



EFFECT OF GRADED LEVELS OF STAR APPLE (*Chrysophyllum albidum*) MEAL ON THE BLOOD PARAMETERS AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

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ABSTRACT

An experiment was conducted to investigate the effect of feeding graded levels (0, 0.5, 1.0, 1.5 and 2%) of star-apple meal to broiler chickens on Haematological and carcass characteristics. A total of 150 day-old broiler chicks were randomly allocated to five treatments of 30 birds each, replicated three times with 10 birds each in a completely randomized design. Feed and water were given ad-libitum for 3 and 4 weeks during the starter and finisher phases respectively. Haematological parameters and biochemical indices were obtained using appropriate analytical methods. Carcass characteristics were conducted at the end of finisher stage. Haematological parameters and biochemical indices (PCV, Hb, lymphocyte, albumin, creatinine, sodium, were significantly ($P<0.05$) affected. Carcass analysis showed significant ($P<0.05$) difference among the treatments in terms of thigh and breast values. Similar trend was observed in visceral organs with significant ($P<0.05$) difference among the treatments on the values of liver, kidneys, proventriculus and spleen. The study revealed that inclusion level of Star-apple in the diet of broilers has no negative effect on the blood biochemical indices and haematology as well as carcass characteristics.

Keywords: Star apple, haematology, serum, carcass, broiler birds.

INTRODUCTION

Feed supply is a major constrain to animal production due to high cost of conventional feed stuff and competition between man and animal for the same food (Amaefule and Obioha, 2001). In Nigeria it was estimated (Oluyemi and Robert, 2002; Sobayo *et al*, 2006) feed cost over 70% of the total cost of production, it accounts for 65-70% (Nworgu *et al.*, 1999) and 70-85% (Opara, 1996) of total cost of production. The use of non-conventional feed ingredients is very much important in assessing the health status of an animal. A readily available and fast mean of

assessing clinical and nutritional status of the animal on feeding trial may be the use of blood analysis (Olabanji *et al.*, 2007). Blood is very vital to life and before any meaningful work can be done on the biology of birds the blood must be studied in details (Akinmutimi and Oke, 2002).

In view of this there is a need to evaluate cheaper, locally available and un-conventional feed resource such as Star apple. Star apple (*Chrysophyllum albidum*) fruit is a forest tree that belongs to the family *sapotaceae*. The plant in recent time has become a crop of commercial

value in Nigeria. The freshly pulp of the fruits is eaten especially as snacks and relished by both young and old (Cenred, 1999). The fruit has high an excellent source of calcium, potassium, phosphorous and magnesium, (Adisa, 2000). The ripe fruit, because of its mucilaginous character, is eaten to sooth inflammation in laryngitis and pneumonia. It is given for treatment of diabetes mellitus, and as a decoction is gargled to relieve angina (Morton, 1987). The bark is used for the treatment of malaria and yellow fever, while the leaf is used as an emollient and for the treatment of skin eruption, stomach and diarrhoea (Idowu *et al.*, 2006).

MATERIALS AND METHODS

The study was conducted at Miko Abdallah farm near Bayero University, Kano. The State lies approximately between latitudes 10⁰ 33'N to 12⁰ 23'N and longitudes 7⁰ 45'E to 9⁰ 29'E, with a population of 9,383,682 (NPC, 2006). Kano has an estimated land area of 21,276.872 km² with 1,754,200 hectares for agricultural land and 75,000 hectares of forest vegetation and grazing land (AIAE, 2007). The climate of the study area is the tropical dry-

and-wet type. The wet season lasts from May to October with a peak in August while the dry season extends from mid-October of one calendar-year to mid-May of the next. The annual mean rainfall ranges between 800 mm to 900 mm and mean annual temperature is about 26⁰ C (Falola, 2002; Olofin, 2008).

Sources and processing of star apple

The Star- apple (*Chrysophyllum albidum*) was purchased from Yan Lemo Market, Na'ibawa. It was washed and sliced in to portions (seeds removed), the peels and pulps were allowed to dry under shade and finally ground to powder, before used in formulating the diet.

Proximate and analysis

Samples of the experimental diets and star apple peels and pulp meal were analysed to determined CP, CF, EE, NFE and Ash according to the procedure of Association of Official Analytical Chemist (A.O.A.C,1995). Data were subjected to analysis of variance using SAS, (1989) version. Significant (p<0.05) difference between means were separated using Fishers Least Significance Difference (LSD).

Table 1: Proximate Composition of Star-Apple Peels and Pulp Meal

Proximate content	Star-Apple (%)
Dry Matter (DM)	75.80
Moisture (MS)	24.20
Crude Protein (CP)	7.87
Crude Fibre (CF)	13.46
Ether Extract (EE)	29.12
Ash (ASH)	3.27
Nitrogen Free Extract (NFE)	64.46

Table 2: Gross Composition (%) of Broiler Starter Experimental Diets

Ingredients	T₁	T₂	T₃	T₄	T₅
Maize	62.00	61.50	61.00	60.50	60.00
Soya bean cake	15.00	15.00	15.00	15.00	15.00
Ground nut cake	10.10	10.10	10.0	10.0	10.0
Star-apple	0.00	0.50	1.00	1.50	2.00
Fish meal	5.50	5.50	5.50	5.50	5.50
Blood meal	3.50	3.50	3.50	3.50	3.50
Bone meal	1.50	1.50	1.50	1.50	1.50
Limestone	1.50	1.50	1.50	1.50	1.50
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

Calculated Analysis

Crude protein (%)	23.14	23.12	23.10	23.08	23.06
Crude fibre (%)	2.81	2.82	2.83	2.85	2.86
ME(Kcal/kg)	2914	2897	2880	2864	2847

*Vitamin a 10,000,000iu, Vitamin D3 2000000iu, Vitamin E 23,000mg, Vitamin k3 2000mg, Vitamin B1 1800mg, Vitamin B2 5500mg, Niacin 27500mg, Pantothenic Acid 7500mg, Vitamin B12 15mg, Folic Acid 750mg, Biotin H2 60mg, Cobalt 200mg, Copper 3000mg, Iodine 1000mg, Antioxidant 1250mg. Selenium 200mg, Zinc 30000mg,

Experimental diets

Five experimental (starter and finisher) broiler diets were formulated, containing the Star apple at 0, 0.5, 1, 1.5 and 2% respectively (Table 2 and 3). The treatments were tagged as T₁, T₂, T₃, T₄ and T₅.

Experimental birds and their management

One hundred and fifty (150) day-old broiler chicks were randomly allotted to five dietary treatment groups in a completely randomized design. Each treatment has 30 birds divided in to three replicate of 10 birds each. The birds were managed under the deep litter system. The birds

were vaccinated against diseases prevalent in the area. Source of heat was provided using charcoal pot. The chicks were fed commercial diet for one week for physiological adjustment. Experimental feed and fresh, clean water were given *ad-libitum* for 3 and 4 weeks during starter and finisher phase respectively.

Blood collection and analysis

At the end of the trial, two birds per replicate were randomly selected and blood sample (5mL) was carefully collected via wing vein. A hypodermic syringe was used to collect 2.5mL from each bird, placed in a labelled

specimen plastic tube containing Ethylene Diamine Tetra acetic acid (EDTA), for haematological analysis while the other blood sample (2.5mL) was collected in to non EDTA plastic tubes for blood chemistry. Packed cell volume (PCV), haemoglobin (Hb), Red blood cell (RBC) and White blood cell (WBC), were determined by methods outlined by Schalm (1971). Serum total protein and albumin were determined by the method of Peters, Biamonte and Doumas (1984) and globulin according to Cole (1986).

Carcass Evaluation

Also at the end of feeding trial, two birds per replicate were randomly selected, fasted overnight and slaughtered by severing the jugular vein, thoroughly bled. Each carcass was de-feathered and eviscerated. Primal cuts were divided in to the following anatomical parts: shank, head, breast, neck, drumstick, thigh, wings and breast cage, while visceral organs which include liver, gizzard, proventriculus heart, crop and abdominal fat were all weight and converted as their percentage live weight.

Statistical analysis

Data collected were subjected to analysis of variance using SAS, 1989 version. Significant ($p < 0.05$) difference between means were separated using Fishers Least Significance Difference (LSD).

RESULT AND DISCUSSION

The results on the haematological parameters obtained in this study (Table 3) showed that PCV, Hb and lymphocytes were significantly affected ($P < 0.05$) in different passion by the

inclusion levels of star apple in the diet of finisher birds. However, RBC, WBC, MCH, MCHC, MCV and neutrophils of the birds on all treatment groups were not significantly ($P > 0.05$) affected by the inclusion of Star apple meal. Birds fed 2%-star apple (T5) had the highest value of PCV, Hb, RBC and WBC while the least was in the control group 0%-star apple (T1). The results of PCV, Hb and RBC were in consonant with the report of Sobayo *et al.* (2013) for healthy birds and were within the range (25-40%, 7-13gdl and $2.8-3.5 \times 10^6/\text{mm}^3$) reported by Anon (1980). These normal values indicated no mal-nourishment or anaemic condition in the birds. Reports by Aletor (1989) and Aletor and Egberongbe (1992) indicated that blood variable most consistently affected by dietary factors includes PCV, RBC and plasma protein.

Increase in the number of neutrophils indicate, the existence of resent (acute) infection usually with bacteria, while decrease in number of WBC could be due to the diet which might not increase the production of blood component Jain (1986). However, higher values of Neutrophils obtained in this study could be due to presence of immunogenic substances, in which star-apple has such (vitamin c).

Lymphocytes are the key elements in production of immunity (Ganong, 2005). Lymphocytes values observed in this study were within the normal range (44-81%) reported by Mitruka and Rownsly, (1977) except for T1 (0%star-apple) and T5 (2%star-apple). This reduction in lymphocyte count could be an immunological problem indicating negative anti-gene effect associated to the bird or could be due to diet.

Table 3: Haematological Parameters of Broiler Chickens fed Graded Levels of Star-Apple

Parameters	T1	T2	T3	T4	T5	LSD
PCV (%)	26.00 ^b	30.00 ^{ab}	30.00 ^{ab}	29.00 ^{ab}	32.00 ^a	5.26
Hb (g/dl)	8.60 ^b	10.20 ^a	9.95 ^{ab}	9.60 ^{ab}	10.55 ^a	1.52
RBC (x10 ¹² /l)	2.80	3.30	3.30	3.30	3.50	2.57 ^{NS}
WBC (x10 ⁹ /l)	10.80	10.35	10.80	10.80	11.15	5.03 ^{NS}
MCH (pg)	30.65	30.85	30.10	30.00	29.65	2.02 ^{NS}
MCHC (g/dl)	33.05	33.40	33.15	33.10	32.95	1.12 ^{NS}
MCV (fl)	92.80	92.45	90.85	90.55	90.05	4.62 ^{NS}
Lymphocytes (%)	27.00 ^b	45.00 ^{ab}	49.00 ^{ab}	55.00 ^a	27.50 ^b	2.77
Neutrophils (%)	69.00	50.00	42.00	51.00	70.50	34.17 ^{NS}

^{a,b,c}:mean in the same row with different super scripts differ significantly(p<0.05) ,PCV=Packed Cell Volume; Hb= Haemoglobin; RBC= Red Blood Cell; WBC= White Blood Cell; MCV= Mean Corpuscular Volume; MCH= Mean Corpuscular Haemoglobin; MCHC= Mean Corpuscular Haemoglobin Concentration. NS= Not Significant

Serum biochemical indices (Table 4) showed there were significant (P<0.05) difference among treatment groups in albumin, globulin, creatinine and sodium. Other biochemical indices such as total protein, urea and potassium were not significantly (P>0.05) varied among the treatment groups. T5 recorded the highest Albumin value (2.13g/dl) while the least is T4 (1.5g/dl). The highest values of globulin and creatinine were obtained in T1 (3.43g/dl) and T5 (0.50mmol/l) respectively. Sodium and potassium had the highest value of 145.67mmol/l and 4.50mmol/l in T2 compared with the rest of the treatment groups.

Total protein values (2.73-5.03g/dl) and albumin values (1.5- 2.13g/dl) in this study were within the range values (5.00-7.00g/dl) and (2.0-3.5g/dl) reported by Anon (1980) and Jain (1986).

However, globulin values (0.33 – 3.43g/dl) in this study were within the range values (2.07 – 3.81g/dl) reported by Abu *et al.* (2013) and that of Lawal *et al.* (2011) who reported range value of 2.01-3.61g/dl except (0.33g/dl) in T3 (1% star-apple) which shows lower value. The values of these parameters (Total protein, Albumin and Globulin) observed in this study might indicated the nutritional adequacy of the test materials and quality of protein utilization in the diet or implies that the birds on the test ingredient utilized and synthesized the dietary protein from the star-apple meal adequately together with the control group. The finding of Iyayi and Tewe (1998) reported increase in globulin and albumin syntheses are related to availability of nutritional protein.

Table 4: Serum Biochemical Indices of Broiler Chickens fed Graded Levels of Star-Apple

Parameters	T1	T2	T3	T4	T5	LSD
Total Protein (g/dl)	5.03	4.13	2.73	4.73	3.57	2.90 ^{NS}
Albumin (g/dl)	1.60 ^{bc}	2.07 ^{ab}	2.07 ^{ab}	1.50 ^c	2.13 ^a	0.47
Globulin (g/dl)	3.43 ^a	2.07 ^{ab}	0.33 ^b	3.23 ^{ab}	1.43 ^{ab}	2.90
Urea (mmol/l)	8.73	7.97	11.30	11.43	9.60	8.16 ^{NS}
Creatinin (mmol/l)	0.40 ^{ab}	0.37 ^{ab}	0.37 ^{ab}	0.43 ^{ab}	0.50 ^a	0.14
Sodium (mmol/l)	145.67 ^{ab}	154.33 ^a	139.00 ^b	140.00 ^b	139.33 ^b	11.30
Potassium (mmol/l)	3.73	4.50	4.67	4.70	4.93	1.33 ^{NS}

^{abc}: means with different superscripts are significantly different (P<0.05). NS= Not Significant. LSD=Least significant difference

The live weight and carcass weight as well as dressing percentage for all the treatment groups were similar (P>0.05) and non-significant. Similarly, the values for head, neck, wings, shanks and drum stick were all not affected by the dietary treatment. However, thigh and breast values for the experimental chicks indicated

significant (P<0.05) differences among the treatment groups in a different passion. While the highest value of thigh was recorded in birds on diet 2, 4 and 5, the highest value of breast muscle was found on chicks for diets 1 and 2. The values obtained were closer to those reported by Sobayo *et al* (2013).

Table 5: Carcass Weight (g) of Broiler Chicken fed Graded Levels of Star-Apple

Parameters	T1	T2	T3	T4	T5	LSD
Live weight (g)	1516.6	1533.33	1366.67	1333.33	1450.00	204.75 ^{NS}
Carcass weight (g)	906.50	972.73	840.63	821.40	922.07	198.07 ^{NS}
Dressing %	59.70	62.13	61.90	61.57	63.50	12.27 ^{NS}
Prime cut % LV wt						
Head	3.20	3.12	3.34	3.28	3.05	0.59 ^{NS}
Neck	4.01	4.01	4.51	4.36	4.61	1.67 ^{NS}
Wings	7.35	8.35	8.56	8.20	8.65	1.78 ^{NS}
Shank	4.24	3.74	4.15	4.13	4.22	0.99 ^{NS}
Drum stick	9.68	10.98	11.13	10.31	10.20	3.60 ^{NS}
Thigh	11.31 ^c	16.50 ^a	12.20 ^c	15.17 ^{ab}	16.60 ^a	3.57
Breast	17.67 ^{ab}	19.76 ^a	15.24 ^b	14.47 ^b	15.11 ^b	3.51

^{a,b,c}: means in the same row with different superscripts differ significantly (P<0.05). NS= Not Significant

The values of visceral organs (Table 6) showed significant (P<0.05) differences among treatment means in term of liver, kidneys, proventriculus and spleen while the remaining parameters showed no significant (P>0.05)

differences among the treatment means. T2 and T5 had the highest values of gizzard and heart while T4 and T5 had the highest values of proventriculus.

The increased values obtained in the relative weight of gizzard, heart and proventriculus with increased star-apple level than the control treatment might be connected to increased muscularity of the gizzard in the act of digestion of fiber while for heart might be due to supply of

blood. Onibi *et al.* (1999) reported similar report due to increased dietary fiber. Fiber was known to increase the size of gastro-intestinal tract because of the pressure exerted in its digestion (Abeke, 2005).

Table 6: Visceral Organs of Broiler Chicken fed Graded Levels of Star-Apple (% LVwt)

Parameters	T1	T2	T3	T4	T5	LSD
Abdominal fat	0.22	0.52	0.35	0.15	0.24	0.55 ^{NS}
Liver	2.89 ^{ab}	3.15 ^a	2.43 ^b	2.69 ^{ab}	2.61 ^{ab}	0.61
Kidneys	0.68 ^a	0.51 ^{ab}	0.44 ^b	0.63 ^{ab}	0.49 ^{ab}	0.22
Heart	0.44	0.51	0.45	0.45	0.51	0.17 ^{NS}
Gizzard	1.81	1.93	1.83	1.85	1.93	0.62 ^{NS}
Crop	0.67	0.59	0.80	0.81	0.67	0.25 ^{NS}
Proventriculus	0.55 ^b	0.56 ^{ab}	0.59 ^{ab}	0.74 ^a	0.74 ^a	0.18
Spleen	19.7 ^{ab}	2.87 ^a	1.77 ^{ab}	1.26 ^b	1.70 ^{ab}	1.23
Lungs	0.80	0.72	0.70	0.78	0.79	0.32 ^{NS}

^{a,b,c}: means in the same row with different superscripts differ significantly (P<0.05), NS=Not Significant, LVwt= Live weight

CONCLUSION AND RECOMMENDATIONS

The effect of dietary graded levels of star apple meal was investigated in the diet of broiler chickens. The result showed inclusion level of star-apple in the diet of broiler chickens

improved performance and had no health hazard in term of blood profile. Further research should be carried out on the use/productive potentials of star-apple for better performance on broiler chickens.

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