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Carcass Characteristics and Nutrient Digestibility of Broiler Chickens Fed White Sorghum Supplemented with Graded Levels of Synthetic Methionine

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Abstract

The effect of feeding broiler chickens with white sorghum supplemented with graded levels of synthetic methionine on carcass characteristics and nutrient digestibility were investigated as 300 day old chicks were used for the experiment. They were randomly divided into five dietary treatments with 60 birds each and replicated thrice with 20 birds per replicate in a Completely Randomized Design (CRD). The experimental diets (white sorghum) were supplemented with synthetic methionine at 0.1, 0.2, 0.3, 0.4 and 0.5% for treatment T_1, T_2, T_3, T_4 and T_5 respectively. Results showed no significant effect ($P>0.05$) on carcass characteristics and internal organs but was significantly ($P<0.05$) different in nutrient digestibility amongst treatments. From this study, it was concluded that inclusion of synthetic methionine to white sorghum diets up to 0.5% in broiler ration was found to be beneficial at 0.5% for carcass characteristics and at 0.4% for nutrient digestibility without any deleterious effect.

Keywords: *White sorghum, synthetic methionine, broiler, carcass, nutrient, digestibility.*

Introduction

It is an established fact that the sub-Saharan African has not been able to meet the animal protein requirement of her citizens due to so many reasons principally the inability to produce enough animal protein (meat, milk and meat) to meet the demand of teeming population as a result of high cost of conventional feed stuffs for animals. The poultry nutrition constitute about 65-70% of the total cost of poultry production (1). Because of that the development of poultry industry depends to large extent on the availability of feedstuffs that are used or can be made suitable for use in poultry nutrition. Maize corn and soyabean meal are the two major ingredients used in poultry nutrition. The energy source component of poultry diets represents the largest single dietary ingredient. Maize which is the main source of energy in poultry diets over the year has become very expensive due to human-animal competition and other industrial use coupled with low production in the drier areas of the tropics (2). The situation therefore requires research interest in sourcing for alternative energy feedstuffs in poultry feeds (3). One of such alternatives is white sorghum variety largely produced in the northern part of Nigeria with low human demand unlike maize. It is fairly white in colour, high yielding, drought resistant, tolerant to heat and has relatively low tannin content, not commonly or satisfactory used by farmers as food but instead used for local drinks (Burukutu). (4) reported that sorghum can play an important role in poultry diets in a trial where sorghum was used as source of dietary energy in turkey poults feed. The haematology and serum parameters did not vary much from the normal maize and therefore recommended that the use of the sorghum varieties would improve the feed supply system of the birds at affordable cost in poultry feeds. The supplementation of methionine is to aid in digestion of the feed and provide other numerous benefits associated to its inclusion. Methionine is an essential nutrient for poultry, in addition, this amino acid provides methyl groups, which are needed for serial metabolic reactions such as the synthesis of carnithine and creatine (5). Methionine is considered to be the first limiting amino acid in broilers fed practical corn-soyabean meal diets were the lysine and methionine requirement for broiler chicks. If the corn or soyabean meal were replaced in the ration, adequate dietary supplementation with lysine or methionine were needed to support optimum growth and carcass yield of fast growing commercial broilers (6). Information is therefore needed on carcass characteristics and nutrient digestibility of broiler chickens fed white sorghum supplemented with graded levels of methionine which was investigated in this study.

It is therefore important to evaluate the dietary value of sorghum in the diets of broiler chickens for performance and cost benefits. This study therefore was designed to assess the carcass characteristics and nutrient digestibility of broiler

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chickens fed white sorghum supplemented with graded levels of synthetic methionine.

Materials and Methods

Study Area/Location

The study was carried out at the poultry units of Teaching and Research farm of Taraba State College of Agriculture, Jalingo. The State is in the North-East ge-political zone of Nigeria. It lies between latitude $80^0$52'59N and $11^0$22'E and longitude 8.89^0N and 11.38^0 East of the equator in the Savannah zone of Northern Nigeria (7). There are two main seasons existing in the area of study, it has an annual rainfall of 1000-1500mm with temperature range of 30-42^0C. The State is characterized by tropical climate marked by dry and rainy/wet season. The rainy season usually commences in the month of March and ends in October, while dry season start in late October and ends in March (7).

Experimental Birds and Management

A total of three hundred (300) day old Anak white broiler chicks of mixed sexes were used for the experiment. The chicks were raised/brooded on a deep litter management system for a period of one week. During the brooding, all the necessary management practices were strictly adhered to/followed. After the brooding, the chick were randomly allotted to various experimental treatments.

Experimental Diets and Design

Five dietary treatment were formulated in which sorghum was supplemented with graded levels of methionine at 0.1, 0.2, 0.3, 0.4 and 0.5% for T_1, T_2, T_3, T_4 and T_5 respectively. Each dietary treatment is made up of sixty birds and three replicates of twenty (20) birds each and coded R_1, R_2 and R_3. The experiment was conducted in a Completely Randomized Design (CRD) in a conventional poultry house. The feeding trials lasted for eight (8) weeks in two phases i.e. 1-4 weeks (starter phase) and 5-8 weeks (finisher phase). Feed and clean water were provided *ad libitum*, while routine medication and management practices were strictly followed throughout the duration.

Data Collection

Carcass Evaluation

Five birds were randomly selected from each of the replicates for carcass analysis, the selected birds were starved overnight and their live weights recorded. The birds were slaughtered by severing the jugular vein and were fully bled before scalding in hot water. The birds were de-feathered after scalding. The birds were eviscerated and the eviscerated weight recorded. The dressed weights, thigh weights, drumsticks and organs (liver, heart and gizzard) weights were expressed as percentage of liveweight.

Nutrient Digestibility Trial

Broilers were fed the diets for a period of 56 days each during starter and finisher phases. Faeces were collected to evaluate the nutrient utilization of diet containing different levels of treatments at the last 7days of the trial of each phase. The required quantity of feed were weighed daily with a sensitive scale before given to the birds. Left over were measured and subtracted from the feed offered to get actual feed intake. Fecal samples were collected over the period of one week. One from each of the units was used for digestibility studies. The droppings collected were oven-dried for a period of 18 hours at a temperature of 105^0C and weighed daily. At the end of the collection period, the fecal samples collected from each replicate per day were bulked, ground and thoroughly mixed to obtain a homogenous mixture. Samples of the droppings were taken for proximate analysis according to standard methods (8) and the results obtained was used to calculate the apparent digestibility by using the formula below:

$$\frac{\text{nutrient in feed} - \text{nutrient in faeces}}{\text{nutrient in feed}} \; x \; 100$$

Statistical Data Analysis

Data obtained were subjected to two way analysis of variance (ANOVA) for factorial experiment using (9) model and significant different means were separated at 5% level of significant using Duncan's Range Test (DRMT) as described by (10).

Results and Discussion

The proximate composition of Broiler starter and finisher diets were as presented in Table 3 and 4 respectively. The Crude Protein (CP) and metabolizable energy values of the experimental diets are adequate for birds raised under tropical climates (9, 10, 11). The carcass and internal organ characteristics is presented in Table 5. All parameters measured were not affected by the diet ($P>0.05$). The liveweight, plucked weight, eviscerated weight, carcass weight values were highest in T_5 (0.5%) with values of T_5 (1911.67g), T_4 (1850g). T_3 (1810g), T_2 (1785g) and T_1 (1760g) respectively. So also is dressing percentage better in T_5 (71.49%), followed by T_3 (69.98%), T_1 (69.60%), T_2 (69.47%) and T_4 (69.29%). The results obtained for dressing percentage in this study were similar, these results are in agreement with that of (14) who reported that there was no significant different among the treatments in whole carcass or weight of carcass parts of broiler chickens fed on sorghum based diets at 42 days of age. All other parameters measured showed non-significant difference ($P>0.05$) among the treatment groups. This finding was similar to the observations of (15) who reported that groundnuts cake and sorghum had no negative effect on carcass characteristics of broiler chicken, but in contrast to (16) who reported variation in carcass characteristics of broiler chickens fed different energy sources, probably due to varietal differences. The liveweight range of 1760-1911.67g (1.8-1.9kg) falls within 1.5-3.1kg reported by (17) and slightly higher than 1351.66-1856.66g and 1.3-1.80kg recorded by (18) and (19) respectively. The carcass weight range of 1225-1366.77g is within the range of 1106.66-1403.33g and 1102.67-1416.67g reported by (18) and (20). As can be observed, carcass weight increased slightly with increased inclusion levels of methionine from T_1 – T_5. This can be explained by the report of (20) that increase in methionine intake resulted in a higher body weight. The dressing percentage with a range of 69.29-71.29% falls within the range of 63.71-74.24% 71-75%, reported by (21, 22). The

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fact that high dressing percentage were recorded on dietary treatments is an indication that broilers can perform well with the diets, since carcass weight and dressed percentage represent the absolute value of sellable meat (23). The result indicated that the cut parts did not follow any definitive pattern. The internal organs showed no significant differences among the treatment, even though some parts shows higher values from T_1-T_5. This is a preliminary indication that there was no hypertrophy of any of the visceral organs. Relative organ weight has been used as an indication of suitability of feed for livestock (24). Table 6 shows the result of nutrient digestibility of broiler chickens fed different inclusion levels off synthetic methionine with white sorghum-soyabean diet. There was significant ($P<0.05$) difference amongst treatments. However, Crude Protein (CP) was more digestible in T_4 (91.14%), followed by T_2 (90.38%), T_1 (87.62%), T_3 (87.19%) and the least in T_5 (84.22%). This is in agreement with the report of (25). Crude fibre (CF) was also better in T_4 (65.10%) followed by T_2 (60.77%) and the least in T_5 (30.22%). Most of the parameters measured were better in T_4 (0.4%) methionine. This may indicate optimal inclusion level for best performance and also in line with the findings of (25). However, dry matter (DM) digestibility was better in T_3 (92.02%), followed by T_5 (85.28%) with the least in T_4 (64.22%) also in agreement with (26).

Conclusion

Inclusion of synthetic methionine in broiler ration fed white sorghum was found to be beneficial at 0.5% (T_5) for carcass characteristics and 0.4% (T_4) for nutrient digestibility without any deleterious effect on the birds and can be so used.

Table 1: Ingredient composition of broiler starter diets (1-4 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Ingredients	Diets				
	T_1 (0.1%)	T_2 (0.2 %)	T_3 (0.3%)	T_4 (0.4 %)	T_5 (0.5%)
White Sorghum	47.10	46.96	46.82	46.69	46.57
Soya bean	33.60	33.64	33.68	33.71	33.73
Wheat offal	9	9	9	9	9
Methionine	0.1	0.2	0.3	0.4	0.5
Fish meal	5	5	5	5	5
Bone meal	2	2	2	2	2
Lime stone	1	1	1	1	1
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100
Calculate Analysis					
Crude protein	23.47	23.47	23.47	23.47	23.47
ME/kcal/kg	2934.88	2931.26	2982.12	2924.75	2921.41
Crude fibre (%)	3.49	3.49	3.49	3.49	3.49
Calcium (%)	1.62	1.62	1.62	1.62	1.62
Phosphorus (%)	0.80	0.72	0.72	0.71	0.72
Lysine (%)	1.33	1.33	1.33	1.33	1.33
Methionine (%)	0.52	0.52	0.52	0.52	0.52

* Vitamin-mineral premix provide per kg: Vit. A 1500 IU; Vit. D_3 3000 IU; Vit. E; 30 IU, Vit. K 2.5mg; Thiamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4mg; Niacin 40mg; Vit. B_{12} 0.02mg; Panthonic acid 10mg; Folic acid 1mg; Biotin 0.08mg; Chloride 0.125mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; 10.014g; Se 0.24g; Co 0.240g.

Table 2: Ingredient composition of broiler finisher diets (5-8 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Ingredients	Diets				
	T_1 (0.1%)	T_2 (0.2 %)	T_3 (0.3%)	T_4 (0.4%)	T_5 (0.5%)
White Sorghum	53.09	52.97	52.82	52.70	52.56
Soya bean	22.61	22.63	22.68	22.70	22.74
Wheat offal	12	12	12	12	12
Methionine	0.1	0.2	0.3	0.4	0.5
Fish meal	5	5	5	5	5
Palm oil	3	3	3	3	3
Bone meal	2	2	2	2	2

*Corresponding Author: **Olusiyi, J. A.**

Lime stone	1.5	1.5	1.5	1.5	1.5
Salt	0.25	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25	0.25
Lysine	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100
Calculate Analysis					
Crude protein	20.53	20.53	20.53	20.53	20.53
ME/kcal/kg	2989.12	2985.78	2982.38	2979.04	2975.66
Crude fibre (%)	3.05	3.05	3.05	3.05	3.05
Calcium (%)	1.62	1.62	1.62	1.62	1.62
Phosphorus (%)	0.78	0.76	0.76	0.76	0.76
Lysine (%)	1.09	1.09	1.09	1.09	1.09
Methionine (%)	0.51	0.51	0.51	0.51	0.51

* Vitamin-mineral premix provide per kg: Vit. A 1500 IU; Vit. D_3 3000 IU; Vit. E; 30 IU, Vit. K 2.5mg; Thiamine B_1 3mg; Riboflavin B_2 6mg; Pyrodoxine B_6 4mg; Niacin 40mg; Vit. B_{12} 0.02mg; Panthonic acid 10mg; Folic acid 1mg; Biotin 0.08mg; Chloride 0.125mg; Mn 0.0956g; Antioxidant 0.125g; Fe 0.024g; Cu 0.006g; 10.014g; Se 0.24g; Co 0.240g.

Table 3: Proximate composition of broiler starter diets (1-4 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Nutrients	Diets				
	T_1 (0.1%)	T_2 (0.2%)	T_3 (0.3%)	T_4 (0.4%)	T_5 (0.5%)
Dry matter	94.20	95.50	95.20	95.40	94.80
Moisture content	5.80	4.50	4.80	4.60	5.20
Crude protein	21.66	20.99	21.95	20.20	23.95
Crude fibre	4.90	4.50	4.10	4.40	3.90
Ash	9.20	14.20	9.90	16.20	12.50
Ether extract	9.40	9.31	9.48	9.13	9.26
Nitrogen	49.04	46.50	49.77	45.45	45.19
ME (kcal/kg)	3303.74	3181.49	3346.87	3101.12	3240.46

NFE - Nitrogen Free Extract
ME - Metabolizable Energy
ME (kcal/kg) - 37 x % CP + 81 x %EE + 35.5 x % NFE (Pauzenga, 1985)

Table 4: Proximate composition of broiler finisher diets (5-8 weeks) containing white sorghum supplemented with varying levels of methionine (%)

Nutrients	Diets				
	T_1 (0.1%)	T_2 (0.2%)	T_3 (0.3%)	T_4 (0.4%)	T_5 (0.5%)
Dry matter	93.80	95.00	94.60	93.80	91.70
Moisture content	6.20	5.00	5.40	6.20	8.30
Crude protein	19.95	18.85	19.20	18.40	19.60
Crude fibre	5.70	5.40	4.80	5.80	6.40
Ash	11.10	9.90	10.50	10.30	8.80
Ether extract	9.20	9.90	9.30	9.00	9.35
Nitrogen free extract	47.85	51.95	50.80	50.30	47.55
ME (kcal/kg)	3182.03	3262.58	3267.10	3203.45	3197.58

NFE - Nitrogen Free Extract
ME - Metabolizable Energy
ME (kcal/kg) - 37 x % CP + 81 x %EE + 35.5 x % NFE (Pauzenga, 1985)

Table 5: Carcass yield and internal organs characteristics of broiler chickens fed white sorghum supplemented with graded levels of synthetic

*Corresponding Author: **Olusiyi, J. A.**

Parameters	Diets					SEM
	T_1 (0.1 %)	T_2 (0.2%)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5%)	
Live weight (g)	1760.00	1785.00	1810.00	1850.00	1911.67	2.42^{ns}
Plucked weight (g)	1595.00	1603.33	1633.33	1668.23	1705.00	2.45^{ns}
Eviscerated weight	1381.67	1396.67	1426.67	1460.00	1523.33	2.21^{ns}
Carcass weight (g)	1225.00	1240.00	1266.67	1281.67	1366.67	24.74^{ns}
Dressing (%)	69.60	69.47	69.98	69.29	71.49	0.39^{ns}
% of liveweight						
Back	9.39	9.28	9.30	10.02	8.16	0.299^{ns}
Chest	6.19	6.14	6.08	6.96	6.47	0.16^{ns}
Wings	10.78	10.72	10.83	12.22	11.25	0.28^{ns}
Thighs	13.91^{a}	13.89	13.31	12.65	11.81	0.39^{ns}
Drum sticks	12.92^{a}	12.57^{a}	12.29^{a}	11.22^{b}	10.64^{b}	0.4307^{ns}
Shanks	5.61	5.17	5.19	4.89	4.74	0.15^{ns}
Gizzard	3.88	3.14	3.39	3.45	2.99	0.15^{ns}
Kidney	2.18	1.92	1.77	1.87	1.73	0.08^{ns}
Liver	0.68	0.67	0.85	0.76	0.75	0.03^{ns}
Lungs	0.47	0.42	0.44	0.36	0.35	0.02^{ns}
Spleen	9.55	9.86	10.85	9.89	9.29	0.26^{ns}
Pancreas	0.23	0.15	0.17	0.19	0.12	0.12^{ns}

methionine

a, b, c means with different superscripts on the same row are significantly different * = Significant (P<0.05)
NS - Not significant
SEM - Standard error of means

Table 6: Effect of different inclusion of synthetic methionine on nutrient digestibility of broiler chickens fed white sorghum

% Utilization	Diets					SEM
	T_1 (0.1 %)	T_2 (0.2 %)	T_3 (0.3 %)	T_4 (0.4 %)	T_5 (0.5 %)	
Crude protein (CP)	87.62^{b}	90.38^{a}	87.19^{b}	91.14^{a}	84.22^{c}	0.54*
Crude fibre (CF)	39.06^{b}	60.77^{a}	41.05^{b}	65.10^{a}	30.22^{b}	3.10*
Ether Extract (EE)	85.90^{d}	94.01^{b}	93.90^{b}	96.09^{a}	48.70^{c}	2.89*
ASH	35.88^{d}	62.40^{b}	58.01^{b}	76.20^{a}	48.73^{c}	2.91*
Dried Matter (DM)	84.00^{b}	81.86^{b}	92.02^{a}	64.22^{c}	84.28^{b}	1.80*
Nitrogen Free Extract (NFE)	80.30^{b}	79.50^{b}	75.62^{c}	87.05^{a}	79.22^{b}	0.84*
Creatine (mg/dl)	30.09^{b}	30.10^{a}	30.06^{c}	30.11^{a}	30.09^{b}	0.01*

^{abcd} means along the same row with difference superscripts a significant difference (P<0.05).

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