

# Growth indices and cost implications of broiler chicks fed graded levels of cashew nut waste meal in place of soybean meal.

J. AGBEDE\* M. OGUNSIPE and V. ALETOR

School of Agriculture and Agricultural Technology, Division of Nutritional Biochemistry, Department of Animal Production and Health, Federal University of Technology, P.M.B. 704, Akure, Nigeria.

\* Corresponding author: joagbede @ yahoo.com

---

Following the high cost of feeding poultry and other non-ruminants in developing countries, there is a compelling need to explore the possibility of using agro-industrial by products and wastes such as discarded cashew nut-waste (DCNW) in feeding poultry. To this end, a batch of three hundred and sixty Hypeco broiler-chicks aged 7 days was used to investigate the effect of replacing soybean meal (SBM) protein with DCNW protein in the starter diets. Six diets were used for the trial. The control diet contained 250 g kg<sup>-1</sup> SBM protein and this was replaced with DCNW protein at 10, 20, 30, 40 and 50% on equi-protein basis in diets 2 – 6, respectively. Thereafter, they were randomly assigned to the dietary treatments with each treatment having 60 birds replicated thrice. The design of the experiment was a completely randomized one. The birds were fed their respective diets for 21 days during which records of the average weight gain (AWG), average feed consumption (AFC) and feed conversion ratio (FCR) were taken. Also, the nitrogen retention (NR), fat retention (FR) and the influence of the DCNW based diets on haematological parameters were measured and the cost benefit analyzed. Results showed that the AWG, AFC, FCR and NR of birds fed the control diet were not significantly ( $P>0.05$ ) higher than those fed the test diets, but the final weight (961.9±21.8g) and AWG (39.0±0.9g/chick/day) were highest in birds fed 40% DCNW-based diet. The FR of birds on the control diet and those on 10 – 20% DCNW-based diets were not significantly ( $P>0.05$ ) different but they were significantly ( $P<0.05$ ) lower than those fed 30 – 50% DCNW-based diets. Also the FR increased with increased DCNW inclusion in the diets. The PCV, RBC, Hbc, MCHC, MCH, MCV and ESR which were used to determine the health status of the birds were not significantly ( $P>0.05$ ) influenced by the dietary treatment. The cost of feed per ton was highest (\$295.48) in the control diet. This cost decreased gradually with increased inclusion level of DCNW as indicated by the prediction equation,  $Y = 295.12 - 1.22 X$  ( $r^2 = 0.99$ ;  $P<0.05$ ). Replacing Soybean meal protein with DCNW protein led to 7 – 28 % cost reduction (i.e. \$/kg weight gain). Consequently, it was recommended that soybean meal could be replaced up to 50% level with DCNW in broiler chick diets in regions where this waste is abundant with a view to achieving substantial savings in the unit cost of broiler chick's production.

---

**Keywords:** Cashew nut waste; soy bean meal; broilers; blood indices; production cost

## Introduction

The poultry enterprise in most developing countries of sub-Saharan Africa has suffered more than any other livestock sub-sector as a result of the short supply of feed ingredients which by extension have contributed significantly to the high cost of finished feeds especially under the intensive system. For instance, feed cost constitutes between 60 and 80% of the commercial poultry and pig production in most developing countries including Nigeria (Onibi, 2006). Consequently, in order to reduce the cost of finish feeds essentially in poultry enterprise in Nigeria, Aletor (1986) and more recently, Agbede *et al.* (2005) emphasized the need to fully harness the potentials of the myriad agro-industrial by products and the so called 'wastes' as partial and where possible whole substitute for the more expensive conventional protein resources

One of such wastes is the discarded cashew nut meal (DCNM) which at present constitutes a major menace around most cashew nut processing industries in southwest Nigeria. Cashew (*Anacardium occidentale*) is among the widely cultivated fruits in southwestern Nigeria. The fruits are squeezed and made into fruit juice while the seeds, which contain the nuts, are processed into cashew nuts, pistachio, resin and oils (Adeyeye, 2004). Although the nutritional value of cashew nuts has long been recognized (Fetuga *et al.* 1974), cashew nut meal has more recently assumed greater importance due to the fact that its use has been extended from human consumption to the feeding of poultry, especially in layers (Onifade *et al.*, 1998). The upsurge in the consumption of the cashew in this region has resulted in its large-scale production for local consumption and export during which, large quantities of the kernels are broken, bruised or burnt. Such grades of nuts, which do not meet local or export requirements are usually discarded as wastes in several industrial sites in southwest of Nigeria. Conceivably, rejects or the discarded nuts wastes could be exploited as alternative protein feed resources in poultry feeding.

Thus, the present study was designed to evaluate the growth indices and cost implications of feeding diets to broiler chicks in which soybean meal was partially replaced with cashew nut waste meal on equi-protein basis.

## Materials and Methods

The discarded cashew nuts were collected free from a dump site at the Ideal Family Farm, Owo, Nigeria, sun-dried and milled before use. Thereafter, a batch of 360 day-old HIPECO breed of broiler chicks was electrically brooded at the Teaching and Research Farm of The Federal University of Technology, Akure, Nigeria. During the 1<sup>st</sup> week of brooding, the chicks were fed on commercial chicks mash (Guinea feed, containing 230 g kg<sup>-1</sup> crude proteins and 3200 kcal kg<sup>-1</sup> metabolizable energy). On the 3<sup>rd</sup> day, the chicks were sexed as described by Laseinde and Oluyemi, (1997) and on the 4<sup>th</sup> day, they were transferred to the metabolism cages to allow them acclimatized to the facilities in the cages. Six experimental diets with composition as presented in Table 1 were formulated. Diet 1 which contained 250 g kg<sup>-1</sup> soybean meal (SBM) was the control diet. The SBM in diet 1 was thereafter replaced on equi-protein basis at 10, 20, 30, 40 and 50 % level with DCNM in diets 2, 3, 4, 5 and 6, respectively. After the 7 days of brooding, the chicks were weighed and 60 chicks were randomly assigned to each of the 6 diets which constituted the treatments. The chicks were divided into 3 subgroups of 20 chicks each that made the replicates. The experiment was conducted using a completely randomized design. The chicks were fed the respective diets *ad libitum* for 21 days during which daily feed consumption and weekly weight gain were measured and the feed conversion ratio calculated as the ratio of feed

consumed to weight gain. Water was provided the chicks *ad libitum*. For the estimation of nitrogen and fat retention, feed consumption of five days towards the end of the trial as well as the droppings voided was measured. The bulk faecal droppings from each replicate for the 5 days were weighed, thoroughly mixed and 25 g aliquot samples put in labeled aluminum foil and dried at 55 – 60 °C in an air circulating oven for 72 hr after which the nitrogen and fat retained in the dried droppings were determined by the method of AOAC, (1990). The nitrogen or fat retained was calculated as the algebraic difference between dietary nitrogen or fat (on dry matter basis) intake and faecal nitrogen or fat for the period, respectively.

On the 21<sup>st</sup> day of the trial, the birds were fasted overnight to empty their crops but water was provided. Thereafter, they were weighed, slaughtered as described by Aletor *et al.* (2000) and the blood were collected into sample bottles containing ethylene diamine tetracetate (EDTA) and later analyzed as described by Lamb, (1981).

**Table 1: Composition of the experimental diets (g kg<sup>-1</sup>)**

| Ingredients                         | DIETS  |       |       |       |       |       |
|-------------------------------------|--|-------|-------|-------|-------|-------|
|                                     | 1  | 2     | 3     | 4     | 5     | 6     |
|                                     | % soybean meal replaced by discarded cashew nut meal |       |       |       |       |       |
|                                     | 0  | 10    | 20    | 30    | 40    | 50    |
| Maize                               | 575.7  | 536.7 | 503.4 | 459.0 | 417.5 | 406.0 |
| GNC                                 | 45.8   | 53.5  | 58.6  | 68.6  | 78.8  | 59.0  |
| SBM                                 | 250  | 225.0 | 200.0 | 175.0 | 150.0 | 125.0 |
| DCNM                                | -  | 56.3  | 112.6 | 168.9 | 225.2 | 281.5 |
| Others*                             | 128.5  | 128.5 | 128.5 | 128.5 | 128.5 | 128.5 |
| Total                               | 100  | 100   | 100   | 100   | 100   | 100   |
| Calculated                          |  |       |       |       |       |       |
| Crude protein (g kg <sup>-1</sup> ) | 230  | 230   | 230   | 230   | 230   | 230   |
| ME (MJkg <sup>-1</sup> )            | 12   | 12    | 12    | 12    | 12    | 12    |
| Analyzed                            |  |       |       |       |       |       |
| Crude protein (g kg <sup>-1</sup> ) | 231  | 232   | 230   | 230   | 231   | 231   |
| Crude fibre (g kg <sup>-1</sup> )   | 44   | 54    | 59    | 53    | 64    | 69    |
| Ether extract (g kg <sup>-1</sup> ) | 133  | 135   | 136   | 158   | 194   | 225   |

Fishmeal 40 g; brewer's dried grains 50g; bone meal 25 g; oyster shell 5 g; premix 2g; methionine 1.5g and salt 5 g kg<sup>-1</sup>. GNC = Groundnut cake, SBM = Soybean meal; DCNM =Discarded cashew nut meal

The cost of the feed ingredients vis-à-vis the cost of each diet was computed based on the prevailing market prices of the component ingredients at the time of the trial. All data collected on the growth indices and haematological variables were subjected to analysis of variance (Steel and Torrie, 1960) and means were compared using the Duncan multiple range test (Duncan, 1955).

## Results and discussion

Table 2 shows that the final weight (FW), average weight gain (AWG), average feed consumption (AFC) and feed conversion ratio (FCR) of birds fed the control diet were not significantly ( $P>0.05$ ) different from those fed the test diets. However, while the FW and AWG of the chicks increased (885.7 g – 961.9 g) and (35.3 – 39.0 g/chick/day) respectively with SBM substitution by DCNM up to 40 %, the AFC decreased from 67.9 g/chick/day in birds fed the

control diet to 65.1 g/chick/day in birds fed on 40 % DCNM-based diet. The increased AWG was predicted using a regression equation  $Y=0.07X + 35.6$  ( $r^2 = 0.86$ ;  $P<0.05$ ) while the decreased AFC was also predicted using a regression equation  $Y = -0.04 X + 67.82$  ( $r^2 = 0.43$ ;  $P<0.05$ ). The nitrogen retention (NR) of the birds was not significantly ( $P>0.05$ ) affected as it varied only from 2.0 to 2.2 g/chick/day. Thus, the present study suggests clearly that DCNM has similar nutritive potentials as the conventional SBM. It implies the potentials of DCNM in the production of broiler chicks in region where DCNM are available and where SBM are in short supply as evident in most developing countries of Africa. This study further suggests that DCNM could be included in broiler chick's diets up to 225.2 g kg<sup>-1</sup> without adverse effect on performance indices. This agrees with the recent report of Agbede, (2006) that SBM in broiler finisher diets could be replaced up to 50 % with DCNM. Although the FCR was not significantly ( $P>0.05$ ) affected by the dietary treatment, birds on 40% DCNM-based diet had the highest FCR. Similarly, birds fed DCNM-based diets had higher FCR than those on the control diet suggesting that the birds on the test diets utilized their diets better than the control. This in part explains the better performance of birds on the test diets with respect to FW, AWG and AFC (Table 2).

**Table 2: Performance records of broiler chicks fed diets in which SBM was replaced with DCNM**

| Diets | %SBM replaced by DCNM | Initial weight. (g) | Final weight. (g) | Average wt. gain (g/chick /day) | Average feed consumption (g/chick/day) | Feed conversion ratio | Fat retention (g/chick/day) |
|-------|-----------------------|---------------------|-------------------|---------------------------------|--|-----------------------|-----------------------------|
| 1     | 0                     | 142.8±2.8           | 885.7±28.5        | 35.3±1.5                        | 67.9±1.2                               | 1.9±0.1               | 9.0±0.4 <sup>a</sup>        |
| 2     | 10                    | 143.8±7.1           | 909.5±29.7        | 36.4±1.6                        | 67.7±2.1                               | 1.8±0.1               | 9.1±0.2 <sup>a</sup>        |
| 3     | 20                    | 141.9±4.3           | 914.3±42.8        | 36.7±1.9                        | 67.2±0.4                               | 1.8±0.1               | 9.1±0.2 <sup>a</sup>        |
| 4     | 30                    | 142.8±5.7           | 959.2±50.1        | 37.8±2.1                        | 66.7±1.9                               | 1.8±0.1               | 10.6±0.1 <sup>b</sup>       |
| 5     | 40                    | 142.8±2.8           | 961.9±21.8        | 39.0±0.9                        | 65.1±0.2                               | 1.7±0.0               | 12.9±0.3 <sup>c</sup>       |
| 6     | 50                    | 144.7±5.8           | 947.6±21.8        | 38.2±0.6                        | 67.1±1.1                               | 1.7±0.1               | 15.4±0.4 <sup>d</sup>       |

Means with different superscripts are significantly different ( $P<0.05$ ); SBM = Soybean meal ; DCNM = Discarded cashew nut meal.

Fat retained of birds fed with the control diet was not significantly ( $P>0.05$ ) higher than those fed 10 and 20 % DCNM-based diets but they were significantly ( $P<0.05$ ) lower than those fed with 30 – 50 % DCNM-based diets. The FR increased significantly in birds fed 30 % DCNM-based diet (10.6 g/chick/day) to 15.4 g/chick/day in birds on 50% DCNM-based diet. The increased fat retention derives from the high oil content of cashew nut (Fetuga *et al.*, 1974) which increased with increased replacement of SBM with DCNM. Conceivably, the diets and chicken meat from DCNM-based diets are likely to be susceptible to oxidative deterioration which could affect not only the storability of such diets, but also the shelf life of the resulting meat. Consequently, such meat might not be suitable for consumption by persons prone to hypertension as high dietary fat has been implicated in cardio vascular disorder (Onibi, 2006).

The haematological variables of birds fed with the control diet and those fed with the test diets were not significantly ( $P>0.05$ ) affected by the dietary treatment. However, the values range: PCV 29.6 – 32.0 %; rbc 2.3 – 2.7 X 10<sup>6</sup>mm<sup>3</sup>; Hbc 2.2 – 3.4 g / 100 ml; MCHC 9.8 – 10.7 %; MCH 11.5 – 14.1 pg; MCV 113.3 – 132.3 μm<sup>3</sup> and ESR 1.7 – 3.1 mm/hr. This suggests that the replacement of SBM with DCNM did not have adverse effect on these haematological variables in the chicks. However, the PCV, rbc and Hbc observed in this study fall within the range reported for chicks of the same age by Agbede and Aletor , (2003).

Table 3 reveals that the cost / ton of the feed was highest (\$295.46) in the control diet and decreased gradually with increasing levels of DCNM with a prediction equation:  $Y = 295.12 - 1.22 X$  ( $r^2 = 0.99$ ;  $P < 0.05$ ). Also, the cost / kg weight gain of the birds was lowered with increased level of DCNM inclusion. The study suggests that farmers would have 7 - 28 % cost reduction when DCNM is substituted for SBM in broiler chick's diets. Therefore, the inclusion of DCNM in broiler diets up to 281.5 g kg<sup>-1</sup> is recommended in regions where cashew nut is abundant and this would help to reduce the cost of finished feed with an attendant increase in profit margin to the farmers.

**Table 3: Cost analysis of broiler chicks fed diets in which soybean meal was replaced with discarded cashew nut meal**

| Diets | %SBM replaced by DCNM | ATWG (kg) | AFC (kg) | Feed cost (\$/ton) | Cost of feed \$/kg weight gain | % reduction | Cost |
|-------|-----------------------|-----------|----------|--------------------|--------------------------------|-------------|------|
| 1     | 0                     | 2.12      | 4.07     | 295.46             | 0.57                           | -           |      |
| 2     | 10                    | 2.18      | 4.06     | 282.86             | 0.53                           | 7.02        |      |
| 3     | 20                    | 2.20      | 4.03     | 270.25             | 0.50                           | 12.28       |      |
| 4     | 30                    | 2.27      | 4.00     | 258.24             | 0.46                           | 19.30       |      |
| 5     | 40                    | 2.34      | 3.91     | 246.27             | 0.41                           | 28.07       |      |
| 6     | 50                    | 2.29      | 4.03     | 234.28             | 0.41                           | 28.07       |      |

ATWG = Average total weight gain; AFC = Average feed consumption.

## References

- ADEYEYE, S.A.** (2004) Nutritional significance of cashew (*Anacardium occidentale*) nut meal in broiler-chickens. M. Agric. Tech Thesis, Department of Animal Production and Health, Federal University of Technology, Akure, Nigeria pp 1 – 115.
- AGBEDE, J.O.** (2006) Growth indices and muscle development in broiler-chickens fed equi-protein replacement of soyabean meal with discarded cashew nut meal. *The Journal of Poultry Science*, Ibaraki 305-0901, Japan. in press.
- AGBEDE, J.O., AJAJA, K. and ALETOR, V.A.** (2005) Response of broiler chicks to roxazyme-G supplemented diets in which wheat offal and rice bran replaced maize. *Applied Tropical Agriculture* **10**: 39 – 43.
- AGBEDE, J.O and ALETOR, V.A.** (2003) Evaluation of fishmeal replaced with protein concentrate from *Glyricidia* in diets for broiler-chicks: Effect on performance, muscle growth, haematology and serum metabolites. *International Journal of Poultry Science* **2**: 242 – 252.
- ALETOR, V.A.** (1986) Some agro-industrial by-products and wastes in livestock feeding: A review of prospects and problems. *World Review of Animal Production* **XXII 4** : 35-41.
- ALETOR, V.A , HAMID, II., NIEß and PFEFFER, E.** (2000) Low-protein amino acid Supplemented diets in broiler chickens: effects on performance, carcass characteristics, whole-body composition and efficiencies of nutrient utilization. *Journal of the Science of Food and Agriculture* **80**: 547-554.
- DUNCAN, D. B.** (1955) Multiple range and multiple F-test. *Biometrics* **11**: 1 –41.
- FETUGA, B.L., BABATUNDE, G.M. and OYENUGA, V.A.** (1974) Composition and nutritive value of cashew nut to the rats. *Journal of Agriculture and Food Chemistry* **22**: 678-682.
- ONIBI, G.E.** (2006) Dietary oil quality and vitamin E supplementation I: An assessment of

- performance characteristics of broiler chickens. *Bowen Journal of Agriculture* **3**: 87-98.
- ONIFADE, A.A., TEWE, O.O., FANIMO, A.O., OKUNOLA, O. and AFOLABI, A.B.** (1998) Replacement values of cashew nut meal for groundnut cake in pullet diets; effects on pre laying performance and serum biochemical indices. *Indian Journal of Animal Science* **68**: 273-275.
- AOAC.** (1990) Association of Official Analytical Chemists. Official method of analysis (15<sup>th</sup> ed). Washington DC, USA.
- LAMB, G. M.** (1981) Manual of veterinary laboratory techniques (Lamb, G. M. ed.) CIBA – Geigy, Kenya, pp. 96 – 111.
- LASEINDE, E. A. O. and OLUYEMI, F. A.** (1997) Sexual dimorphism in the growth pattern Of broilers under different dietary and housing conditions. *Nigerian Journal of Animal Production* **24**: 1 – 6.
- STEEL, R. D. G. and TORRIE, J. H.** (1980) Principles and procedures of statistics (1<sup>st</sup> edn.). Mc Graw Hill, New York.