabean meal) with no JSC. Treatments 2, 3 and 4 contained the basal diet plus 5, 10 15% JSC included at the expense of SBM respectively.

**DATA COLLECTION**

Feed intake was calculated as the difference between amounts offered and left over. The birds were weighed at the start and end of the study, with changes in values used to calculate body weight gain and feed conversion ratio. On day 28, blood was collected from the jugular vein of two birds from each replicate treatment and placed into two vaccutainer tubes for each bird; one of the two tubes contained Ethylene Diamine Tetracetic Acid (EDTA) for haematological study, while the other vaccutainer tube was sterile i.e. without EDTA to be used for serum biochemical analyses.

**Haematological Parameters**

Red Blood Cell and White Blood Cell (WBC) counts were determined the Neubauer haemocyтомeter, after the appropriate dilution. Packed cell volume (PCV) was determined as described by Wintrobe (1956) using the Wintrobe haemocytometer method. WBC differential leukocyte counts were performed using the oil – immersion objective examination of blood films stained with the modified Romanowsky’s Giemsa stain (Wittekind and Kretschmer, 1987).

**Serum Metabolites**

The biuret method was utilized in the determination of the total protein fraction while the serum albumin was subjected to the direct colorimetric method for albumin with Bromocresol Green (BCG) as the dye as described by Peters *et al.* (1982). Serum creatinine was determined by Jaffe reaction and serum urea was determined by the dimethyl monoxide method (Baily *et al.*, 1967).
Chemical and Statistical Analyses

The proximate composition of the diets was determined using the methods of AOAC (2000). Data obtained were analyzed using ANOVA (SAS, 2008); significant level of P = 0.05 was used. The treatment means were compared using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The results from performance characteristics of broilers fed varying levels of heat-treated Jatropha seed cake (JSC) are shown in Table 1. The highest final live weight (1002g/b) and weight gain (872.1g/b) were recorded in birds on the control diet, while the least FW (685.38g/b) and WG (553.98g/b) were for birds on the 15% JSC diet respectively; birds on the 5% and 10% JSC had similar FW and WG values.

Table 1: Performance characteristics of birds fed varying levels of heat-treated

<table>
<thead>
<tr>
<th>Jatropha Seed Cake-Based Diets</th>
<th>Parameters</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>SEM</th>
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<tbody>
<tr>
<td></td>
<td>IW (g/b)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>129.90</td>
<td>129.30</td>
<td>129.96</td>
<td>131.40</td>
<td>2.54</td>
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<tr>
<td></td>
<td>FW (g/b)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1002.00</td>
<td>856.02</td>
<td>799.72</td>
<td>685.38</td>
<td>30.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WG (g/b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>872.10</td>
<td>726.72</td>
<td>669.76</td>
<td>553.98</td>
<td>31.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FI (g/b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1419.18</td>
<td>1242.40</td>
<td>1158.24</td>
<td>1118.94</td>
<td>38.33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FCR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.63</td>
<td>1.70</td>
<td>1.70</td>
<td>1.96</td>
<td>0.07</td>
<td></td>
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<tr>
<td></td>
<td>M (%)</td>
<td></td>
<td></td>
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<td></td>
<td>0</td>
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</tbody>
</table>

Means on the same row with different superscripts are significantly different (P < 0.05) g/b = gram per bird, W= initial weight, FW= final weight, WG= Weight Gain, FI= Feed intake, FCR = Feed conversion ratio, SEM= Standard error of mean, M= mortality

The final live weight and weight gain in birds on the experimental diets showed that inclusion of Jatropha seed cake (JSC) in the diet of broilers did not affect body weight gain at the various inclusion levels adopted when compared with birds on the control diet. This result is in agreement with the experiment conducted by Pasaribu et al. (2010) who fed broiler chicks on diets with jatropha seed meal (at 4% inclusion) processed using different methods of detoxification. This however contradicts findings of Adenuga (2014) who reported an increase in growth rate of broiler chickens fed Jatropha seed cake diets.
reported significant weight losses in growing Japanese quails fed 15-20% inclusion levels of JSC. Identical feed intake was observed in birds on the JSC-based diets in this study; these were significantly (P<0.05) lower than for birds on the control diet. This observation was similar to the findings of Pasaribu et al. (2010) who reported significant decrease in the feed intake of birds fed both physically and chemically treated JSM compared with birds on a control diet. Feed conversion ratio (FCR) of birds on the control diet, as well as the 5% and 10% JSC-based diets were significantly (P<0.05) improved compared with those on the 15% JSC diet. This however disagreed with findings of Anongu et al. (2010) who concluded that the inclusion of JSM had no significant effect on FCR in monogastric rats. There was no mortality recorded for birds on all the experimental diets in this study. This again was contrary to the findings of Adenuga (2014) who reported 50-90% mortality levels in growing Japanese quails fed 10-15% JSC-based diets. This is probably because JSC used in this study was allowed to ferment further for 21 days before incorporating into the broiler diets. Table 2 shows the result of serum biochemical indices and haematological parameters of broiler chickens on Jatropha seed cake diets.

Table 2: Blood Indices of Broiler Chickens on Varying Levels of Jatropha Seed Cake-Based Diets

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Normal range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine (mg/100ml)</td>
<td>0.49</td>
<td>0.34</td>
<td>0.33</td>
<td>0.54</td>
<td>0.07</td>
</tr>
<tr>
<td>Total protein (g/dL)</td>
<td>3.42</td>
<td>3.58</td>
<td>3.56</td>
<td>3.44</td>
<td>0.15</td>
</tr>
<tr>
<td>ALB (g/dL)</td>
<td>1.73</td>
<td>1.90</td>
<td>1.79</td>
<td>1.78</td>
<td>0.08</td>
</tr>
<tr>
<td>GLO (g/dL)</td>
<td>1.69</td>
<td>1.67</td>
<td>1.76</td>
<td>1.66</td>
<td>0.14</td>
</tr>
<tr>
<td>ALB/GLO (g/dL)</td>
<td>1.07</td>
<td>1.18</td>
<td>1.03</td>
<td>1.09</td>
<td>0.12</td>
</tr>
<tr>
<td>Urea (mg/100ml)</td>
<td>4.87</td>
<td>4.45</td>
<td>5.02</td>
<td>5.58</td>
<td>0.35</td>
</tr>
<tr>
<td>Packed cell volume (%)</td>
<td>31.80</td>
<td>33.70</td>
<td>32.20</td>
<td>33.06</td>
<td>1.80</td>
</tr>
<tr>
<td>Red blood cell (x10^12/L)</td>
<td>3.43</td>
<td>3.40</td>
<td>3.39</td>
<td>3.55</td>
<td>0.07</td>
</tr>
<tr>
<td>White blood cell (x10^12/L)</td>
<td>17.98</td>
<td>16.95</td>
<td>17.11</td>
<td>16.78</td>
<td>0.43</td>
</tr>
<tr>
<td>Lymphocyte (%)</td>
<td>63.80</td>
<td>65.00</td>
<td>64.90</td>
<td>57.40</td>
<td>2.37</td>
</tr>
<tr>
<td>Heterophils (%)</td>
<td>27.40</td>
<td>29.40</td>
<td>29.70</td>
<td>35.40</td>
<td>2.97</td>
</tr>
<tr>
<td>Monocyte (%)</td>
<td>3.60</td>
<td>3.20</td>
<td>2.96</td>
<td>3.70</td>
<td>0.37</td>
</tr>
<tr>
<td>Eosinophils (%)</td>
<td>4.80</td>
<td>4.10</td>
<td>4.20</td>
<td>3.70</td>
<td>0.71</td>
</tr>
<tr>
<td>Basophils (%)</td>
<td>0.40</td>
<td>0.30</td>
<td>0.20</td>
<td>0.30</td>
<td>0.13</td>
</tr>
<tr>
<td>Platelets (x10^5/L)</td>
<td>141.50</td>
<td>139.90</td>
<td>127.70</td>
<td>126.70</td>
<td>46.26</td>
</tr>
</tbody>
</table>

Means on the same row with the different superscripts are significantly different (P<0.05) ALB =Albumin, GLO = Globulin, SEM = Standard error of mean, *Normal haematological ranges for broiler chickens.
CONCLUSION

Heat-treated jatropha seed cake at varying inclusion levels did not elicit any deleterious effect on the growth and blood metabolites of broiler starter chickens. It can therefore be considered as a potential feed resource in broiler nutrition.

References


parameters of broiler similar in all the treatments (Mitruka and Rawnley, et al., 2008). The diets contain adequate levels of essential nutrients which can compromise and cause compromised parameters.

Nutrition levels did not elicit any metabolites of broiler starter feed resource in broiler


