

Nutrient retention and blood profile of broiler chickens fed diets containing graded levels of *Burukutu* waste supplemented with Kingzyme as a replacement for maize

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Target Audience: *Poultry Farmers, Animal Nutritionists, Feed millers*

Abstract

The study was conducted to determine the effect of replacing maize with graded levels of Kingzyme enzyme-supplemented burukutu waste on nutrient retention and blood profile of broiler chickens. One hundred and twenty (120) day-old Ross 308 broiler chicks were used in a completely randomized design with five dietary treatments each with three replicates. The treatments had burukutu waste replacing 0%, 25%, 50%, 75% and 100% of maize in a single phase feeding system and were labeled T1, T2, T3, T4 and T5 respectively. Treatment T1 had no Kingzyme enzyme while others had the enzyme included at manufacturer's recommended inclusion level of 0.02%. Nutrients retention trial was carried out and haematological and serum biochemical parameters were also determined. All data collected were subjected to ANOVA and treatments means were separated using Duncan Multiple Range Test. There were no significant differences ($P>0.05$) between the treatments on retention of dry matter, crude protein, ether extract and NFE. However, Kingzyme-supplemented treatments were significantly better than the control on crude fiber digestibility while no significant differences ($P>0.05$) were observed among the treatments on biochemical parameters. The effects of enzyme supplemented waste were not significantly different ($P>0.05$) on haematological parameters except for MCV and MCH where treatment T3 was significantly lowest than others. The eosinophil contents of birds on Treatment T2 and T4 were significantly highest. It was concluded that burukutu waste has no detrimental effect on blood profile of broilers. Kingzyme enzyme was effective in improving the utilization of burukutu waste with broiler chickens.

Key words: *Biochemistry, Burukutu waste, Haematology, Nutrient Retention, Kingzyme*

Description of Problem

Energy sources in poultry nutrition are increasingly becoming a threat to poultry production. Energy is the single most important factor that affects feed intake of poultry species (1). According to (2), the metabolisable energy content of the feed dictates its consumption since animals eat to satisfy their energy need. Therefore, the calorific content of the feed is an essential yardstick for measuring the intake of other

nutrients by the animal. There is inverse relationship between feed intake and energy content of the feed and according to (3) laying hens adjust their diets so that if the metabolisable energy content of the diet is increased they tend to eat less whereas they eat more when the metabolisable energy of the diet is decreased. Either grossly excessive or gross deficient calorie consumption is damaging to the health and productivity of the birds as numerous

interrelationships exist between feed calorie and other nutrients.

The most commonly used energy feedstuff in poultry nutrition is maize. However, there are stiff competitions among man, industry and livestock for this feedstuff and this has led to remarkable increase and fluctuation in its price to the extent that it is difficult for a poultry farmer to break even (1). For an ingredient that accounts for about 40% of typical poultry feed, its price and availability will determine the price of feed and products like egg and meat. Thus, the need for alternative energy source for poultry feeding cannot be overemphasized. However, such alternative must be free from competition by man and industry.

Several alternative feedstuffs have been investigated for their utilization in poultry feeding, and these include agro-allied wastes like rice husk, brewers dried grains, maize offal. For example, the use of rice husk has been investigated by several authors (4; 5; 6) and it was concluded that the highly fibrous feedstuff is not good for poultry species because of the absence of appropriate enzyme that can digest the fibre. Fibre is known to affect the utilization of other nutrients by encapsulating the nutrients. Metabolisable energy values of feeds and feedstuffs are affected by factors like feedstuff composition, feedstuff processing, enzyme supplementation and animal factor (3). The fibre fraction of a feedstuff has the greatest influence on its digestibility in monogastric nutrition and both the quantity and quality of the fibre are important especially for poultry species. This explains why high fibre feedstuffs have lower calorific value with monogastric animals compared to polygastric animals. This has necessitated the use of exogenous enzymes to assist the animal in utilization of the fiber feedstuff. Several studies have been done in this regard. Report by (7) shows that

Roxazyme G-supplemented bovine rumen content can replace 37.5% of maize in the diets of pullets. Also, (8) reported a significantly better Hen Day Production percentage with corn bran- based diet supplemented with Roxazyme G. Xylanase has been reported to increase the apparent metabolisable energy (AME) value of wheat offal and Brewers' Dried Grains by 56% and 26% respectively (9). Furthermore, (10) observed a lower feed-to- grain ratio and lower feed cost /Kg weight gained when palm kernel-based diet was supplemented with Maxigrain enzyme. Broiler birds fed rice husk diets supplemented with commercial enzymes performed better in all parameters tested than those fed rice husk diets without commercial enzyme (6). According to (11), exogenous xylanase, Roxazyme G and phytase enzymes significantly ($p>0.05$) improved the AME value of palm kernel cake and cocktails of the enzymes were significantly better than respective individual enzymes.

Sorghum is one of the cereals that can be used in poultry feeding as an alternative to maize but its tannin content is an impediment. Tannin is known to reduce the digestibility of nutrients like protein and energy. According to (12), different processing methods such as soaking, sprouting, cooking and fermentation have been reported to improve the nutritional and functional properties of plant seeds. Sprouting has been reported to be more superior to cooking. Burukutu waste is a product of local brewery industry where sorghum is locally brewed to produce the drink (*Burukutu*). In practice, guinea corn grains are soaked in water for 24 hours and removed. The grains are later allowed to sprout over a period of 72 hours. The sprouted grains are milled and sieved to obtain the drink (*Burukutu*) while the chaff is collected as Burukutu waste. Nutritional

evaluation revealed that it has good nutrient profile but highly fibrous for monogastric usage. According to (13) fermented and sprouted *Sorghum bicolor* has 26.0% crude protein, 8.2% crude fiber, 6.5% ether extract and 7.3% ash and this shows that it has nutritional potential to be used as feedstuff in poultry except for its relatively high crude fiber content. Furthermore, the blood profile of birds is known to be affected by diets because whatever animal eat has a direct influence on its blood. According to (14) and (15), the serum biochemical constituents of animals are positively correlated to the quality of the diet. This study was therefore conducted to investigate the effects of graded levels of *Kingzyme* enzyme-supplemented burukutu waste on nutrient retention and blood profile of broiler chickens.

Materials and Methods

Experimental Site

The study was conducted at the Livestock Teaching and Research farm of Federal University of Agriculture, Makurdi, North central Nigeria. Makurdi is located approximately between latitude 7°44'N and longitude 8° 54'N and is in the Guinea Savanna zone of Nigeria. It has annual rainfall season of seven months from April to October with annual rainfall ranging from 508mm to 1016mm (16).

Collection of Experimental Materials

Burukutu waste was obtained from local breweries at 72 battalion military barracks, Makurdi. The waste was sundried to constant moisture content and reference was made to (13) for its proximate composition. *Kingzyme* enzyme was obtained from feed miller in Kaduna, Nigeria. The enzyme's profile composed of endo-1,4- β xylanase, endo-1,3(4) beta-glucanase, endo-1,4- β mannase, pectinase, amylase and cellulase. Its recommended

inclusion level is 200grams per ton of feed.

Experimental Diets

Five isonitrogenous single phase broiler diets were formulated consisting of a control and four experimental diets. The diets were formulated such that burukutu waste replaced 0%, 25%, 50%, 75% and 100% of maize and were labeled T1, T2, T3, T4 and T5 respectively. The compositions of the diets are as shown in Table 1. Diets T2, T3, T4 and T5 were supplemented with *kingzyme* enzyme at the recommended inclusion level of 0.02%.

Experimental Design and Management of Animal

One hundred and twenty (120) day-old Ross 308 broiler chicks were randomly allocated to five dietary treatments (T1, T2, T3, T4 and T5) with three replicates each in a completely randomized design. The birds were housed in wooden cages each with area of 10m² as experimental unit. The wooden cages and the entire pen were cleaned and disinfected before the arrival of the chicks. Electricity was used as source of heat for brooding. All necessary biosecurity measures were taken into consideration and the birds were given vaccination against Newcastle disease and Gumboro disease. Experimental feeds and water were given *ad libitum* to the birds from day old and the study lasted for 56 days.

Nutrients Retention Trial

At about six weeks of the study, nutrient retention trial was carried out. A weighed amount of the respective feed was given to birds in each replicate for five days. The quantity of feed consumed for each replicate was obtained by determining the difference between the initial weight of the feed and the final weight of the feed used for the nutrient retention trial. Faecal collection

was done on daily basis, weighed and oven dried to reduce moisture content. The faecal collections for each day were pulled together for each replicate and subjected to proximate analyses. The apparent nutrient retention percentage was calculated for each dietary treatment as follows.

Apparent Nutrient Retention (%):

$$\frac{\text{Nutrient Intake (g)} - \text{Nutrient Output (g)}}{\text{Nutrient Intake (g)}} \times 100$$
 Nutrient Intake= Nutrient coefficient in feed x weight of feed consumed (g)
 Nutrient Output= Nutrient coefficient in faecal sample x weight of faecal sample (g)

Table 1: Compositions of experimental diets and nutrient analyses

Feedstuffs	Treatments				
	T1 (%)	T2 (%)	T3 (%)	T4 (%)	T5 (%)
Maize	55	41.25	27.50	13.75	0.00
BW	0.00	13.75	27.50	41.25	55.00
Full fat Soya	3.10	16.50	17.00	15.50	17.60
Soya bean meal	38.00	24.60	20.00	17.10	11.10
Maize offal	0.00	0.00	4.10	8.50	12.40
Bone	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Salt	0.25	0.25	0.25	0.25	0.25
Broiler Premix ¹	0.25	0.25	0.25	0.25	0.25
Kingzyme ²	0.00	0.02	0.02	0.02	0.02
Total, %	100.00	100.02	100.02	100.02	100.02
Proximate Analysis					
Crude Protein,%	21.95	22.09	22.15	22.17	22.16
ME, Kcal/Kg	3010.40	2935.98	2801.35	2658.15	2530.30
Ether Extract,%	4.07	6.04	6.10	5.86	6.16
Crude Fibre,%	4.29	4.70	5.52	6.35	7.11
Lysine,%	1.30	1.30	1.32	1.33	1.30
Methionine,%	0.50	0.50	0.49	0.51	0.51
Calcium,%	1.09	1.10	1.12	1.12	1.13
Av. Pho.,%	0.60	0.59	0.61	0.60	0.60

BW= Burukutu Waste,

¹: Premix supplied per kg: vitamin A, 12,000 IU; vitamin D3, 2,000 IU; vitamin E, 50 IU; vitamin B1, 1 mg; vitamin B2, 3 mg; vitamin B6, 1 mg; vitamin B12, 10 µg; vitamin K, 2 mg; copper (cupric sulphate), 75 mg; nicotinic acid, 12 mg; pantothenic acid, 10 mg; iron, 200 mg; cobalt, 0.5 mg; manganese, 40 mg; zinc, 90 mg, iodine, 1 mg; selenium, 0.2 mg; calcium, 31.25 g; sodium, 10 g

²: Composed of endo-1,4-β xylanase, endo-1, 3(4) beta-glucanase, endo-1,4-β mannase, pectinase, amylase and cellulase

ME=Metabolisable Energy, Kcal/Kg= Kilocalorie per kilogram, Av. Pho.: Available phosphorus

Biochemical and Haematological Analyses

At the 8th week of the study, one bird from each replicate was selected for serum biochemical and haematological analyses. Two milliliters (2ml) of blood was collected from the wing vein of the selected birds for the determination of serum biochemical parameters namely total protein, glucose, globulin, albumin, cholesterol, Creatinine, alkaline phosphatase, Aspartate transaminase (AST) and Alanine transaminase (ALT). The blood was drained into anticoagulant-free bottle and was allowed to clot to obtain serum by placing upright for about two hours at room temperature. It was later centrifuged using the high speed Wintrobe Microhaematocrit for 10 minutes at 2000 rpm (revolutions per minute) to separate the cells from the serum.

For haematological analysis, another two milliliters (2ml) of blood was collected from the wing vein of the selected birds and drained into a labeled sterile bottle

containing ethylenediamine tetraacetic acid (EDTA) to prevent coagulation. Packed cell volume (PCV) was determined by the procedure of (17). Other haematological parameters determined were White blood cell (WBC), Red blood cells (RBC), Hemoglobin concentration (Hb), Corpuscular values (Mean corpuscular volume, Mean Corpuscular Haemoglobin and Mean corpuscular haemoglobin concentration), Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils, all by the procedure of (18).

Statistical Analysis

All data collected for nutrients retention, biochemical and haematological values were subjected to one way Analysis of Variance suitable for a completely randomized design using Statistical Package for Social Science (19). Treatments means were separated using Duncan Multiple Range Test (20) at 5% significance level.

Table 2: Apparent nutrient retention values of broilers fed *burukutu* waste-based diet supplemented with *kingzyme*

Parameters	Treatments					SEM	P-Value
	T1	T2	T3	T4	T5		
Dry Matter, %	80.44	85.67	76.50	76.96	84.01	1.72	0.14
Crude Protein, %	66.85	77.26	69.99	68.63	79.56	2.50	0.17
Crude Fiber, %	33.98 ^b	67.74 ^a	60.20 ^a	45.65 ^a	69.52 ^a	4.75	0.05
Ether Extract, %	92.19	93.79	86.66	92.18	92.21	1.13	0.08
NFE,%	87.45	90.02	81.54	85.58	89.12	1.36	0.09

a,b: Means in the same row with similar superscript are not significantly different (P≤0.05)

T1= 0% Burukutu waste with no enzyme, T2, T3=, T4=, T5=

SEM= Standard Error of Mean, NFE= Nitrogen Free Extract

Results and Discussion

Effects of *Kingzyme* Supplementation on Nutrients Retention of Broilers Fed *Burukutu* Waste

The effects of graded levels of *burukutu* waste supplemented with *Kingzyme* enzyme on apparent nutrients retention of broilers are shown in table 2. There were no significant differences (P>0.05) among the treatments

on retention of dry matter, crude protein, ether extract and nitrogen-free extract. However, there was significant difference (P≤0.05) between the control (T1) and the *Kingzyme*-supplemented treatments (T2, T3, T4 and T5) on digestibility and retention of crude fiber. Sorghum grain contains tannin which is an anti-nutritional component that usually gives rise to a dry astringent

sensation in the mouth. Tannin is known to interfere with crude protein and amino acid digestibility and energy utilization (21; 22). Tannin is also responsible for bitter taste thereby resulting in reduced feed intake (23).

The amount of tannin differs among the different species of sorghum and high tannin content in sorghum can depress growth (24). Several researchers have worked on the inclusion of sorghum spent grains in chicken diets. It has been observed that fermented sorghum spent grains cannot replace maize in the diets of broiler chickens but 5% inclusion had no negative effects (25). However, (26) observed that broilers fed 15% sorghum spent grain had significantly lower performance and digestibility values compared to diets containing 15% BDG. This was attributed to the tannin content in the diets. In an attempt to increase its utilization, (27) observed that broilers fed 15% sorghum spent grains treated with plantain peels ash extract had no adverse effects in term of growth performance and carcass characteristics. Crude fiber is also known to reduce the digestibility of protein and other nutrients as well as energy utilization and this will imply that an increase in the inclusion of burukutu waste from treatments T2 to T5 should lead to gradual reduction in the digestibility and retention of the nutrients. However, the non-significant difference in the retention of crude protein and other nutrients obtained in this study may be attributed to the double effects of processing and Kingzyme enzyme. *Kingzyme* enzyme has significantly improved the digestibility and retention of crude fiber which may also be responsible for the statistically similar digestibility values for crude protein, ether extract and NFE as crude fiber is known to negatively affect the digestibility of these nutrients. However, the non-significant difference in crude fiber digestibility among the enzyme-

supplemented treatments (T2, T3, T4 and T5) may be attributed to the fact that enzymes have fixed active sites and an increase in the inclusion level of burukutu waste without a corresponding increase in the enzyme's active sites may not result in increased digestibility. According to (28), exogenous enzymes and cocktails are effective in improving the utilization of crude fibre of feedstuffs thereby producing simple sugars that can be absorbed.

Serum Biochemical Parameters of Broiler Chickens Fed Graded Levels of Burukutu Waste Supplemented with *Kingzyme*

Table 3 shows the biochemical parameters of broiler chickens fed diets containing burukutu waste supplemented with *Kingzyme* enzyme. There were no significant differences ($P>0.05$) among the treatments in their effects on total protein, albumin, globulin, glucose, cholesterol, and Creatinine. Biochemical values are known to be related to diet. The normal range of total protein for broiler chickens according to (29) is 3.0-4.9 mg/dl. The relatively higher serum protein obtained in this study may be attributed to the effectiveness of the processing method in removing the tannin content of the grain. Burukutu waste has a relatively higher protein content compared to sorghum grains. Tannin is known to bind with protein and reduce its digestibility. The *Kingzyme* enzyme improved the crude fibre digestibility in this study which in turn has positively affected the protein digestibility and serum protein level. Blood glucose level is a reflection of the level of digestion of dietary carbohydrate. Standard biochemical values have been reported for broiler chickens. Values obtained in this study (80.35 -132.40mg/dl) are lower than 200-500mg/dl for broiler chickens as reported by (30). This may be attributed to several factors. Burukutu waste has very low

nitrogen-free extract. The profile and activity of exogenous enzymes are important in their efficacy. The test ingredient in this study (burukutu waste) has a relatively high amount of crude fibre compared with maize.

This may indicate that there will be need to increase the enzyme inclusion level as the inclusion level of the burukutu waste increases.

Table 3: Serum biochemical parameters of broilers fed *burukutu* waste-based diet supplemented with *kingzyme*

Parameters	Treatments					SEM	P-Value
	T1	T2	T3	T4	T5		
Total Protein, g/dl	4.70	4.90	4.47	6.47	5.55	0.33	0.09
Albumin, g/dl	2.33	2.50	2.30	2.23	2.05	0.09	0.17
Globulin, g/dl	2.37	2.40	2.17	4.23	3.50	0.36	0.12
Glucose, mg/dl	123.27	117.20	104.27	132.40	80.35	9.86	0.17
Cholesterol, mg/dl	95.93	85.07	87.03	99.90	78.50	4.00	0.16
Creatinine, mg/dl	0.96	0.92	0.88	1.17	1.08	0.08	0.33
AST, u/l	126.53	121.37	115.60	119.47	129.80	2.31	0.09
ALT, u/l	41.67 ^b	49.20 ^a	52.57 ^a	49.43 ^a	49.05 ^a	1.46 ^a	0.11
ALP, u/l	140.97	142.27	133.60	133.20	134.75	2.57	0.36

Means in the same row with no superscript are not significantly different (P>0.05)

T1= 0% Burukutu waste with no enzyme, T2, T3=, T4=, T5= SEM= Standard Error of Mean, NFE= Nitrogen Free Extract

The treatments have no significant effect on AST, ALT and ALP except treatment T1 which was significantly different in ALT. Liver enzymes are present in small concentration and an increase in their concentrations have been attributed to damaged liver cells and such damage could also be attributed to nutritional plane. The levels of liver enzymes are significant in monitoring the presence of toxic substances in the liver. Tannin has been reported to have such negative effect on the liver (31). Sprouting and fermentation are capable of reducing the tannin content of sorghum grains (32). Sprouting is also known to reduce minerals and vitamins of grains and these have negative effect on the liver enzymes. The level of these enzymes may be altered especially in deficiency situation of vitamins and minerals. The AST values in this study are within the normal range of 70-220 as reported by (29) and this indicates that the method of processing used in this

study was effective in reducing the tannin content of the sorghum.

Haematological Parameters of Broiler Chickens Fed Graded Levels of Burukutu Waste Supplemented with *Kingzyme*

The effects of graded levels of *Kingzyme*-supplemented burukutu waste on haematological parameters of broiler chickens are presented in table 4. The treatments were not significantly different (P>0.05) in their effects on PCV, RBC, WBC, Haemoglobin, MCHC, lymphocytes, neutrophils, basophils and monocytes. However, there were significant differences between the treatments in their effects on MCV, MCH and eosinophil as treatment T3 was significantly lowest than others for both MCV and MCH while treatments T2 and T4 were significantly highest in their effects on eosinophil. The haematological values of an organism are known to be affected by nutritional plane. According to (33)

haematological parameters are important in monitoring the feed toxicity and health status of farm animals. According to (34), haematological values are essential in assessing clinical and nutritional health of farm animals and also for disease diagnosis. When these haematological values are within normal range reported for the animal, this implies that the nutritional plane has no adverse effect on the animal. The PCV, RBC, WBC and Haemoglobin values obtained in this study are not significantly different indicating that the diets were not harmful to the experimental birds. The RBC values obtained in this study ($2.05-2.27 \times 10^{12}/L$) are within the normal range reported for chicken ($2.5-3.5 \times 10^6/L$) by (35). The haemoglobin values in this study ranging from 8.15 to 9.23g/dl are within the normal range of 7 to 13g/dl for chicken as reported by (35). Haemoglobin is useful in the transportation of oxygen where it forms oxyhaemoglobin. It is one of the major indices in for evaluating erythrocytes and is also a useful index in of the bone marrow capacity to produce red blood cells. The PCV values obtained in this study ranging

from 24.53 to 27.67 are within the normal range (22-35 %) reported for chicken (35). Packed cell volume (PCV) is involved in the transportation of oxygen and absorbed nutrients round the body and significant difference in values can be attributed to physiological and nutritional status. The non-significant difference in this study indicates that the dietary treatments have no negative effects on the birds despite an increase in the inclusion level of the test ingredient (burukutu waste). The RBC values in this study, ranging from 2.05 to 2.27, were not significantly different including for the control. Red blood cells are involved in the transportation of oxygen and carbon (IV) oxide in the body. The MCV and MCHC values obtained in this study ranging, respectively, from 116.47-125.47fL and 33.23-33.33% are within the normal range for chicken as reported by (35) which are MCV: 90-140 fL and MCHC: 26-35 g/dl. Nutritional status could cause differences in MCV of animals (34). Results obtained in this study indicate that the test ingredient has no adverse effect on the MCV of the animal.

Table 4: Haematological parameters of broilers fed *burukutu* waste-based diet supplemented with *kingzyme*

Parameters	Treatments					SEM	P-Value
	T1	T2	T3	T4	T5		
PCV, %	27.67	26.33	26.33	27.00	24.53	0.86	0.36
RBC, ($\times 10^{12}/l$)	2.20	2.13	2.27	2.27	2.05	0.06	0.48
WBC, ($\times 10^9/l$)	5.67	5.67	6.17	6.10	5.65	0.20	0.52
Hb, g/dl	9.23	8.77	8.90	9.00	8.15	0.28	0.34
MCV, fl	125.47 ^a	122.40 ^a	116.47 ^b	119.53 ^a	119.80 ^a	1.26	0.16
MCH, pg	41.87 ^a	41.20 ^a	38.96 ^b	39.83 ^a	39.87 ^a	0.41	0.10
MCHC, %	33.33	33.30	33.30	33.23	33.23	0.02	0.24
Lymphocyte, %	50.33	51.67	51.67	50.33	51.00	0.73	0.65
Neutrophil, %	46.67	45.00	45.33	46.00	45.50	0.78	0.60
Eosinophil, %	0.33 ^b	4.33 ^a	0.00 ^b	2.33 ^a	0.50 ^b	0.61	0.20
Basophil, %	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monocyte, %	2.67	2.00	3.00	3.00	3.00	0.25	0.30

Means in the same row with no superscript are not significantly different ($P > 0.05$)

T1= 0% Burukutu waste with no enzyme, T2, T3=, T4=, T5=

SEM= Standard Error of Mean, NFE= Nitrogen Free Extract

The values obtained in this study for lymphocyte (50.33-51.67%) are lower than 87.50-91.67% obtained by (36) where four varieties of sorghum grains were supplemented with Maxigrain enzyme. Lymphocyte count indicates that the animal is not battling with any disease. This may also indicate that the method of processing for the burukutu waste is okay and that the *Kingzyme* enzyme has no detrimental effect on the birds. Values obtained for Neutrophil, Basophil and Monocyte in this study were not significantly different and this could be an indication that an increase in inclusion level of the *burukutu* waste has no detrimental effect on the haematological values. Generally, the haematological values obtained in this study indicate that the *burukutu* waste and the use of *Kingzyme* enzyme did not compromise the health of the broiler chickens and these findings are similar to that of (36) where four varieties of sorghum were supplemented with Maxigrain® enzyme and are also similar to the findings of (37) who reported that the use of multi enzyme in sorghum diets did not compromise the haematological index.

Conclusions= and Applications

This study revealed that

1. Burukutu waste has no detrimental effect on broilers as reflected on haematological parameters in this studied. Biochemical parameters are also not negatively affected especially liver enzymes namely AST, ALT and ALP. This implies that the method of processing is adequate in removing the tannin content.
2. *Kingzyme* enzyme supplementation is effective in digesting the fibre content of *burukutu* waste as there was improvement in the crude fiber digestibility of *burukutu* waste.
3. *Burukutu* waste supplemented with

Kingzyme enzyme can replace maize in the diets of broiler chickens without any adverse effect.

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