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Carcass characteristics and blood profile of broiler chicken fed graded levels of *Hibiscus sabdariffa* seed meal as alternative source of methionine

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Abstract

One hundred and fifty (150) broilers chicks at 14 days of age were used in six weeks feeding trial to determine the effect of the best natural sources of methionine on performance of broiler chicken. Five broiler starter and finisher diets each were formulated. Diet 1 was the control and contained the DL – methionine., while Diets 2, 3, 4 and 5 contained 2.5%, 5.0%, 7.5% and 10.0% Hibiscus sabdariffa Seed Meal (HSSM) respectively. The birds were randomly allocated to the five treatment diets in a completely randomized design (CRD). Each treatment comprised of three replicates of ten (10) birds per replicates. The result showed that carcass parts were significantly (P<0.05) different across the treatment groups, while organs such as lungs, heart, spleen, gizzard, small intestine length and ceacal length showed no significant (P>0.05) effect. All haematological and biochemical parameters were not affected by dietary treatment except glucose, globulin and urea were significant across the treatment groups. Final weight, body weight gain, daily weight gain, total feed intake, and feed conversion ratio in starter phase were significantly different across the treatment groups. In finisher phase, only initial weight, total feed intake and daily feed intake were significant across the treatment groups. Cost of feed consumed per bird was lowest in T1 (#131.00) and was highest in T5 (#231.00). Feed cost/kg gain was highest in T5 (#700.30) but lowest in T1 (#330.67), while total weight gain/kg was highest in T1 (1.24kg) followed by T4 (1.08). Based on this study, it indicated that replacement of DL – methionine with 2.5% HSS could result in higher profit margin for poultry farmers. It is therefore recommended that Hibiscus sabdariffa seed of natural sources of methionine can replace synthetic methionine in the diet of broiler chickens.

Key words: *Carcass Characteristics, Blood Profile, Broiler Chicken and Hibiscus sabdariffa Seed Meal*

Description of Problem

Broiler chickens grow very fast due to genetic selection and reach a market size at six weeks of age with high breast meat yield (5). Therefore, productivity of broiler chickens need not be compromised despite increasing cost of conventional feedstuffs. According to (16), price of concentrates in Nigeria rose by nearly 400% and commercial feeds by about 2000% within the last 20 years. However, this trend does not have effect on the demand for chicken (13). The authors maintained that demand for broiler chickens were rising as meat consumers interest were gradually shifting from red to white meat. To match this demand as well as produce broiler at reduced cost than what is currently obtainable, evaluation of cheaper, locally available and unconventional feed resources might be the answer.

Methionine and cysteine are considered as the first limiting amino acids in broiler diets based on corn and soya bean meal. Methionine is typically supplemented in broiler diets in the form of chemically produced supplement DL – methionine or methionine hydroxyl analogue producers of organic diets are presently allowed to use chemical methionine supplement but regulators are seeking to eliminate chemical sources from such diets. A good number of natural feedstuffs are considered as rich sources of methionine. However, a plant product has recently been reported to be a satisfactory replacement for DL – methionine broiler feeds (8). The main objective of the study is to evaluate the effect of alternative source of methionine supplementation on carcass characteristics haematological and biochemical indices of domestic chickens

Materials and Methods

Site of the experiment

The research was conducted at the Teaching and Research Farm of the Department of Animal Science and Range Management, Madibbo Adama University. Yola Adamawa State is located in Girei Local Government Area. Girei within the Guinea Savannah Zone of Nigeria and lies between Latitude 90 and 11^0N of the Equator and Longitude 110 and 14^0E of the Greenwich Meridian. Adamawa State Shares its boundaries with Taraba State to the South and West, Gombe State to the North-West and Borno State to the North. The State has a tropical climate with distinct dry and wet seasons. The rainfall begins in April and ends in late October, while the dry season commence in October or November and ends the following April. It has annual rainfall of about700mm-1600mm and an average minimum and maximum temperature of 18-40^0C and relative humidity of 20-50%. Adamawa State has an international boundary with the Cameron Republic along its eastern border (1)

The experiment was conducted for a period of six (6) weeks at the Poultry Unit of the Department of Animal Science Modibbo Adama University Yola Adamawa State, Nigeria. The poultry building is an open side type that permits adequate ventilation in the house with a concrete floor and zinc-roofing sheet. The house is well electrified.

Experimental diets

One hundred and Fifty (150) healthy broiler chicks of nearly similar live body weights of 14 days of age were randomly allocated to five treatments with 10 birds per each per placed on deep litter after two weeks of brooding. The chicks were protected against Gumboro, Newcastle and infectious Bursal Diseases by routine vaccination. Group were T1 (0%) Control diet without Hibiscus sabdariffa Seed Meal (HSSM) supplementation, T2 (2.5%)-Diet with HSSM T3 (5.0%) - Diet with HSSM, T4 (7.5%) – Diet with HSSM and T5 (10.0%)-Diet with HSSM. All the five diets and clean drinking water were given on *ad libitum*. Measured quantity of diet was fed to chicks every day and the leftover feed was recorded after 24 hrs. Mean live body weight (gm/chick/week) was recorded at weekly intervals from 2^{nd}week to 6^{th} week of study. Periodical blood samples were collected from the experimental birds for haematological and biochemical studies at the end of experiment and carcasses traits were also determined.

Economic Analysis

The economic parameter considered were determined using the prevailing market prices of the feedstuff at the time cost of HSSM, cost of medication and that of broilers on the live weight basis.

Results and Discussion

The result on carcass yield and internal organ characteristics were presented in Table 3. It showed no significant difference across the treatment for lungs, heart, spleen, gizzard, small intestinal length and ceacal length, although live weight, slaughter weight, plucked weight, carcass weight, eviscerated weight, dressing percentage, liver, kidney, large intestine length, large intestine weight, small intestine weight, ceacal weight and abdominal fat were significant across the treatment groups. The dressing percentage obtained were in line with report of (12) who reported dressing percentage of 67.32 to 71.59. (10) reported higher values for dressing percentage (73.15 to 89.49) for raw and processed pigeon pea *(Cajanus cajan)* Seed meal which is in line with the result obtained in this study (69.63% to 82.56%). Other organs that were not significant (P>0.05) as mentioned above, the result obtained were however superior to those reported by (6) and (19).

This result agreed with *(*20) reported that source or level of methionine had no significant effect on different organ weights when expressed as percentage of body weight however DL-methionine fed birds had numerically lower organ weight as percentage of body weight when compared to herbal methionine fed groups while the non-significant result, agreed with (9) who reported no significant differences in relative weight of internal organs. This result is in agreement with findings of (17). It also reveals the general inferiority of HSSM to synthetic methionine

Haematological and Biochemical profile (Table 4). The haematological and biochemical profile of broiler chicken fed experimental diets show non-significant differences across the dietary treatments except glucose, globulin and urea (Table 4) showed no significant difference across various dietary treatment, except Glucose, Globulin and Urea which were significantly difference across the dietary treatment. A beneficial effect of HSSM could be assumed from the Serum cholesterol and glucose values which were higher in synthetic methionine fed groups, than in HSSM fed groups elevated glucose and cholesterol being important indicators of stress in chicken (15), thus signifying the anti-stress effect of HSSM in fast growing birds.

This study showed that there were similarities in the haematological indices across the treatment group which was an indication of nutrient balance in the experimental diets. The values for these parameters (PCV, Hb and MCHC) g/dl were similar to the value reported by (4) who reported 25.40-30.00% for PCV, 8.33-10.11g/dl for Hb and 27.30-32.11 for MCHC g/dl which are in line with the one recorded in this study. The RBC values were similar to the values obtained by (18) who reported 1.18-1.94 ($X10^{12}$/L) The values of WBC in this study were the same with values 7.7-23.95 (X109/L) reported by (2). These values indicated that the birds were not affected by the dietary treatment.

The values of serum biochemical indices recorded in this study were within the recommendation reported by (11) and (3). (11) asserted that serum biochemical analysis is used to determine the level of heart attack, liver damage and to evaluate the protein quality and amino acid utilization in animals. The results in this study revealed that utilization of the best sources of HSSM increase Serum glucose and high density lipoprotein and reduce cholesterol, low density lipoprotein and triglyceride.

Parameters such as albumin, creatinine total protein and cholesterol were not significantly difference across the treatment groups, except Urea, globulin and glucose.

The cost benefit analysis is presented in Table 5. The feed cost (N /kg feed) increase and decrease due to the different level of the best sources of Alternative sources of methionine (BSASM) in the diet. The test diet is available in the market. Thus, cost per kg feed were N131.00, N156.00, N181.00, N 206.00 and N231.00 for diet T1(0%BSASM), T2(2.5%BSAM) T3(5.0%BSASM), T4(7.5%BSASM) and T5(10.0%BSASM) respectively. However, the cost per (N/kg) weight gain in treatment diet was lower in T2 (156.00/kg) Hence, diet T2 (2.5% HSS) prove to be more effective. This implied that inclusion of not more than 2.5% HSS in place of synthetic methionine may increase profit margin of broiler production in Nigeria as reported by (7) that natural source of methionine could be substituted in an equal amount like 1.2kg (1.2%) natural sources may just effective, if not more so, than the synthetic counterpart.

Table 1 Proximate composition of experimental broiler chicken starter diet containing graded levels of *Hibiscus sabdariffa* seed meal (HSSM)

Nutrients	T1	T2	T3	T4	T5
Dry matter (%)	89.99	89.59	89.48	89.30	89.35
Crude protein (%)	21.20	20.40	20.50	20.70	20.10
Crude fibre (%)	3.30	3.09	3.54	3.67	3.45
Ether Extract (%)	4.01	4.35	4.15	4.10	4.00
Nitrogen Free Extracts (%)	49.20	46.30	46.70	47.90	47.80
Ash (%)	5.01	5.24	5.00	5.84	5.43
ME (kcal/kg)	2855.81	2750.80	2752.50	2798.45	2764.60

Metabolizable energy (ME) calculated according to the formular of (14). ME = 37 x % CP + 81 x % EE + 35.5 x % NFE.
T1= 0% of HSSM; T 2= 2.5% of HSSM; T3 = 5.0% of HSSM; T4= 7.5% of HSSM; T5 = 10.0% of HSSM
HSSM = *Hibiscus sabdariffa* Seed Meal

Table 2: Proximate composition of experimental broiler chicken finisher diets

Nutrients	T1	T2	T3	T4	T5
Dry matter (%)	90.68	90.58	90.39	90.44	90.75
Moisture	9.32	9.42	9.61	9.56	9.25
Crude protein (%)	20.70	19.60	19.61	19.80	19.70
Crude fibre (%)	3.40	3.60	4.10	4.30	4.50
Ether extract (%)	4.23	4.80	4.45	4.60	4.70
Nitrogen free extract (%)	57.50	55.90	56.40	54.90	53.65
Ash (%)	4.90	5.20	4.43	5.49	5.18
ME (kcal/kg)	3149.78	3098.45	3088.22	3025.40	3014.18

Metabolizable energy (ME) calculated according to the formular of (14). ME = 37 x % CP + 81 x % EE + 35.5 x % NFE.
T1= 0% of HSSM ; T 2= 2.5% of HSSM; T3 = 5.0% of HSSM; T4= 7.5% of HSSM; T5 = 10.0% of HSSM
HSSM = *Hibiscus sabdariffa* Seed Meal

Table 3: Carcass yield and internal organs characteristics of broiler chicken fed graded level of the best source of alternative sources of methionine (ASM)

Parameters	T1 (0%)	T2 (2.5%)	T3 (5.0%)	T4 (7.5%)	T5 (10.08)	SEM
Live wt (g)	1658.00^{ab}	1441.33^{c}	1517.33^{bc}	1758.33^{a}	1451.00^{bc}	62.18*
Slaughter wt (g)	1627.33^{ab}	1409.00^{c}	1491.00^{bc}	1730.33^{a}	1425.00^{c}	57.97*
Plucked wt (g)	1553.33^{a}	1191.00^{b}	1317.33^{ab}	1532.00^{a}	1241.00^{b}	72.90*
Eviscerated wt (g)	1413.67^{a}	1079.00^{b}	1210.67^{ab}	1406.33^{a}	1079.00^{b}	68.90*
Carcass wt (g)	1370.33^{a}	730.67^{b}	1104.00^{ab}	1359.00^{a}	1052.33^{ab}	152.20*
Dressing percentag (%)	82.56^{a}	69.63^{b}	72.90^{b}	77.07^{ab}	72.69^{b}	2.68*
Internal Organs						
Lungs (g)	8.33	5.67	5.33	8.67	7.67	1.18^{NS}
Heart (g)	7.00	8.00	6.00	8.00	10.00	1.15^{NS}
Liver (g)	26.00^{b}	24.33^{b}	28.33^{b}	40.33^{a}	32.00^{ab}	2.61*
Kidney (g)	12.67^{a}	11.67^{a}	6.00^{b}	6.00^{b}	8.33^{b}	1.02*
Spleen (g)	1.00	1.00	1.33	1.67	1.33	0.28^{NS}
Gizzard (g)	25.67	22.67	27.33	23.00	22.33	2.48^{NS}
Large int. length (cm)/kg	7.33^{ab}	7.33^{ab}	6.50^{ab}	8.00^{a}	5.33^{b}	0.72*
Large int. wt (g)	2.33^{ab}	3.67^{a}	2.00^{a}	2.67^{ab}	1.67^{a}	0.49*
Small int. length (cm)/kg	157.67	149.33	163.67	171.67	165.00	11.93^{NS}
Small int. wt (g)	46.33^{b}	46.33^{b}	50.00^{ab}	66.00^{a}	64.33^{a}	4.93*
Ceacal length (cm)/kg	16.33	16.33	18.00	18.33	15.00	1.06^{NS}
Ceacal wt. (g)	7.00^{ab}	6.67^{b}	8.33^{ab}	10.67^{a}	9.00^{ab}	1.11*
Abdominal fat (g)	22.00^{b}	47.33^{a}	34.67^{ab}	43.00^{ab}	40.33^{ab}	6.45*

a,b,c = means on the same row with different superscript are significant differently (P<0.05)
(P<0.01), (P<0.001), * = (P<0.05) ** = (P<0.01), *** = (P<0.001)
Wt = weight ASM = Alternative sources of methionine * = Significant NS = not significant
SEM = Standard Error of Mean.

Table 4: Haematological and Biochemical Indices of broiler chickens fed graded level of the best sources of alternative sources of methionine (ASM)

Parameters	T1 (%)	T2 (2.5%)	T3 (2.5%)	T4(2.5%)	T5 (2.5%)	SEM
Haematology						
WBC (x 10^9/L)	2.36	2.34	2.39	2.49	2.43	0.12^{NS}
RBC (x 10^6ml)	2.00	2.23	2.10	2.16	2.12	0.21^{NS}
Hb (g/dl)	7.73	7.63	7.43	8.67	8.43	0.80^{NS}
PCV (%)	24.40	27.37	27.13	30.90	29.70	2.43^{NS}
MCV (fl)	131.87	138.97	141.83	143.70	140.03	4.31^{NS}
MCH (pg)	38.60	38.67	40.53	40.23	39.50	1.11^{NS}
MCHC (g/dl)	29.27	27.87	28.57	28.07	28.20	0.55^{NS}
PLT (Cells/L)	10.67	16.00	20.67	15.33m	15.00	3.05^{NS}
Biochemical indices						
Albumin (mg/dl)	1.42	1.52	1.45	1.52	1.66	1.39^{NS}
Creatinine (ummol/l)	48.13	43.57	44.90	41.47	40.63	3.46^{NS}
Glucose (ummol/l)	13.60	14.30^{a}	13.27^{a}	7.37^{b}	10.30^{ab}	1.52*
Total protein (mg/dl)	2.70	3.22	2.91	3.46	3.38	2.84^{NS}
Cholesterol (mg/dl)	200.67	191.67	186.67	199.00	183.33	11.30^{NS}
Globulin (g/l)	1.88^{b}	1.71^{c}	1.97^{a}	1.91^{a}	1.89^{b}	0.92*
Urea (ummol/L)	3.60^{b}	3.10^{b}	4.47^{a}	3.30^{b}	2.93^{b}	0.25*

a,b& c = mean on the same row with different superscripts differently significantly (P<0.05)
SEM = Standard Error of Mean * = Significant (P<0.05),
NS= Not Significant (P>0.05) ASM = Alternative Sources of Methionine
PCV= Packed Cell Volume MCV= Mean Corpuscular Volumes
MCH= Mean Corpuscular Haemoglobin MCHC = Mean Corpuscular Haemoglobin Concentration
WBC = White Blood, Cell RBC = Red Blood Cell PLT = Platelets

Table 5: Economics of production of broiler chicken fed graded levels of HSSM

	Diets/Treatment				
Parameters	T1 (0.0%)	T2 (2.5%)	T3 (5.0%)	T4 (7.5%)	T5 (10.0%)
Total feed intake (kg/birds)	3.13	2.49	2.39	2.96	2.88
Feed cost (N/kg)	131.00	1.56.00	181.00	206.00	231.00
Cost of total feed intake (N/kg)	410.03	388.44	432.59	609.76	665s.28
Total cost gain (kg)	1.24	0.90	0.86s	1.08	0.95
Feed cost/kg (N/gain)	330.67	431.60	503.01	564.59	700.30
Feed cost saving	266.67	479.56	584.90	522.77	737.16

Metabolizable energy (ME) calculated according to the formular of (14). ME = 37 x % CP + 81 x % EE + 35.5 x % NFE.
T1= 0% of HSSM
T 2= 2.5% of HSSM
T3 = 5.0% of HSSM
T4= 7.5% of HSSM
T5 = 10.0% of HSSM
HSSM = *Hibiscus sabdariffa* Seed Meal

Conclusion and Applications

From the results of this study,

1. It is concluded that poultry farmers should use plants such as *Hibiscus sabdariffa*, that contained high amount of methionine to prepare natural methionine that will replace synthetic methionine in their animal diets.
2. The study recommends that 2.5% of *Hibiscus sabdariffa* seed meal of natural sources of methionine can replace synthetic methionine in the diet of broiler chickens.

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