Effect of Feeding Graded Levels of Decorticated Pigeon Pea (Cajanus Cajan) Seeds on Broiler Chicks Performance

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Abstract— This study was conducted at Alneelain University farm, Jebel Awlia, Khartoum, Sudan, to assess the performance of broiler chicks fed on graded levels of decorticated Pigeon pea (Pp) Cajanus cajan seeds as a replacer to sesame cake. Two hundred unsexed Ross hybrid one day old broiler chicks were randomly assigned into 5 groups, 40 chicks each and randomly divided into 4 replicates of 10 chicks each in 5 feed treatments inside an open sided deep litter poultry house. They were fed (0%, 3%, 6%, 9% and 12%) levels.

The study results showed significant (P ≤ 0.05) improvement in feed intake, Feed conversion ratio (FCR) weight gain and final body weight by decortications and increasing rate of inclusion of (Pp) progressively. Incorporation of (Pp) at 12 % level followed by 9% gain the best results for all parameters studied but 6% incorporation did not show any significant (P ≥ 0.05) difference from 9 and 12% inclusion rates indicating best option for incorporation. Serum proteins and uric acid were within normal levels for all incorporation rates. Mortality ranged from 2.5-10% being highest at 12% incorporation level.

It was concluded from this study that broilers can perform well up to 12% incorporation rate of (Pp) as a substitute to sesame cake.

Index Terms— Pigeon pea, Sesame cake, Performance, Blood parameters, Uric acid, Mortality.

I. INTRODUCTION

Pigeon pea (Cajanus cajan) which is known locally as 'lobia adassy' is an important source of plant proteins for human beings and livestock in the tropics and semi arid tropics of the world [1]. Its seeds are considered non-conventional poultry feed and are available potential protein source and resource that can avail an option or protein substitute in poultry feeding in many parts of the country. The Food and Agricultural Organization (FAO) [2] reported that in 2006, pigeon pea (Pp) is cultivated in over 4.63 M hectares in 20 major producing countries and according to [3], the area cultivated has jumped to over 4.92 M hectares. Traditionally (Pp) is grown in northern and central Sudan as minor crop, around the irrigation canals of the Gezira scheme and in western Sudan as rain fed crop [4].

Pigeon pea is a rich protein source in which, crude protein (CP) varies from 12 to 32% [5]. It is also rich in carbohydrates, minerals and sulfur-containing amino acids, methionine and cystine [6].

Some studies were conducted to evaluate the seed value in poultry nutrition to determine best levels of incorporation. Some studies used raw seeds up to 15-30% incorporation [7]. These studies showed that 30% inclusion rate significantly (P ≤ 0.05) reduced body weight and increased feed conversion ratio in broiler chicks. They attributed that to high amounts of trypsin and chymotrypsin inhibitors in raw (Pp) and they indicated that decortications reduced the effects of antinutritional factors. Awdallah, [8] evaluated feeding 7.5% and 15% levels of corticated and decorticated (Pp) seeds on Lohman broiler chicks and found significantly (P < 0.05) better feed intake and weight gain for the birds fed 7.5% decorticated (Pp) seeds.

Abdelati, et al., [9] assessed feeding different processed (Pp) seeds on broiler performance. Their results of inclusion of 10% soaked (Pp) seeds, decorticated (Pp) seeds with added enzymes and decorticated (Pp) roasted seeds showed no significant treatment effect on feed intake, weight gain, FCR and final body weight. Other researchers, [10] reported that processing of (Pp) seed improved dry matter and crude protein retention.

Evaluation of plasma metabolites in birds allows for the identification of metabolic alterations due to several factors, including physiological and husbandry conditions [11]. The total avian blood protein ranges between 3-6 g/dl and normal avian blood uric acid values for most birds range between 2-15 mg/dl [12].

In an attempt to explore more possibilities of the use of decorticated (Pp) seeds in poultry feeding the present research was carried out to assess the effects of feeding (3%, 6%, 9% and 12%) levels of decorticated (Pp) seeds on broiler feed intake, Feed conversion ratio (FCR) weight gain and final body weight and some blood metabolites.

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II. MATERIALS AND METHODS

Experimental site, housing and duration

The research study was conducted at Alneelain University poultry farm at Jebel Awlia, Khartoum (latitude 15°N), Sudan, during the period from May 4th to June 22nd 2005 to assess the effects of feeding graded levels (3%, 6%, 9% and 12%) of pigeon pea (Pp) on broiler performance as a replacer to sesame cake. Deep litter open housing system partitioned into 20 pens 1×1 meter was used. Pens were cleaned and disinfected before housing the chicks. One feeder and one drinker were supplied for each pen. Continuous lighting programme was applied for 24 hours as natural and supplemented artificial light throughout the experimental period.

Experimental birds

Two hundred unsexed one day old commercial broiler chicks (Ross) from Coral Company were used for the study. Chicks were weighed individually, divided randomly into 5 groups of 40 chicks each allotted in 4 replicates of 10 chicks each and randomly distributed into 20 pens 1×1 meter each for 10 baby chicks. Initial weights for all the chicks were taken and adjusted round 41.5 gram / chick. All chicks were vaccinated against Newcastle (days 7 and 21) and Gumboro diseases (day 12) in drinking water.

Experimental diets

Pigeon pea seeds were soaked in water for 12 hours, dried for 3 days and then mechanically decorticated. The corticated and decorticated seeds were chemically analyzed at the Animal Production Research Centre laboratory at Kuku, Khartoum.

Tables 1 and 2 show the ingredients compositions of the experimental diets and the determined and calculated analysis respectively, based on the actual analysis and literature values [13, 14] of composite samples of feed ingredients involved. Metabolizable energy (ME) was calculated according to the modified equation of [15]. Diets were formulated to meet the requirements of broilers chicks for essential nutrients as outlined by [14]. The analysis of ingredients of (Pp) seed and other feeds used in ration formulation was carried out according to the Association of Official Analytical Chemist [16].

Productive traits

Body weight, feed intake, weight gain, feed conversion ratio (FCR) and mortality rate were recorded weekly for each dietary treatment and were calculated for each individual replicates of each dietary treatment and for each dietary group. Mortalities were recorded whenever occurred and tabulated weekly for each treatment.

Serobiochemical blood analysis

One bird was randomly selected from each replicate, tagged and used for hematological analysis by drawing blood from the wing vein under sterilized conditions where the skin was first dampened with 70% alcohol to disinfect the area and make the vein more visible (12). Serum was analyzed for total protein, albumin, globulin and uric acid at the National Stack Laboratory in Khartoum using Dry-chem 7000 system (Fuji Medical System Co. Ltd., Japan; Catalog number: Fujifilm DRICHEM 7000).

Statistical analysis

The data were subjected to analysis of variance, and the least significant difference (LSD) was used to separate the means as described by [17].

| Table (1). Ingredients composition of experimental diets on percent basis |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Ingredients                | Level of Pigeon pea in the diet | 0.0 | 3% | 6% | 9% | 12% |
| Sorghum                    | 65                          | 65  | 65  | 65  | 65  |
| Groundnut cake             | 16.2                        | 16.2| 17.2| 17.2| 17.2|
| Sesame cake                | 12                          | 9   | 6   | 3   | 0   |
| De-corticated (Pp)         | 0                           | 3   | 6   | 9   | 12  |
| Super concentrate          | 5                           | 5   | 5   | 5   | 5   |
| Wheat bran                 | 1                           | 1   | 0   | 0   | 0   |
| Salt                       | 0.1                         | 0.1 | 0.1 | 0.1 | 0.1 |
| Lime stone                 | 0.7                         | 0.7 | 0.7 | 0.7 | 0.7 |
| Total                      | 100                         | 100 | 100 | 100 | 100 |

Super concentrate: A concentrated source of protein, minerals and amino acids containing 35% CP, 12% Ca, 5.8%P, 5.3% Lysine, 2.8% methionine, 1650 Kcal/kg ME plus sufficient amounts of vitamins and minerals.
Table (2). Determined and calculated composition of the experimental diets

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Level of Pigeon pea in the diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>Crude protein</td>
<td>21.58</td>
</tr>
<tr>
<td>Ether extract</td>
<td>4.2</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>4</td>
</tr>
<tr>
<td>Ash</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Determined diet composition

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Level of Pigeon pea in the diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>Crude protein</td>
<td>21.58</td>
</tr>
<tr>
<td>Ether extract</td>
<td>31.32</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>0.808</td>
</tr>
</tbody>
</table>

Calculated according to (13) and actual analysis of sorghum sample

CP= Crude protein
ME= Metabolizable energy

III. RESULTS AND DISCUSSION
Results of the chemical analysis (Table 3) showed that
decorticated (Pp) contained higher crude protein, low crude
fiber and ether extracts values than the undecorticated (Pp)
which indicates better nutritional value for the decorticated
(Pp). This result agrees with [18] who reported similar results
of higher crude protein of 22.5 and low lipids content of 1.3%.
Results were also within the ranges reported by [19] and [20],
where CP, CF, Fats and ash ranged between (22-27%), (7.3-
10%), (1.7-2.1%), and (3.1-4.2%) respectively.

Table (3). Chemical analysis of Pigeon pea (%)

<table>
<thead>
<tr>
<th>Seed treatment</th>
<th>Parameter</th>
<th>Dry matter</th>
<th>Crude protein</th>
<th>Ether extract</th>
<th>Crude fibre</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corticated (Pp)</td>
<td></td>
<td>93.4</td>
<td>19.72</td>
<td>2</td>
<td>11</td>
<td>4.28</td>
</tr>
<tr>
<td>Decorticated (Pp)</td>
<td></td>
<td>93.3</td>
<td>22.25</td>
<td>1.4</td>
<td>3.6</td>
<td>4.47</td>
</tr>
</tbody>
</table>

Table 4 shows the overall performance of feeding graded
levels of (Pp) to broiler chicks. Feed intake and total feed
intake showed progressive increase with increasing inclusion
and incorporation of (Pp). This finding agrees with [21] and
[22] who attributed this increase to the absence of tannin and
palatability improvement. Another explanation reported by
[23] was that decortication probably removes some anti
nutritional or digestion suppressive factors.

Table (4). Performance and mortality of broilers fed on graded levels of (Pp) as a substitute to sesame cake

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Level of (Pp) in the diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>Total weight gain(g)</td>
<td>1750b</td>
</tr>
<tr>
<td>Total feed intake(g)</td>
<td>3635b</td>
</tr>
<tr>
<td>Feed conversion ratio</td>
<td>2.03b</td>
</tr>
<tr>
<td>Final body weight (g)</td>
<td>1792b</td>
</tr>
<tr>
<td>Mortality %</td>
<td>2.52</td>
</tr>
</tbody>
</table>

There was no significant difference between the control and
3% inclusion rate for all parameters studied (Table 4). Inclusion of 9% and 12% showed significant (P < 0.05) improvements for total final body weight, FCR and total feed intake compared to the control and 3% inclusion rate. On the other hand the inclusion rate 6% showed no significant difference between the control, 3%, 9% and 12% inclusion rate in final body weight and total weight gain and FCR suggesting best option for inclusion rate.

Abdelati, et al., [9] reported significant treatment effect on
broiler performance when fed 10% soaked (Pp) decorticated
with added enzymes and decorticated roasted (Pp). No significant effect was found in feed intake, weight gain, FCR and final body weight.

These findings support the assumption that mixing protein
sources or using more than one protein source improves both
growth and FCR [24]. The current study findings support this
assumption as 6% incorporation of each of (Pp) and sesame
cake showed the best option for incorporation compared to
12% (Pp) and 12% sesame cake being not significantly different from the first and of better results than the second. Results of mortality showed irregular trend with increasing level of (Pp) but was highest at the highest level of inclusion. No scientific explanation can be offered for the highest mortality in 12% (Pp) inclusion rate.

The results of serological chemical changes (Table 5) showed no significant treatment effect for the blood parameters studied indicating tolerance of (Pp) dietary incorporation up to 12% level and suggesting no ill-health effect. Values obtained were within the range reported by [12].

### Table 5. Serological chemical changes for feeding graded levels of (Pp) to broilers.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total protein g/l</th>
<th>Albumen g/l</th>
<th>Globulin g/l</th>
<th>Uric acid mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control A</td>
<td>2.6 ± 0.47</td>
<td>0.89 ± 0.24</td>
<td>1.75 ± 0.84</td>
<td>11.76 ± 4.1</td>
</tr>
<tr>
<td>B 3%</td>
<td>2.6 ± 0.47</td>
<td>1.37± 0.24</td>
<td>1.28 ± 0.84</td>
<td>10.81± 4.1</td>
</tr>
<tr>
<td>C 6%</td>
<td>3.56 ± 0.47</td>
<td>1.38± 0.24</td>
<td>2.22 ± 0.84</td>
<td>9.7± 4.1</td>
</tr>
<tr>
<td>D 9%</td>
<td>3.7 ± 0.47</td>
<td>1.5± 0.24</td>
<td>2.20 ± 0.84</td>
<td>20.39± 4.1</td>
</tr>
<tr>
<td>E 12%</td>
<td>3.3 ± 0.47</td>
<td>1.6± 0.24</td>
<td>1.70 ± 0.84</td>
<td>17.28± 4.1</td>
</tr>
</tbody>
</table>

NS: Not statistically significant at (P ≤ 0.05)

gl: gram / liter

### IV. CONCLUSIONS

It was concluded from this study that:

1. Decortication improves the nutritional value of (Pp) and that broilers can perform well up to 12% rate of inclusion without ill-health or deviation from normal.

2. 6% (Pp) incorporation gives the best option of inclusion rate compared with the control, 3%, 9% and 12% incorporation rates.

3. Pigeon pea can replace up to 12% incorporation of sesame cake without jeopardizing broiler performance or the blood protein components and uric acid normal values indicating no negative effects on bird’s health.

4. Two protein sources (6% sesame and 6% pigeon pea) give better performance results than one protein source (12%).

### REFERENCES


