# PERFORMANCE CHARACTERISTICS OF BROILER CHICKEN FED DRIED CASHEW APPLE SUPPLEMENTED DIET WITH OR WITHOUT ENZYME

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**Abstract**
A 35-day feeding trial was conducted to evaluate the response of broiler chickens graded inclusion levels of dried cashew apple (DCA) with or without enzyme supplementation. Two hundred and ten 1-day old Ross broiler chicks were randomly allocated to seven treatment groups. Each treatment had three replicates containing 10 birds each in a 2 X 3 factorial arrangement with a control using completely randomized design. Diets were formulated to contain 0% DCA as control diet, while diets D2, D3, and D4 containing 10, 20, and 30% DCA without enzyme and diets D5, D6, and D7 contained 10, 20, and 30% DCA with enzyme supplementation. Growth performance, blood profile and carcass characteristics were determined at the end of the experiment. All parameters examined were significantly ($P<0.05$) affected, except for white blood cells, aspartate transaminase and dressed weight. Birds showed a linear response ($P<0.05$), in average daily gain as the value decreased along the treatments. Increased average daily feed intake and feed conversion ratio were recorded in birds fed D4 and D7. Higher ($P<0.05$) values of packed cell volume, haemoglobin and red blood cells were reported for birds fed D3. Significant ($P<0.05$) higher values were also recorded for alkaline phosphatase in birds fed D4 to D7. Inclusion of DCA increased ($P<0.05$) the breast and thigh meat (D3 and D6 respectively). Conclusively DCA, with or without enzyme supplementation could replace maize in the diets of broiler chickens up to 20% without any deleterious effect on performance and overall health of the birds.
**Key words:** broiler, dried cashew apple, carcass, haematology, serum biochemistry

## Introduction

Protein supply (especially meat) for human race is one of the concerns of poultry producers as it is an expedient factor of a healthy labour force and nation. A rise in cost of feeds and feed ingredients is a result of inadequate supply of raw materials and competition between man and animal for staple foods (Aletor *et al.*, 2007). A promising solution to reduce the cost of broiler production has emanated from alternative ingredients transformed from farm wastes into commercial products thus lowering environmental pollution and increased farmer's income from the crop. A by-product of cashew industry- cashew apple is one of such potential material for use in poultry rations. Reports on the nutritional qualities and anti-nutritional properties of cashew pulp have been documented (Jayalekshmy *et al*., 2004; Okpanachi *et al*., 2016).

Dietary supplementation of dried cashew apple have been investigated in species of animals like rabbits, pig, layers and broiler chickens which had consequently improved feed intake, weight gain and feed conversion ratio thereby enhancing the performance and carcass yield (Attri, 2009). However, inclusion levels of dried cashew apple are low due to levels of antinutritional factors (Venkatramana *et al*., 2018). It was established that antinutritional factors specifically high tannin content causes reduction in digestibility and also interferes with the growth performance of poultry birds (Choct, 2006), Thus, effect of these antinutritional factors can be suppressed by the use of enzymes which aids digestion and also improved the overall performance of broiler chickens (Ravindran, 2013). Hence, this experiment was conducted to investigate the effects of dried cashew supplementation with or without enzymes on the performance characteristics of broiler chicken.

## Materials and Methods

### Location of the experiment

The experiment was conducted at Poultry Unit, Teaching and Research Farms, Ladoke Akintola University of Technology, Ogbomoso.

### Source of test ingredient

Cashew apple fruits were sourced from cashew plantation farms in Ogbomoso metropolis; during the period of harvest after which the farmer must have removed the seeds. The cashew apple was washed under a running-water and sorted to remove dirt. A mechanical pressure was then applied to reduce the moisture content and then sundried until it becomes crispy. The test ingredient, dried cashew apple (DCA), was ground using a hammer mill to pass through a 2mm sieve before its incorporation into the experimental diets.

**Experimental Diets and Management of Birds**

Two hundred and ten 1-day-old Ross chicks were used for the trial. Broiler chicks were weighed and randomly allotted into seven groups with 30 birds each. The groups were divided into three (3) replicates containing ten birds, each in a 2 X 3 factorial arrangement with a control in a completely randomized design. Feeds and water were supplied *ad libitum.* Diets formulated to meet or exceed NRC (1994) recommendation for broilers chicken comprised of a Control diet (0% .DCA), Diets 2, 3, and 4 had 10, 20, and 30% DCA levels without enzyme supplementation. Diets 5, 6, and 7 have 10, 20, and 30% dried cashew apple (DCA) levels with enzyme supplementation.

**Data Collection**

**Growth Performance**

Average Daily Feed Intake (ADFI), Average Daily Gain (ADG), and Feed Conversion Ratio (FCR) were measured during the experiment.

**Blood Profile Analysis**

At the end of the study, two birds of median weight were selected; fasted for twelve hours and slaughtered by severing the jugular vein of the birds. About 5ml of blood were collected into separate sterilized bottles for haematological and serum biochemical analysis according to Campbell (1995)

**Carcass characteristics**

One bird per replicate from each treatment was randomly selected, sacrificed, bled and properly dissected into parts and the weights were recorded. The bled weight, eviscerated weight, carcass weight, breast, thigh, back, wings, drumstick, back, head shank were recorded and determined relative to the fasted weight.

**Statistical Analysis**

Data collected were subjected to a One-way Analysis of Variance using the IBM SPSS version 21 statistical packages; separation of means was done using Duncan's Multiple Range Tests of the same software. The difference was set at 0.05 probability level.

**Results and Discussion**

**Growth Performance**

All the parameters were significantly ($P<0.05$) influenced by the dietary treatments (Table 1). A linear decrease ($P<0.05$) was observed in the values recorded for ADG from 10% to 30% with or without enzyme addition. Significantly ($P<0.05$) higher values (100.06 g/b/d) were recorded for ADFI in birds fed 30 % DCA without enzymes; closely followed and statistically the same with 30 % DCA plus enzyme (95.85 g/b/d). Lower value (72.97g/b/d) for ADFI was observed for birds fed the control diet. The same trend was observed in the FCR. Incorporation of DCA into the diet of broiler at 10% with or without addition of enzyme improved ADG compared to the control and other treatment groups. This finding is consistent with the report of Yisa and Longe (2017) that the inclusion of DCA up to 10% in broiler chickens results in no loss of performance as measured by growth. The reduced performance observed in birds at 30% DCA inclusion, with or without enzyme, could be as a result of high dietary fibre in DCA at increased concentration in the feed (Lumpkins *et al.*, 2004).

**Table 1: Growth performance of broiler chickens fed diets containing different inclusion levels of DCA supplemented with or without enzyme**

| Parameters | Control | 10% DCA | 20 | 30% DCA | 10% DCA +enzyme | 20% DCA +enzyme | 30% DCA +enzyme | SEM |
|---|---|---|---|---|---|---|---|---|
| | | | % DCA | | | | | |
| ADG(g/b/d) | 36.85$^{ab}$ | 38.50$^{a}$ | 36.72$^{ab}$ | 34.26$^{b}$ | 38.43$^{a}$ | 35.31$^{b}$ | 34.45$^{b}$ | 0.31 |
| ADFI(g/b/d) | 72.97$^{d}$ | 88.57$^{bc}$ | 82.88$^{c}$ | 100.06$^{a}$ | 88.71$^{bc}$ | 81.33$^{c}$ | 95.85$^{ab}$ | 0.92 |
| FCR | 2.00$^{c}$ | 2.30$^{b}$ | 2.26$^{b}$ | 2.92$^{a}$ | 2.31$^{b}$ | 2.31$^{b}$ | 2.80$^{a}$ | 0.03 |

$^{abcd}$Means across the rows with different superscript are significantly (P<0.05) different. ADG=Average daily gain, ADFI=Average daily feed intake, FCR=Feed conversion ratio SEM=Standard error mean.

**Blood Profile Analysis**

The dietary treatment significantly (P<0.05) affects the blood parameters examined except WBC and AST (Table 2). The PCV, Haemoglobin, RBC and ALP had significantly higher values for birds fed 20% DCA with enzyme. Higher values of ALP were recorded for birds fed 10-30% DCA with enzyme addition; and 30% without enzyme. Increased (P<0.05) total protein value (36.93g/l) was reported in the control group. The values obtained fall within the normal range of reference values reported for healthy chicken (Ogbuewu *et al*., 2010). This is consistent with report of Oyewole *et al*. (2017), who noted that including DCA in broiler chickens' diet did not compromise the birds' health. The PCV range from 24.90% to 45.20% suggested the inclusion of DCA in broiler chickens diet did not trigger any adverse effect on the health of the birds. The haemoglobin range of 11.53g/dl (T5) to 13.20g/dl (D6) obtained from this study indicate that the diets supplied adequate minerals to enable birds adequately synthesize haemoglobin which is responsible for oxygen and carbon dioxide transport in the blood. Furthermore, serum biochemical analysis reveals that the liver was not compromised by the dietary treatment, as reflected in the values obtained for liver enzymes AST, ALT, and ALP. These values are within the range reported for normal healthy broiler chickens by previous studies (Meluzzi *et al.,* 1992).

**Table 2: Blood profile of broiler chickens fed diet containing graded levels of DCA Supplemented with or without Enzyme**

| Parameters | Control | 10% DCA | 20% DCA | 30% DCA | 10% DCA +enzyme | 20% DCA +enzyme | 30% DCA +enzyme | SEM |
|---|---|---|---|---|---|---|---|---|
| Packed Cell Volume (%) | 37.67$^{ab}$ | 32.67$^{bc}$ | 31.67 $^{c}$ | 36.67$^{abc}$ | 33.00$^{bc}$ | 41.33$^{a}$ | 35.33$^{bc}$ | 1.61 |
| Haemoglobin (g/l) | 12.77$^{ab}$ | 12.53$^{ab}$ | 12.17$^{ab}$ | 12.63$^{ab}$ | 11.53$^{b}$ | 13.20$^{a}$ | 12.00$^{ab}$ | 0.48 |
| RBC $10^{12}$/L | 2.07$^{ab}$ | 1.86$^{b}$ | 1.90$^{b}$ | 2.20$^{ab}$ | 2.00$^{ab}$ | 2.53$^{a}$ | 2.20$^{ab}$ | 0.18 |
| WBC $10^{9}$/L | 106.33 | 121.00 | 112.00 | 120.33 | 99.67 | 120.67 | 117.00 | 9.07 |
| **AST (U/L) | 57.67 | 69.00 | 56.67 | 79.00 | 62.67 | 87.33 | 69.33 | 3.98 |
| $^{+}$ALT(U/L) | 1.00$^{b}$ | 3.67$^{a}$ | 2.33$^{b}$ | 2.00$^{b}$ | 1.67$^{b}$ | 1.47$^{b}$ | 1.67$^{b}$ | 0.16 |
| $^{++}$ALP(U/L) | 246.67$^{c}$ | 253.33$^{ab}$ | 248.00$^{bc}$ | 255.33$^{a}$ | 254.67$^{a}$ | 255.33$^{a}$ | 253.67$^{a}$ | 0.70 |
| Total Protein | 45.57$^{a}$ | 36.93$^{c}$ | 41.03$^{b}$ | 33.00$^{c}$ | 37.17$^{c}$ | 36.27$^{c}$ | 35.47$^{c}$ | 0.50 |

$^{a\ b\ c}$ Means within rows for different groups with different superscripts differ (P < 0.05) RBC**:** Red Blood Cell; WBC**:** White Blood Cell; $^{**}$AST**:**Aspartate transaminase; $^{+}$ALT**:** Alanine Aminotransferase; $^{++}$ALP**:** Alkaline phosphatase; SEM**:** Standard Error Mean

**Carcass characteristics**

The result of carcass characteristics is as shown on Table 3. Carcass weight increased significantly (P<0.05) at 10%DCA with or without enzyme addition compared to the control and other treatments. This could imply the efficient use of 10% DCA. This result however, disagreed with the report of Swain *et al.* (2007) who observed cashew apple waste in replacement for maize among the treatments

has no effect on carcass yield. Moreover, DCA caused increased breast meat of broiler chicken at 10 and 20 % DCA inclusion with or without enzymes compared to the control and other dietary treatments The breast meat of broiler is of economic importance and so a positive effect of DCA and enzyme addition is noticed in this experiment.

**Table 3: Carcass characteristics of broiler chickens fed diet containing graded levels of DCA with or without enzyme**

| Parameters | Control | 10% DCA | 20% DCA | 30% DCA | 10% DCA +enzyme | 20% DCA +enzyme | 30% DCA +enzyme | SEM |
|---|---|---|---|---|---|---|---|---|
| Fasted weight (g) | 1265.67$^{ab}$ | 1360.00$^{a}$ | 1279.33$^{ab}$ | 1257.69$^{ab}$ | 1300.67$^{ab}$ | 1246.00$^{ab}$ | 1179.33$^{b}$ | 16.11 |
| Dressed weight(%) | 66.40 | 66.34 | 68.49 | 67.48 | 69.10 | 67.28 | 66.31 | 0.38 |
| Breast (%) | 20.87$^{ab}$ | 20.31$^{bc}$ | 23.74$^{a}$ | 21.20$^{ab}$ | 19.62$^{bc}$ | 17.08$^{c}$ | 19.90$^{bc}$ | 0.40 |
| Thigh (%) | 9.46$^{b}$ | 9.71$^{b}$ | 10.03$^{ab}$ | 9.50$^{b}$ | 10.32$^{ab}$ | 10.86$^{a}$ | 10.38$^{ab}$ | 0.10 |
| Drumstick (%) | 10.00$^{ab}$ | 10.02$^{ab}$ | 9.01$^{c}$ | 9.69$^{bc}$ | 10.58$^{a}$ | 9.39$^{abc}$ | 10.61$^{a}$ | 1.00 |
| Back (%) | 14.90$^{abc}$ | 15.21$^{ab}$ | 13.57$^{bc}$ | 13.32$^{c}$ | 16.56$^{a}$ | 14.81$^{abc}$ | 15.21$^{ab}$ | 57.00 |

$^{a\ b\ c}$ Means within rows for different groups with different superscripts differ ($P < 0.05$) **SEM:** Standard Error Mean

**Conclusion**

The results of this study showed that up to 10% inclusion of DCA with or without enzyme in broiler chickens can be tolerated with no loss of performance as measured by carcass conformation

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