GROWTH PERFORMANCE AND ECONOMY OF REPLACING MAIZE WITH COMBINATIONS OF BREWERS’ GRAINS, JACK BEAN AND CASSAVA ROOT MEAL IN BROILER FINISHER RATIONS

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ABSTRACT: This study was done to determine the effect of complete replacement of maize with maize/sorghum-based brewers’ dried grains (MSBDG), jackbean (JB) and cassava root meal (CRM) on performance of finisher broilers and the feed cost implication of using these test materials as the major energy sources. Four experimental diets T1, T2, T3 and T4 were formulated to contain maize, MSBDG, JB and CRM in the following proportions 60, 0, 0%; 0, 20, 15, 25%; 0, 20, 20, 20%, and 0, 20, 25, 15% respectively. Other ingredients were the same for the four diets. One hundred and sixty eight (168) 4-week-old Hubbard broilers were divided into 4 treatment groups of 42 birds each; and each group subdivided into 3 replicates of 14 birds per replicate. Each treatment group was randomly assigned to an experimental diet in a completely randomized design (CRD) experiment. The feed intake of T1, T2 and T4 birds were similar (P>0.05) but lower (P<0.05) than that of T3 birds. There was no significant (P>0.05) difference in daily weight gain between T1 (1.70g) and T2 (1.55g) birds. The feed conversion ratio of T1 birds was better (P<0.05) than T2, T3 and T4 birds. The feed cost of N195.58 for T4 required to produce 1kg meat was lower than the cost of N214.50 required for meat production in T1. Generally, the MSBDG/JB/CRM feeds produced 1kg meat at costs 6.17%, 3.71% and 8.82% for T2, T3 and T4 lower than the T1 diet.

Keywords: Broilers, feed ingredient combinations, performance

INTRODUCTION

The conventional energy ingredient in poultry ration is maize. Maize and/or guinea corn constitutes over 50% of the diet for the different classes of poultry (Iyayi, 2009). Since intake of other nutrients is controlled by energy intake, it becomes imperative that poultry rations contain ingredients that will supply adequate amount of energy to meet the birds’ requirement for production.

Maize is a staple for humans, livestock and poultry, and now fuel. This rising demand for maize for alternative uses has driven the cost of maize upwards (Good, 2006). Nigeria has never produced enough maize to meet the demand for human consumption, the beverage industries and livestock production. Whereas in the United States, maize is grown largely for livestock feeding with about 80 – 90% maize included in the rations for cattle, in Nigeria none of the sectorial units of the nation’s industry that use maize hardly get enough. It could be attributed in part to its poor yield. FMWR (2008) has reported that the potential yield of maize is about 8 tons/ha while the actual average yield is about 3.9 tons/ha. Similar pattern was reported for millet, sorghum, rice and some tubers like sweet potato and cassava.

According to Uchegbu et al. (2004), prices of feed ingredients have gone so much high that poultry producers in Nigeria are focusing on unconventional alternatives rather than on conventional ones like maize, soybean and other possible ingredients to achieve reduced cost of production. At present, the astronomical rise in the prices of these conventional ingredients (maize, soybean, groundnut cake and fish meal) has put enormous pressure on the poultry farmer to look for alternatives.


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A brief survey of literature shows that efforts have been made by researchers in Nigeria for over four decades to find alternative sources of feeds from unconventional feed ingredients that are readily available at reasonable prices (Udedibie and Emenalom, 1993; Uchegbu et al., 2004). Each of these researchers has succeeded in reducing the maize component of the diets incompletely. Thus there appeared to be no alternatives as good as maize. Hence there is need for a continued search for an ingredient or combinations of ingredients that would simulate maize in poultry diet. Maize/sorghum brewers’ dried grain is the extracted residue of maize and sorghum which resulted from the production of beer. It is a moderate source of energy and contains a high percentage of protein relative to maize (Uchegbu, 1995).

Raw jackbean contains 28.5% crude protein, 7.8% crude fibre, 3.1% ether extract. However, the crude protein content of jackbean has been reported to drop to 25% after boiling or autoclaving (Udedibie, 2003); in an effort to reduce its anti-nutritional contents such as canavanine, concanavalin A, urease, canatoxin, etc. (Udedibie et al., 2004). Cassava root is abundantly produced in Nigeria, especially Eastern Nigeria, and the mature root can be left in the soil for as long as two years (Irvine, 1979), hence it is available throughout the year. Cassava root meal has been reported to be low in protein (2.4%) (Aduku, 1993) and relatively high in energy (3620 kcal/kg ME). Attempts to use cassava as a source of energy in poultry diets as replacement for maize have, however, yielded conflicting results. This is because cassava tuber contains cyanogenic glucoside, linamarin. Linamarin is deglycosylated by the enzyme, linamarase, yielding acetone cyanohydrins, which spontaneously converts to hydrogen cyanide once it is ingested (Sayre, 2007). Methods of detoxifying cassava tubers include sun drying (Odukwe, 1994) cooking, (Okeke et al., 1985), use of additives (Obioha et al., 1984) and fermentation (Udedibie et al., 2004). The price of cassava is low relative to maize, although man also consumes it. Having considered the attributes of brewers’ dried grains, jackbean and cassava, it appeared that appropriate combinations of these ingredients could result in product(s) which could serve as a major energy source in complete replacement of maize in finisher broiler ration.

The objective of this study is therefore to evaluate the performance, of finisher broilers fed diets containing combinations of BDG, jackbean and cassava root meal in complete replacement of maize and the cost effectiveness of using such diets in finisher broiler production.

MATERIALS AND METHODS

Experimental Site
This research was carried out in the Poultry unit of the Teaching and Research Farm of the Department of Animal Science and Technology, Federal University of Technology, Owerri, Imo State. Imo state (4°4’ - 6°3’N, 6°15’ - 8°15’E) is situated in south-eastern agro-ecological zone of Nigeria.

Sources and Processing test ingredients
The maize/sorghum-based brewers dried grains used for this study was obtained from Consolidated Breweries Plc., Awo-Omamma, Imo State, the brewers of ‘33’ Export Larger Beer. It was sundried for 5 day. The brewers dried grains was then run through a hammer mill to break up its lumps before being used in ration formulation. The jackbean used for this experiment was obtained from Jos, Plateau State. The jackbean was cracked, and then soaked in water for 2 days, boiled for 1 hour, then sundried and milled before use in the formulation of the experimental diet. The cassava tubers used for this experiment were produced at Mbirichi – Ohaji, Imo State. The whole fresh tubers were cut in small slices of about 0.1 – 0.2cm and then spread on a platform under the sun to dry. These slices were completely dried within 5 days. The dried cassava chips were then milled to produce the cassava root meal (CRM). Each of these 3 feedstuffs (MSBDG, JB and CRM) was sent for proximate analysis using standard methods (AOAC, 1995).

Experimental diets, birds and design
Maize/sorghum-based brewers dried grains, jackbean and cassava root meal which were combined at varying proportions to completely replace maize in all the diets except in the control diet as shown in Table 1. One hundred and sixty eight (168) broiler chicks at 4 weeks of age were selected for this trial. The birds were divided into 4 groups of 42 birds each. Each group was subdivided into 3 replicates of 14 birds in a completely randomized design experiment. Each group was randomly assigned to an experimental diet. The experimental diets were weighed daily and fed to the birds at about 8:00 am. Before feeding the birds the following morning, the leftover feeds of the previous day were weighed in order to obtain a record of the daily feed intake. Water was supplied ad libitum. However, stale water was changed daily and drinking trough thoroughly cleaned before filling with fresh water every morning. Damp litters were usually removed and replaced with fresh ones.

Data collection
The birds were weighed at the beginning of the experiment and weekly thereafter. Feed intake was determined by the difference between the quantity offered and the leftover the following morning. The experiment lasted for 5 weeks. Data were collected on initial body weight, final body weight, daily weight gain, feed intake, feed conversion ratio, and mortality.

Data analysis
Data collected on daily weight gain, feed intake and feed conversion ratio were subjected to one-way analysis of variance (ANOVA). Where significant treatment effects were detected from the ANOVA, means were compared using Duncan’s new multiple range test as outlined by Steel and Torrie (1980).

RESULTS AND DISCUSSION
The result of the proximate values of maize/sorghum-based brewers’ dried grains, jackbean, cassava root meal and maize is shown in Table 2. The crude protein of MSBDG (19.14%) was lower than the crude protein of jackbean (22.84%). The crude protein value of maize (9.0%) was higher than that of CRM (3.59%). The crude fibre values of MSBDG, JB and CRM were 9.45%, 8.80% and 3.70% respectively; and each of these was higher than the crude fibre content of T1, T2 and T3, and this reflected the lower energy values of these diets relative to T2.

Table 1 - The ingredient compositions of experimental diets fed to finisher broilers

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Diets (% inclusion levels of test ingredients)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>White maize</td>
<td>60.00</td>
</tr>
<tr>
<td>MSBDG</td>
<td>-</td>
</tr>
<tr>
<td>Jackbean</td>
<td>-</td>
</tr>
<tr>
<td>Cassava root meal</td>
<td>-</td>
</tr>
<tr>
<td>Calculated nutrient analysis (%)</td>
<td></td>
</tr>
<tr>
<td>Crude protein</td>
<td>19.56</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>4.27</td>
</tr>
<tr>
<td>Ether extract</td>
<td>4.04</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.26</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.81</td>
</tr>
<tr>
<td>ME (Kcal/Kg)</td>
<td>2906.89</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION
The result of the proximate values of maize/sorghum-based brewers’ dried grains, jackbean, cassava root meal and maize is shown in Table 2. The crude protein of MSBDG (19.14%) was lower than the crude protein of jackbean (22.84%). The crude protein value of maize (9.0%) was higher than that of CRM (3.59%). The crude fibre values of MSBDG, JB and CRM were 9.45%, 8.80% and 3.70% respectively; and each of these was higher than the crude fibre value of maize (2.8%).

Table 2 - Proximate Composition of Maize/Sorghum-based brewers’ dried grains (MSBDG), Jackbean (JB), Cassava Root Meal (CRM) and Maize

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>MSBDG</th>
<th>JB</th>
<th>CRM</th>
<th>Maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content (%)</td>
<td>12.80</td>
<td>13.05</td>
<td>12.25</td>
<td>10.50</td>
</tr>
<tr>
<td>Dry matter (%)</td>
<td>87.20</td>
<td>86.95</td>
<td>87.75</td>
<td>89.50</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>19.14</td>
<td>22.84</td>
<td>3.59</td>
<td>9.0</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>9.45</td>
<td>8.80</td>
<td>3.70</td>
<td>2.8</td>
</tr>
<tr>
<td>Ether extract (%)</td>
<td>7.08</td>
<td>2.08</td>
<td>0.70</td>
<td>4.2</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>4.30</td>
<td>4.00</td>
<td>2.40</td>
<td>1.5</td>
</tr>
<tr>
<td>Nitrogen free extract (%)</td>
<td>47.23</td>
<td>49.23</td>
<td>77.36</td>
<td>72.0</td>
</tr>
<tr>
<td>HCN (mg / 100g)</td>
<td>-</td>
<td>-</td>
<td>2.81</td>
<td>-</td>
</tr>
</tbody>
</table>

The crude protein content of cracked, soaked and cooked jackbean (22.84%) was lower than 25.5% which is the CP value for jackbean cooked for 1 hour as reported by Udedibie (2003). The cassava root meal is lower than MSBDG and Jackbean in both crude protein and crude fibre but higher in metabolize energy.

The feed intake of the control birds (T1) was similar (P>0.05) to that of the T4 birds. The feed intake of bird on T4 was significantly (P<0.05) higher than that of T1 and T2. There was a general increase in feed intake values arising from the various combinations of MSBDG, JB and CRM, and this reflected the lower energy values of these diets relative to the control – a condition which encouraged increased feed intake to enable the birds meet their energy requirement (Hill and Danksy, 1954). However, the drop in feed intake of the group on T4 despite its least energy value could be attributed to its high fibre (7.31%) which was quite above the recommended value of 5.5% for finisher broilers (Obioha, 1992).

There was no significant (P>0.05) difference in average daily weight gain between T1 and T2 birds. The birds on T3 and T4 had significantly (P<0.05) lower daily weight gain than the control (T1) (Table 3). The reason for the similarity in the daily weight gain of the birds on T1 and T2 could be associated with the fact that the crude fibre content of T2 was not high enough as to impede feed consumption and utilization; thus the birds were able to compensate for low energy value of the diet by increasing consumption. The feed conversion ratio of T1 birds was significantly (P<0.05) lower and better than that of T2, T3 and T4 birds, which were similar. This agrees with the report of Afolayan et al.
that birds on lower energy diet would have poor feed conversion efficiency when compared with high energy diet whether in wet, hot or cold season. Birds on low energy diet and high fibre consume more water than those on high energy diet across the three seasons, thus explaining its lower feed intake, lower metabolizable energy as water is consumed at the expense of feed. The number of birds that died in T1 and T4 was 1 each, and no death recorded in T2 and T3. The mortality records were quite low and were not ascribed to the experimental diets.

In terms of feed cost required to produce one kilogram of meat, T4 diet had the least cost of production of N195.58 per kg meat produced while the T1 (control) recorded the highest cost of N214.50 per kg meat produced (Table 4). Therefore, based on the cost of feed required to produce 1kg meat, the various combinations of MSBDG, JB and CRM which resulted in diets T2, T3 and T4 produced 1kg broiler meat at rates 6.17%, 3.71% and 8.82% cheaper for T2, T3 and T4 than the maize based diet (T1).

**CONCLUSION**

This experiment has revealed that maize could be replaced completely with maize/sorghum-based brewers’ dried grains, jackbean and cassava root meal at 20 : 15 : 25 for finisher broiler, producing similar growth rate to the control diet. The superiority of maize-based diet (control) over 20 : 15 : 25 as evidenced in lower feed intake and lower feed conversion ratio is compensated for by the lower feed cost required to produce 1kg weight of broiler meat using MSBDG/Jackbean/CRM combination.

**REFERENCES**

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