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EFFECTS OF DIETS CONTAINING RED AND WHITE SORGHUM SUPPLEMENTED WITH TANNASE ON THE GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF BROILER CHICKENS

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Abstract

A 56 - day feeding trial was conducted to determine the growth performance and nutrient digestibility of broiler chickens fed diets containing red sorghum (RS) and white Sorghum (WS) with or without tannase supplementation. A total of 240 one day old unsexed Arbor acre broiler chicks were randomly assigned to eight (8) dietary treatments which were divided into 3 replicates each of 10 birds in a randomized completely block design 4x2 factorial arrangement. Eight (8) diets were formulated in which sorghum replaced maize at 0, 100 RS, 100 WS and 50RS:50WS% at the starter and finisher phases. The first 4 diets (diets 1, 2, 3 and 4) were

formulated without tannase then the other 4 diets (diets 5, 6, 7 and 8) had the same composition as diets 1, 2, 3 and 4 but supplemented with tannase. Growth performance data was collected on weekly basis and nutrient digestibility was determined at the 28th and 56th day for starter and finisher phases respectively. Starter birds fed 100%WS diet and those fed 50RS:50WS tannase supplemented diet had the highest (P<0.05) final weight and weight gain. There was no significant (P>0.05) difference in the growth indices of the finisher birds except the total feed intake which was highest (P < 0.05) in birds fed 50RS:50WS% diet without tannase. Although, finisher birds fed the control diet with tannase had the least feed intake, those fed the control diet without tannase had the best FCR. None of the nutrient digestibility indices were significantly (P>0.05) influenced at the starter phase except the crude protein retention which was highest (P< 0.05) in finisher birds fed 100%RS diet supplemented with tannase. In conclusion, 100% WS without tannase and 50RS:50WS with tannase may replace maize in starter broilers diet while 100% RS and 100% WS with or without tannase may replace maize in finisher broilers diet for optimum performance and nutrient digestibility without any deleterious effect. Similarly, the addition of tannase to the control diet also enhanced performance and nutrient digestibility.

Introduction

There is an exponential increase in the prices of poultry products lately in sub-Sahara area especially in Nigeria. This hike in price could be attributed to the concurrent increase in the prices of poultry feed ingredients (Nwose *et al*., 2022). Maize being about 60-70% component of such feed could therefore be regarded as a major determinant of the cost of poultry product (Fapohunda *et al*., 2008) which in turn determines the selling price and the rate of demand. The minimum per capita daily protein intake as recommended by Food and Agriculture Organization is 53.8g, where as a paltry 45.4g is consumed in Nigeria (FAO, 2020). The observed low animal protein consumption may be attributed to the declining animal protein production occasioned by high cost of feeds, particularly energy feed sources

like maize which is a major component for poultry feed (Oluyemi and Roberts, 2013). The competition between man and livestock for maize, coupled with its increased industrial uses have led to the scarcity and elevated price of maize (Lakurbe *et al*., 2018) which has necessitated the quest for alternative sources of energy that can replace maize and contribute to increased supply of animal protein at an affordable price (Anthony, 2009; Mafimidiwo *et al*., 2023). Sorghum grain is an interesting energy ingredient in poultry diets due to its similar nutritional composition to maize. Maize and sorghum contain 3432 and 3256 kcal/kg metabolizable energy, 9.0 and 11.0% crude protein respectively (Gunawan *et al*., 2022). Sorghum is a less competitive cereal grain, readily available and can be grown in harsh weather condition (Abdulkadir *et al*., 2016). The utilization of sorghum grain by non-ruminant animal, however, is limited due to the presence of anti-nutritional factors such as tannin and phytates (Etuk *et al*., 2012). The use of improved sorghum varieties with low tannin concentration greatly improve nutrient digestibility for poultry (Scott, 2013). Tannase can be used to reduce the concentration of tannin in sorghum by catalyzing the hydrolysis of tannin to release glucose and gallic acid (Selwal *et al*., 2011). This study aimed to explore whether the use of sorghum to replace maize in broiler chickens' diets will not reduce the nutritional quality of the rations and the performance of the birds. The effects of replacing maize with red and white sorghum supplemented with or without tannase on the growth performance and nutrient digestibility of broiler chickens was therefore evaluated in the study.

Materials and Methods

Preparation of experimental materials : The test ingredients used were red sorghum, white sorghum and tannase (solid). The two sorghum varieties were sourced from open market, while the maize was sourced from a reputable feedmill. The maize, red sorghum and white sorghum were crushed using the mechanical crusher and enriched with the additive (tannase enzyme) during the formulation of the experimental diets. Tannase enzymes were produced at the laboratory of department of Animal Nutrition, Federal University of Agriculture, Abeokuta. Cultured fungal spores (*Aspergillus* spp.)

obtained from Microbiology laboratory were screened and the best clear zone producing isolates were selected and separated for tannase production using methods described by Abou-Bakr *et al.* (2013). Optimization studies were done for temperature, pH and incubation period for maximum enzyme production and activity (Yao *et al.,* 2014). Sorghum was dehulled to obtain sorghum bran. The medium was prepared and autoclaved. Mouldy bran was broken and dried at 40-50^{o}C and the dried mouldy bran was then crushed, milled and stored for usage (solid tannase).

Experimental diets and design

Eight (8) experimental diets were formulated for each phase (broiler starter and finisher) of the experiment to meet with nutrient requirement of the birds according to National Research Council recommendation (NRC, 1994) as shown in Tables 1 and 2 respectively. Diet 1 had maize as the main energy source (control), diets 2,3 and 4 had maize totally replaced by red sorghum, white sorghum and 50% red + 50% white sorghum respectively. Diets 5, 6, 7 and 8 had the same compositions as diets 1, 2, 3 and 4 but with the addition of 0.5g tannase / kg feed. Experimental diets and water were supplied to the birds *ad libitum* for 56 days (0-28 days broiler starter diet and 28-56 days finisher diet). Normal vaccination and medication programmes were strictly adhered to as recommended by the breeder. The birds were allotted into 8 dietary treatments of 30 birds and each treatment was sub divided into 3 replicates of 10 birds each. The experimental design used is a Randomized Completely Block Design (RCBD) in a 4x2 factorial arrangement.

Data collection

Growth performance: Birds in each replicate were weighed at the beginning of the experiment and subsequent weighing was done on weekly basis to determine their weekly body weights. Weight gain was determined by the difference in the body weights of the two consecutive weighings for each replicate group. Feed intake data were collected weekly and feed intake was calculated by deducting the left over feed from the initial feed supplied.

Nutrient digestibility: At the 28th and 56th days (starter and finisher) of the experiment, 2 birds per replicate were randomly selected and transferred to a clean disinfected metabolic cage. A three days acclimatization period was allowed prior to the collection of excreta. Thereafter records of feed supplied, feed intake and voided excreta samples were collected on daily basis for 3 days. The excreta samples were oven dried to a constant weight at 65° C temperature. The dried excreta samples were pooled together on replicate basis and proximate analysis of the experimental diets and excreta samples for dry matter, crude protein, ether extract, crude fiber, ash and nitrogen free extract were determined by the methods of AOAC (2005). Dry matter (%) was determined by drying samples at 65°C in a pre-weighed dried crucible in a convection oven until constant weight was achieved (AOAC International, 2005; method no: 930.15).

The nitrogen free extract (%) was calculated as follows:

NFE = 100 – (% Moisture + % Crude protein + % crude fibre + % ether extract + % ash)

Crude protein was determined by total combustion method (AOAC International, 2005; method no: 968.06). Ether extract content was determined by Soxhlet extraction (AOAC International, 2005; method no: 991.36).The fibre fractions which include the neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were determined according to the methods of Goering and Van Soest (1970). Values obtained were used to estimate the digestibility of constituent nutrients using the formula:

$$\text{Dry matter digestibility} = \frac{\text{Feed intake x DM of feed} - \text{faecal output}}{\text{Feed Intake x DM of feed}} \times 100$$

$$\text{Nutrient digestibility (\%)} = \frac{\text{Nutrient intake (g)} - \text{Nutrient excreted (g)}}{\text{Nutrient Intake (g)}} \times 100$$

The digestible Crude protein was calculated from the result of proximate composition of both the feed and faecal samples as follows:

Digestible CP =

$$\frac{Feed\ intake\ (DM)\ x\ \%\ CP\ in\ feed\ -\ faecal\ (DM)\ x\ \%CP\ in\ faecal\ x\ 100}{Feed\ Intake\ (DM\ )\ x\ \%\ CP\ in\ feed}$$

The same method was used for calculating the digestibility percentage of fat, crude fibre and ash.

Table 1: Gross composition of experimental broiler starter diets (0-28 days)

	Without Tannase				With Tannase			
Ingredients	**Diet1**	**Diet 2**	**Diet 3**	**Diet 4**	**Diet 5**	**Diet 6**	**Diet 7**	**Diet 8**
Maize	52.00	-	-	-	52.00	-	-	-
Red sorghum	-	52.00	-	26.00	-	52.00	-	26.00
White sorghum	-	-	52.00	26.00	-	-	52.00	26.00
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Soyabean meal	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
Palm oil	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Wheat offal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Limestone	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Dicalcium Phosphate	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Premix	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Toxin binder	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Tannase	-	-	-	-	+	+	+	+
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated nutrient values								
ME (kcal/kg)	2920.20	2867.81	2811.00	2839.41	2920.20	2867.81	2811.00	2839.41
Crude Protein	24.30	24.82	24.51	24.69	24.30	24.82	24.51	24.69
Crude Fat (%)	3.68	3.04	3.16	3.10	3.68	3.04	3.16	3.10
Crude Fibre (%)	3.33	3.18	3.31	3.26	3.33	3.18	3.31	3.26
Calcium (%)	1.01	1.00	1.02	1.01	1.01	1.00	1.02	1.01
Available Phosphorus	0.43	0.38	0.54	0.46	0.43	0.38	0.54	0.46

%								

1kg of broiler premix contains*: Vitamin A 10,000,000 IU; Vitamin E 20,000 IU; Vitamin K 2,250mg; Thiamine1750mg; Riboflavin 5000mg; Pyridoxine 2,750mg; Niacin 27,500mg; Vitamin B12 15mg ; Pantothenic acid 7500mg; Biotin 50mg; Choline chloride 400g; Antioxidant 125g; Magnesium 80g; Zinc 50mg; Iron 20g; Copper 5g; Iodine 1.2g; Selenium 200mg; Cobalt 200mg.*

Table 2: Gross composition of experimental broiler finisher diets (28-56 days)

	Without Tannase				With Tannase			
Ingredients	**Diet1**	**Diet 2**	**Diet 3**	**Diet 4**	**Diet 5**	**Diet 6**	**Diet 7**	**Diet 8**
Maize	57.00	-	-	-	57.00	-	-	-
Red sorghum	-	57.00	-	28.50	-	57.00	-	28.50
White sorghum	-	-	57.00	28.50	-	-	57.00	28.50
Fish meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Soyabean meal	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00
Palm oil	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Wheat offal	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
Limestone	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Bonemeal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Toxin binder	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Tannase	-	-	-	-	+	+	+	+
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Calculated nutrient values

ME (kcal/kg)	**2936.50**	**2873.81**	**2816.80**	**2845.31**	**2936.50**	**2873.81**	**2816.80**	**2845.31**
Crude Protein (%)	21.64	22.21	21.81	22.01	21.64	22.21	21.81	22.01
Crude Fat (%)	3.65	2.97	3.08	3.03	3.65	2.97	3.08	3.03
Crude Fibre (%)	3.24	3.13	3.21	3.19	3.24	3.13	3.21	3.19
Calcium%	1.16	1.15	1.18	1.17	1.16	1.15	1.18	1.17

Available Phosphorus %	0.44	0.39	0.57	0.48	0.44	0.39	0.57	0.48

1kg of broiler premix contains*: Vitamin A 10,000,000 IU; Vitamin E 20,000 IU; Vitamin K 2,250mg; Thiamine*

1750mg; Riboflavin 5000mg; Pyridoxine 2,750mg; Niacin 27,500mg; Vitamin B12 15mg ; Pantothenic acid 7500mg; Biotin 50mg; Choline chloride 400g; Antioxidant 125g; Magnesium 80g; Zinc 50mg; Iron 20g; Copper 5g; Iodine 1.2g; Selenium 200mg; Cobalt 200mg.

Statistical analysis

The data generated were subjected to one - way Analysis of Variance (ANOVA) in a 4x2 factorial arrangement using Minitab statistical package (Minitab 2017) and significant ($P<0.05$) means were separated by Tukey - Krammer mean comparism procedure of the same package.

Experimental model

$Y_{ijk} = \mu + S_i + T_j + (ST)_{ij} + \varepsilon_{ijk}$

Where:

Y_{ijk} = observed value of dependent variable

μ = population mean (overall mean)

S_i = Effect of replacement with sorghum (i= maize, red sorghum, white sorghum, red + white sorghum)

T_j = Effect of tannase supplementation (j = with or without tannase)

$(ST)_{ij}$ = Interaction effect of sorghum and tannase supplementation

ε_{ijk} = Random residual error

Results

Table 3 shows that starter broiler chickens fed diet containing 100% WS and those fed 50% RS + 50% WS diet had higher ($P < 0.05$) final weight (515.11 g, 511.10 g), total weight gain (477.93 g, 474.29 g) and daily weight gain (22.76 g, 22.59 g) compared to birds fed diet containing 100% RS which had the least values for these parameters. Starter birds fed the control diet (100% maize) recorded similar ($P < 0.05$) values for FW, TWG and DWG compared to birds fed the 100% WS diet and those fed 50%RS + 50%WS based diet. Tannase supplementation had significant greater ($P<0.05$) effect on the final weight, total weight gain and daily weight gain of starter broiler chickens. Birds fed tannase supplemented diets had the higher final weight (505.32 g), total weight gain (468.65 g) and daily weight gain (22.33 g). The interaction effect

shows that starter birds fed 100%WS with or without tannase, 50%RS + 50%WS with tannase and those fed 100% maize diets (control diet) with tannase had higher and similar ($P < 0.05$) FW, TWG and DWG compared to those fed the control diet without tannase. The least value for these parameters were recorded in starter birds fed 100% maize (control diet) without tannase. At the finisher phase, as shown in Table 4, birds fed diets containing 50%RS +50%WS and those fed 100% RS had the highest (3020.10g, 2955.00 g) total feed intake while birds fed 100% maize (control diet) had the least value of 2711.00g and the best (1.80) feed conversion ratio. The significant ($P < 0.05$) interaction effect of the diets and tannase supplementation is reflected in the finisher broilers fed the control diet without tannase having the best feed conversion ratio (1.71) while those fed 50% RS+ 50%WS diet without tannase had the poorest (2.20) feed conversion ratio. None of the nutrient digestibility indices measured in the starter and finisher broilers were significantly ($P > 0.05$) influenced by the sorghum type and tannase supplementation as well as their interactions except the highest value of crude protein retention recorded in finisher birds fed 100% RS diet with tannase (75.22%) and similar value for birds fed diet containing 50% RS + 50%WS supplemented with tannase (75.12%) as shown in Tables 5 and 6 respectively.

Table 3: Effects of sorghum-based diets with or without tannase on growth performance of starter broiler chickens (0 - 28 days)

Replacement level (%)	Tannase supplementation	Average Initial Weight (g/bird)	Average Final Weight (g/bird)	Average Weight Gain (g/bird)	Average Feed Intake (g/bird)	FCR
Interaction						
0S	+Tannase	36.48	515.99^{a}	480.52^{a}	1022.70	2.13
100RS	+Tannase	36.37	476.70^{bc}	440.33^{bc}	1027.70	2.34
100WS	+Tannase	37.26	512.72^{ab}	475.47^{ab}	1040.50	2.19
50RS:50WS	+Tannase	36.57	514.87^{ab}	478.30^{ab}	1083.50	2.27
0S	No Tannase	38.82	469.93^{c}	431.12^{c}	1073.40	2.50
100RS	No Tannase	38.00	478.87^{abc}	440.87^{abc}	1051.80	2.39
100WS	No Tannase	37.10	517.49^{a}	480.39^{ab}	1044.00	2.17
50RS:50WS	No Tannase	37.06	507.33^{abc}	470.28^{abc}	1054.70	2.25
Pooled SEM		1.67	8.03	8.20	50.3	0.13
Main						
0S	-	37.65	493.46^{ab}	455.82^{ab}	1048.00	2.31
100RS	-	37.19	477.78^{b}	440.62^{b}	1039.70	2.36
100WS	-	37.18	515.11^{a}	477.93^{a}	1042.20	2.18
50RS:50WS	-	36.81	511.10^{a}	474.29^{a}	1069.10	2.26
SEM Level		1.18	5.67	5.80	35.60	0.09
Tannase						

-	+Tannase	36.67	505.32[a]	468.65[a]	1043.60	2.23
-	No Tannase	37.74	499.41[b]	455.66[b]	1056.00	2.33
SEM Tannase		0.84	4.01	4.01	25.20	0.06

[abc]: Means in the same column with different superscript are significantly different ($P < 0.05$)

S - Sorghum, RS - Red sorghum, WS - White sorghum

Discussion

The improved final weight, total weight gain and daily weight gain observed in starter broilers fed diet containing 100% white sorghum and those fed diet containing 50% red : 50% white sorghum correlates with the submission of Kwari *et al*. (2012) that feeding of sorghum based diets to starter broilers positively influenced the weight gain and feed intake.The lower final weight and weight gain observed in birds fed 100% red sorghum may be due to high tannin content. Manyelo *et al*. (2019) attributed low intake of red sorghum based diet in broiler chickens to the fact that high tannin from red sorghum imparted bitter taste to the grains, thus low feed intake and reduced growth rate of the birds.The non-significance of the total feed Intake, daily feed intake and feed conversion ratio across the treatments is an indication that sorghum can effectively be utilized at 100% level of substitution with maize in starter broilers diet. Nyannor *et al*. (2007) reported similar intake of sorghum diet for chicks from 1-21 days. The higher final weight, total weight gain and daily weight gain observed in starter broilers fed tannase supplemented sorghum diets could be due to the effect of tannase in reducing the concentration of tannin in sorghum based diet. Gidado *et al*. (2020) reported significant influence of exogenous enzyme on maize-sorghum based diet as reflected on weight gain of starter broiler chickens.

At finisher phase, the no significance difference in the final weight, total weight gain and daily weight gain of birds fed sorghum based diet and those fed maize based diet (control) may be an indication of the birds ability to cope with the tannin content in the diets as they advanced in age. Nyachoti *et al.*

(1996) stated that the anti nutritive effects of tannin in chickens declined with age.

Table 4 Effects of sorghum-based diets with or without tannase on growth performance of finisher broiler chickens (28 - 56 days)

Replacement level (%)	Tannase supplementation	Average Initial Weight g/bird	Average Final Weight g/bird	Average Weight Gain g/bird	Average Feed Intake g/bird	FCR
Interaction						
0S	+Tannase	499.40	1896.30	1396.90	2649.00	1.88^{bc}
100RS	+Tannase	499.40	2015.60	1516.30	3042.00	2.02^{ab}
100WS	+Tannase	499.40	1853.90	1354.50	2800.00	2.05^{abc}
50RS:50WS	+Tannase	499.40	1973.20	1473.80	2886.00	1.95^{abc}
0S	No Tannase	499.40	2128.10	1628.80	2773.00	1.71^{c}
100RS	No Tannase	499.40	1996.90	1497.87	2869.00	1.94^{abc}
100WS	No Tannase	499.40	2002.80	1503.50	2732.00	1.81^{bc}
50RS:50WS	No Tannase	499.40	1951.90	1452.50	3154.00	2.20^{a}
Pooled SEM		0.00	64.15	64.15	133.62	0.07
Main						
0S	-	499.40	2012.20	1512.80	2711.00^{a}	1.80^{b}
100RS	-	499.40	2006.30	1506.90	2955.00^{a}	1.98^{ab}
100WS	-	499.40	1928.40	1429.00	2765.90^{a}	1.93^{ab}
50RS:50WS	-	499.40	1962.50	1463.10	3020.10^{a}	2.07^{a}
SEM Level		0.00	46.50	46.50	96.67	0.17
-	+Tannase	499.40	1934.70	1435.40	2844.10	1.98
-	No Tannase	499.40	2019.90	1520.60	2882..00	1.91
SEM Tannase		0.00	29.50	29.50	61.40	0.03

Similar weight gains was reported for group of broiler chickens fed maize as well as those fed low tannin sorghum based diets by Kwari *et al.,* 2012; Sallisou *et al.,* 2015.

The improved feed intake recorded for finisher birds fed diet containing 50%RS: 50% WS suggests that feeding sorghum based diets to finisher broilers positively influenced the feed intake of the birds. This may be adduced to the slightly lower energy value of sorghum compared to maize. thus the birds placed on sorghum diets may have consumed more feed to compensate for the energy difference, hence birds tend to eat more of the low energy diet (Aduku,1993) Although, there was an increased feed intake with depressed feed conversion ratio for finisher birds fed 50%RS : 50%WS, it should be noted that there was no significant difference in the weight gains across the dietary treatments which may be an indication that the sorghum based diet could be

used effectively. This is in tandem with the results of Selle *et al*. (2010) when broiler chickens fed sorghum based diet supplemented with xylanase had improved feed intake and weight gain but feed efficiency was reduced. Faquinello *et al*. (2004) stated that up to 80% corn can be replaced by sorghum despite the observed worse feed conversion ratio as dietary sorghum level increased. The non significant influence of tannase supplementation as well as the interaction effect of sorghum with or without tannase on all the growth performance indices suggests that sorghum can totally replace maize in the diets of finisher broiler chickens without tannase and would not compromise the growth performance of the chickens. Several reports have shown that there was similar body weight gain in broilers fed sorghum based diet and those fed maize based diet (Gualtieri and Rapaccini (1990); Georgeta *et al*. (2023).

Table 5: Effects of sorghum-based diets with or without tannase on nutrient digestibility of starter broiler chickens (0 - 28 days)

Replacement level (%)	Tannase supplementation	Dry matter(%)	Ash (%)	Crude Protein(%)	Ether extract(%)	Crude fibre (%)
Interaction						
0S	+Tannase	74.47	78.24	74.67	75.47	75.83
100RS	+Tannase	77.33	77.52	77.20	79.66	75.30
100WS	+Tannase	78.70	77.11	76.61	73.91	75.80
50RS:50WS	+Tannase	73.09	77.07	74.71	75.39	74.08
0S	No Tannase	76.52	79.57	76.18	76.83	78.94
100RS	No Tannase	76.40	79.68	75.35	76.92	72.34
100WS	No Tannase	77.68	78.00	76.19	75.62	81.69
50RS:50WS	No Tannase	78.00	77.81	76.44	76.05	75.46
Pooled SEM		0.99	0.91	0.59	0.85	0.78
Main						
0S	-	75.50	78.90	75.42	76.15	77.38
100RS	-	76.86	78.60	76.27	78.29	73.82
100WS	-	78.19	77.55	76.40	74.76	78.75
50RS:50WS	-	75.54	77.44	75.57	75.72	74.77
SEM Level		2.23	2.13	1.35	1.88	1.28
-	+Tannase	75.90	77.48	75.80	76.11	75.25
-	No Tannase	77.15	78.76	76.04	76.36	77.11
SEM Tannase		1.57	1.51	0.95	1.33	0.90

Table 6: Effects of sorghum-based diets with or without tannase on nutrient digestibility of finisher broiler chickens (28- 56 days)

Replacement level (%)	Tannase supplementation	Dry matter(%)	Ash (%)	Crude Protein(%)	Ether extract(%)	Crude fibre (%)
Interaction **0S**	+Tannase	80.14	67.82	72.38	80.88	76.71
100RS	+Tannase	81.78	69.24	75.22	80.52	76.56
100WS	+Tannase	82.18	65.53	75.10	80.14	75.15
50RS:50WS	+Tannase	81.88	70.33	75.12	80.36	75.47
0S	No Tannase	81.52	69.24	74.80	80.14	76.66
100RS	No Tannase	79.89	65.53	72.20	81.01	75.48
100WS	No Tannase	79.90	66.38	72.00	81.69	76.42
50RS:50WS	No Tannase	81.10	66.98	74.12	80.42	75.96
Pooled SEM		1.39	2.99	0.95	3.62	1.97
Main **0S**	-	80.83	66.69	73.59	80.51	76.68
100RS	-	80.84	67.39	73.71	80.77	76.02
100WS	-	81.04	65.95	75.55	80.91	75.78
50RS:50WS	-	81.49	68.66	74.62	80.39	75.72
SEM Level		0.98	2.12	0.67	2.56	1.39
-	+Tannase	81.50	68.23	74.45	80.48	75.97
-	No Tannase	80.60	66.11	73.28	80.82	76.13
SEM Tannase		0.70	1.50	0.48	1.81	0.98

The no significant difference in the main and interaction effects of sorghum and tannase supplementation on the nutrient digestibility indices measured in the starter and finisher broiler chickens suggests that the sorghum used might have been improved to have low tannin content, there by having no effect on the nutrient digestibility. This agrees with the submission of Scott (2013) that with the use of improved sorghum varieties that contain little

tannin, maize can be totally replaced with sorghum in poultry diet and can greatly improve nutrient digestibility.

Conclusion

It can be concluded from the study that 100% WS without tannase and 50RS:50WS with tannase can replace maize in starter broilers diet while 100% RS and 100% WS with or without tannase can replace maize in finisher broilers diet for optimum performance and nutrient digestibility without any deleterious effect. Similarly, the addition of tannase to the control diet also enhanced performance and nutrient digestibility.

Recommendation

1. Maize can be totally replaced by red or white sorghum in broiler starter and finisher diets without detrimental effect on growth performance. However, red sorghum based broiler starter diet can be supplemented with tannase for improved growth performance.
2. Total replacement of maize by either red or white sorghum in the diets of starter and finisher broiler chickens with tannase supplementation at 0.5g/kg of feed would be recommended for improved nutrient digestibility.

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