

## Blood Profile and Internal Organs of Broiler Chickens fed Diets Containing Raw and Toasted Bambara nut Sievate Supplemented with or without Biozyme

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Target Audience: Poultry farmers, Animal Scientists and Students of Animal Science. is predominant

### Abstract

The effect of feeding diets containing raw and toasted bambara nut sievate (BNS) with or without biozyme supplementation on blood profile and organs weight of broiler chicken was evaluated. Three hundred broiler chicks (Ross 308) were balanced for weight after an adjustment period of one week and randomly divided into 5 groups of 60 chicks. Each of the 5 groups was replicated thrice with 20 chicks in a completely randomized design. Birds in group 1, 2, 3, 4 and 5 were fed diets containing 0 and 10 kg each of raw BNS, raw BNS supplemented with biozyme, toasted BNS and toasted BNS with enzyme supplementation, respectively at the starter phase while in the finisher phase, the birds were fed diets containing 0 and 15 kg each of raw BNS, raw BNS supplemented with biozyme, toasted BNS and toasted BNS with enzyme supplementation, respectively. Enzyme (Biozyme®) supplementation was done at the rate of 100 g/100 kg diet. The result showed no significant variation ( $P>0.05$ ) in haematological indices except eosinophils and monocyte count. Eosinophil value of birds fed diet containing raw bambara nut sievate without enzyme was significantly ( $P<0.05$ ) higher (1.33 %) than those of birds fed diets containing raw and toasted bambara nut with enzyme supplementation (0.00%). Monocyte's count followed a similar variation trend as eosinophil count. All serum biochemical constituents of broiler chickens in this study were not significantly influenced. Internal organs weight of broiler chickens did not vary significantly ( $P>0.05$ ) with inclusion of bambara nut sievate with or without enzyme supplementation in broiler chickens' diets. It can be concluded that, inclusion of 15 % raw or toasted bambara nut sievate with and without enzyme supplementation had no negative effect on haematological indices, serum indices and organs weight of broiler chickens.

**Key words:** Sievate, Biozyme, haematology, serum and organs

### Description of Problem

Farm production economics have shown that for optimum outputs of farm stock in terms of meat, milk, eggs, skin, fur among others, feeding cost accounts for over 70% of the

total cost of production [1]. This is especially high for the production of the non-ruminant species such as poultry, pigs and rabbits. Animal feed development research is thus centered on the search for inexpensive,

readily available and nutritionally adequate sources for feeding farm animals, especially those that are not in direct competition by humans.

All stakeholders in the animal production industry are interested in issues of availability and quality of feed. There is, therefore, great interest in the potential of any material to serve as feed ingredients [2].

The use of agricultural by products in animal feed production is one major strategy that holds great potential for bringing down feed cost [3]. Hence by-products are generally cheaper than the originating commodity, the use of agro by-products will lower price of animal protein, by reducing feed cost [4]. This will in turn raise animal protein supply and consumption levels and ultimately improve the health and productivity of the general populace.

One of such readily available agro-industrial by-products in Nigeria is bambara nut sievate, a waste product from the milling of bambara groundnut seed and subsequent sieving of the flour for production of bambara nut pudding (Okpa). The development of the offal as an alternative energy and protein source could contribute to solving the problem of high cost of poultry feed and could provide a better avenue for its disposal which may constitute an environmental nuisance.

Haematological investigation provides the opportunity to clinically study the presence of metabolites and other constituents in the body of the animals and plays a vital role in physiological, nutritional and pathological status of the animal [5]. Difference in weight of internal organs would arise because of increase metabolic rate of the organs in attempt to reduce toxic elements or anti-nutritional factors to non toxic metabolites

[6].

This study was designed to determine the effect of feeding diets containing raw and toasted bambara nut sievate with or without biozyme supplementation on organs weight, haematological and serum biochemical indices of broiler chickens

## **Materials and methods**

### **Experimental site**

The study was conducted at 'farm craft' farms, Judges Quarters Makurdi, Benue State, Nigeria. Makurdi lies within latitude 7.45°N and longitude 8.32°N within the southern guinea savanna agro-ecological zone of Nigeria. It is characterized by tropical, dry and wet climate. The dry season lasts for a minimum of five months, beginning from November to March, while the wet season spans from April to October. Mean annual rainfall is about 1,290 mm [7].

### **Source and Preparation of Feed Ingredients**

The bambara nut sievate (BNS) was purchased from Makurdi Local Government Area of Benue State. Five (5 kg) kilogramme of raw BNS was thoroughly mixed with 0.5 litre of clean, fresh water to moisten the BNS and allow easy volatisation of the anti-nutritional factors when heat is applied in the course of toasting. Toasting was done using a big aluminum frying pan. The toasting material was turned frequently and cautiously to avoid charring until the material turned light-brown with a sweet aroma. Thereafter, the toasted material was allowed to cool before being incorporated into the various diets.

### **Experimental Diets**

Five diets were formulated for starter and finisher broiler chickens as presented in

Tables 1 and 2, respectively. A maize soya bean-based diets containing 0 and 10 kg each of raw Bambara nut sievate (BNS), raw BNS with enzyme, toasted BNS and toasted BNS with enzyme, respectively were formulated for broiler chicks. Finisher chickens were fed diets containing 0 and 15 kg each of raw BNS, raw BNS with enzyme, toasted BNS and toasted BNS with enzyme, respectively. The diets were designated as T1, T2, T3, T4 and T5, respectively. The lower inclusion of BNS in chicks diets was due to their inability to handle high fibre diet, hence BNS is slightly higher in crude fibre.

#### **Proximate Nutrients Analysis of Raw and Toasted Bambaranut Sievate and Experimental Diets**

Proximate nutrient composition of raw bambara nut sievate (RBNS), toasted bambara nut sievate (TBNS) and experimental diets was determined using the methods described by [8] and the metabolizable energy calculated using the method described by [9].

#### **Management of Experimental Animal**

Birds were allowed adjustment period of one week before feeding trial commenced. Feed and water were provided *ad-libitum* and routine management practices were kept within standard procedures. Experimental broiler chicks were administered Newcastle Disease Vaccine intra ocular, Newcastle disease vaccine Lasota, infectious bursal disease vaccine via drinking water at day old, 7 days old and 14 days old, respectively.

#### **Experimental Design**

The experimental design was a Completely Randomized Design (CRD). Three hundred (300) unsexed 7-day-old broiler chicks (Ross

308) were purchased for the 49 days study. The birds were allowed a week acclimatization period while on commercial feed, thereafter, grouped into five treatments of sixty birds each. The treatments were replicated thrice with twenty (20) birds each offered assigned diet.

#### **Data Collection**

##### **Blood analysis**

At the end of the feeding trial, a bird per replicate was selected for evaluation of haematological and serum biochemical variables. Their blood sample (3 ml) was collected by the wing vein puncture using 5 ml syringes. The haematological specimens were collected separately into sample bottles containing ethylene diamine tetra acetic acid (EDTA). The haematological indices determined were packed cell volume (PCV), Haemoglobin, Red blood cell count (RBC) white blood cell count (WBC), mean corpuscular volume (MCH) and mean corpuscular haemoglobin concentrations (MCHC), lymphocytes, heterophils, eosinophils, basophils and monocytes. These were determined as described by [10]. Serum biochemical samples were collected in separate bottles without the anti-coagulant (EDTA) in order to evaluate its biochemical parameters. Serum biochemical indices assessed include: Total protein, albumin, globulin, glucose, aspartate amino transferase (AST), alanine amino transferase (ALT) and alkaline phosphatase (ALP) according to the method described by [10].

##### **Internal organs Evaluation**

At the end of the feeding trial, a bird was selected from each replicate across the treatments (representing the average live body weight of the treatment group). The

**Table 1: Ingredients and analyzed proximate nutrients composition of broiler chick's diets**

Ingredient (%)	Control (T1)	Raw BNS (T2)	Raw BNS Plus Enzyme (T3)	Toasted BNS (T4)	Toasted BNS plus Enzyme (T5)
Maize	39.06	32.55	32.55	30.53	30.53
Full fat Soybean	50.39	46.90	46.90	48.92	48.92
Rice Offal	4.00	4.00	4.00	4.00	4.00
BNS	-	10.00	10.00	10.00	10.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Bone Ash	3.50	3.50	3.50	3.50	3.50
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Biozyme (g )	-	-	100	-	100
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Analysed Nutrients composition (%)</b>					
Crude protein	26.5	21.75	21.75	22.31	21.75
Crude fibre	4.71	8.62	7.33	7.03	9.50
NFE	42.18	44.15	44.94	44.66	42.73
Either Extract	6.82	8.29	8.26	8.29	7.02
Ash	11.89	9.11	9.41	9.88	11.19
Methionine	0.67	0.72	0.72	0.69	0.69
Lysine	1.83	1.72	1.72	1.77	1.77
Calcium	1.36	1.38	1.38	1.38	1.38
Phosphorus	0.87	0.86	0.86	0.87	0.87
ME (Kcal/kg)	3021.06	3043.57	3069.18	3081.39	2890.29

**BNS** = Bambara nut Sievate, **NFE** = Nitrogen Free Extract, **ME** = Metabolisable Energy calculated using Puozenga 1985 ( $37x\%cp + 81x\%EE + 35.5x\%NFE$ ), **T<sub>1</sub>** = Control diet **T<sub>2</sub>** = Diet containing raw BNS, **T<sub>3</sub>** = Diet containing raw BNS plus Biozyme, **T<sub>4</sub>** = Diet containing Toasted BNS, **T<sub>5</sub>** = Diet containing toasted BNS plus Biozyme, Vitamin-mineral premix\* (animal care) will supply the following additional nutrients per kg of feed. Vitamin (1,200,000 I.U), D, (300,000 I.U), E (3,000 mg), K, (250 mg), folic acid (10 mg), Niacin (4,000 mg), Calpan (1,000 mg), B<sub>1</sub> (500 mg), B<sub>12</sub> (2 mg), B<sub>6</sub> (9,200), B<sub>5</sub> (350 mg), Biotin (8 mg), Antioxidant (12,500mg), Minerals; Cobalt (25 mg), Iodine (120 mg), Iron (4,000 mg), Manganese (700 mg), Copper (800 mg), Zinc (6,000mg), Chlorine Chloride (20,000 mg).

**Table 2: Ingredients and analyzed proximate nutrients composition of finisher broiler chicken diets**

Ingredient (%)	Control (T1)	Raw BNS (T2)	Raw BNS Plus Enzyme (T3)	Toasted BNS (T4)	Toasted BNS plus Enzyme (T5)
Maize	54.35	43.45	43.45	40.56	40.56
Full fat Soybean	36.10	31.00	31.00	33.89	33.89
Rice Offal	4.00	4.00	4.00	4.00	4.00
BNS	-	15.00	15.00	15.00	15.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Bone Ash	3.50	3.50	3.50	3.50	3.50
Salt	0.30	0.30	0.30	0.30	0.30
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Biozyme (g)	-	-	100	-	100
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
<b>Analysed Nutrients composition (%)</b>					
Crude protein	19.69	17.50	21.88	21.88	17.50
Crude fibre	5.56	7.03	9.03	8.80	8.40
NFE	51.64	53.35	42.78	46.34	49.11
Either Extract	6.66	5.80	5.23	5.87	6.13
Ash	8.76	8.90	14.00	10.23	11.73
Methionine	0.56	0.68	0.68	0.64	0.64
Lysine	1.37	1.30	1.30	1.37	1.37
Calcium	1.32	1.35	1.35	1.36	1.36
Phosphorus	0.78	0.78	0.78	0.80	0.80
ME ( Kcal/kg)	3101.21	3011.23	2751.88	2930.05	2887.44

**BNS** = Bambara nut Sievate, **NFE**= Nitrogen Free Extract, **ME** = Metabolisable Energy calculated using Puazenga 1985 (37x %cp + 81 x % EE + 35.5x% NFE), **T<sub>1</sub>** = Control diet **T<sub>2</sub>** = Diet containing raw BNS, **T<sub>3</sub>** = Diet containing raw BNS plus Biozyme, **T<sub>4</sub>** = Diet containing Toasted BNS, **T<sub>5</sub>** = Diet containing toasted BNS plus Biozyme, Vitamin-mineral premix\* (animal care<sup>®</sup>) will supply the following (additional nutrients per kg of feed. Vitamin (1,200,000 I.U), D, (300,000 I.U), E (3,000 mg), K, (250 mg), folic acid (10 mg), Niacin (4,000 mg), Calpan (1,000 mg), B<sub>1</sub> (500 mg), B<sub>2</sub> (2 mg), B<sub>6</sub> (9,200), B<sub>12</sub> (350 mg), Biotin (8 mg), Antioxidant (12,500mg), Minerals; Cobalt (25 mg), Iodine (120 mg), Iron (4,000 mg), Manganese (700 mg), Copper (800 mg), Zinc (6,000mg), Chlorine Chloride (20,000 mg).

selected birds were fasted of feed for 12 hours to avoid faecal contamination during evisceration [11]. The selected birds were slaughtered by severing the neck at the first vertebrae with a Sharp knife and bled.

The birds were dipped in hot water (60-70°C) for one to two minutes and their feathers plucked manually. Each bird was eviscerated, visceral organs removed and expressed as percentage of live weight [12].

Organ proportion (expressed relative to the live weight) =  $\frac{\text{Weight of organ}}{\text{Live weight}} \times 100$

Live weight

#### Statistical Analysis

Data collected were subjected to one-way Analysis of Variance (ANOVA) using the Statistical Package for Social Science and the means that differ significantly ( $P < 0.05$ ) were separated using Duncan's Multiple Range Test (DMRT) using the same package. [13].

**Table 3: Proximate Composition of Raw and Toasted Bambara nut Sievate**

Parameters	Raw BNS	Toasted BNS	SEM
Dry matter	91.30 <sup>b</sup>	92.44 <sup>a</sup>	0.19*
Crude Protein	18.54 <sup>a</sup>	14.11 <sup>b</sup>	0.79*
Crude Fiber	20.58	21.83	0.35
Ether Extract	2.40	1.93	0.08
Ash	2.76	2.67	0.02
Nitrogen-free Extract	47.02	51.90	0.81
Metabolizable energy(kcal/kg)	2549.59	2520.85	13.88

<sup>ab</sup> Means within each row with different superscript are significantly different ( $P < 0.05$ ), BNS – Bambaranut sievate, SEM- Standard Error of Mean.

#### Effect of Dietary Raw and Toasted Bambara nut Sievate Supplemented with or without Biozyme on Blood Profile of Broiler Chickens

Haematological response of broiler chickens to dietary inclusion of raw and toasted bambara nut sievate supplemented with or without enzyme is as shown in Table 4. All the haematological parameters examined were not significantly ( $p > 0.05$ ) influenced by dietary treatments except the Eosinophils and Monocytes. The Eosinophils value was significantly ( $p < 0.05$ ) higher in birds fed diet containing raw bambara nut without enzyme

(1.33 %) compared to birds fed diets containing raw and toasted bambara nut sievate with enzyme supplementation (0.00%). Monocytes level in the birds fed dietary raw bambara nut sievate without enzyme (4.00%) was significantly ( $p < 0.05$ ) higher than that of birds fed toasted bambara nut sievate with enzyme supplementation (1.00 %) but similar to birds on control and other groups. Packed cell volume (PCV) values across the groups ranged from 34.67 – 40.67%, red blood cell (RBC): 2.33 – 2.60 %, white blood cells (WBC): 6.53 – 7.37%, haemoglobin (Hb): 11.37 – 13.57 g/dl, mean

corpuscular volume (MCV): 148.17–159.57 fl, mean corpuscular haemoglobin (MCH): 49.50 – 52.00 pg, mean corpuscular haemoglobin concentration (MCHC): 33.27 – 33.40 g/dl, lymphocytes: 47.67 – 48.33% and heterophils: 46.33–51.33%.

Result of haematological indices of this study was in consonance with that of [12] who reported no significant differences in haematological parameters of broiler chickens fed diets containing processed and unprocessed bambara nut offal. PCV values (34.67 – 40.67%) obtained were within the normal range (31.0 – 42.0%) for healthy birds reported by [14]. Haemoglobin (11.37 – 13.57 g/dl) was also within normal range of (7.0 – 13.0 g/dl) reported by [14]. Other

haematological indices: RBC, WBC, MCH, MCV and MCHC were within their normal ranges as reported by [15].

The absence of basophils in all birds fed experimental diets as well as the absence of eosinophils in birds fed enzyme supplemented diet did not indicate any form of abnormality which is in line with [16] who opined that, absence of eosinophils and basophils is not associated with any characteristic abnormality. A low number or absence of eosinophils and basophils may be detected by chance and this does not usually cause problems because other parts of the animal immune system compensate adequately [16].

**Table 4: Effect of Inclusion of Raw and Toasted Bambara nut Sievate with or without Biozyme Supplementation on Haematological Indices of Broiler Chickens**

Parameters	T1	T2	T3	T4	T5	Normal Ranges	SEM
PCV (%)	34.67	39.33	38.33	35.33	40.67	31.0-42.0	1.37
RBC ( $\times 10^{12}/l$ )	2.33	2.53	2.40	2.37	2.60	2.5-4.5	0.06
WBC ( $\times 10^9/l$ )	6.53	7.17	6.93	7.03	7.37	5.0-15.0	0.12
Haemoglobin(g/dl)	11.37	13.13	12.77	11.77	13.57	7.0-13.0	0.47
MCV (fl)	148.17	148.17	159.57	149.13	155.80	97.07-166.45	3.02
MCH (pg)	49.50	51.60	52.97	49.67	52.00	33.0-47.0	0.82
MCHC (g/dl)	33.40	33.37	33.27	33.27	33.33	32.0-36.0	0.02
Lymphocyte (%)	48.33	48.33	48.33	48.00	47.67	48.33-61.33	0.50
Heterophils	49.33	46.33	49.33	49.33	51.33	10.0-14.6	0.80
Eosinophil	0.33 <sup>ab</sup>	1.33 <sup>a</sup>	0.00 <sup>b</sup>	0.33 <sup>ab</sup>	0.00 <sup>b</sup>	0-2.0	0.19
Basophils	0.00	0.00	0.00	0.00	0.00	0-1.0	0.00
Monocyte	2.00 <sup>ab</sup>	4.00 <sup>a</sup>	0.33 <sup>ab</sup>	2.33 <sup>ab</sup>	1.00 <sup>b</sup>	0-3.0	0.37

<sup>ab</sup> Mean within each row with different superscripts are significantly different ( $P < 0.05$ ) FCR- Feed Conversion Ratio T<sub>0</sub> - Control Diet Containing No Bambara Nut Sievate, T<sub>1</sub> - Containing Raw Bambara Nut Sievate, T<sub>2</sub> - Diet Containing Raw Bambara Nut Sievate + Biozyme, T<sub>3</sub> - Diet Containing Toasted Bambara Nut Sievate And T<sub>4</sub> - Diet Containing Toasted Bambara Nut Sievate + Biozyme, PCV - Pack Cell Volume, RBC - Red Blood Cell count, WBC - White Blood Cell count, MCV - Mean Corpuscular Volume, MCH - Mean Corpuscular Haemoglobin, MCHC - Mean Corpuscular Haemoglobin Concentration.

#### Effect of Inclusion of Raw and Toasted BNS with or without Biozyme Supplementation on Serum Indices of Broiler Chickens

The effect of inclusion of raw and toasted bambara nut sievate with or without biozyme on serum biochemical parameters is shown in Table 5. Result showed no significant

( $P > 0.05$ ) variation in all the serum parameters evaluated. Total protein level ranged from 5.47 – 6.17 g/dl, albumin 3.17 – 4.33 g/dl, globulin 2.30 – 2.67 g/dl, glucose: 164.7 – 198.93 mg/dl, aspartate amino transferase (AST): 116.4 – 131.90 u/l, alanine amino transferase (ALT): 41.80 – 47.30 u/l and alkaline phosphatase (ALP): 80.67 – 100.67 u/l. The results of serum biochemical parameters of all the treatment groups were similar to the control. The non-significant difference recorded in the study conformed to the results of [17] and [14] who observed no dietary effect on MCH, MCHC and MCV of birds fed graded levels of toasted bambara nut offal in diets. The result also suggested that addition of enzyme to raw or toasted bambara nut sievate based diet had

a tendency to increase the serum levels of total protein, albumin, globulin, glucose, AST and ALT of birds fed those diets.

The results however, contradicted the findings of [18] who recorded significant ( $p < 0.05$ ) variation in all serum parameters when broiler chickens were fed diets containing raw and enzyme fortified bambara nut offal diets. Result of the serum indices like that of haematological parameters in this study implied that, inclusion of bambara nut sievate and enzyme addition in diets did not compromise the immune response of the experimental birds. This also implied that the diets did not induce any parasites or foreign substance in the circulatory system of the birds which would compromise the immune response.

**Table 5: Serum Biochemical Indices of Finisher Broiler Chickens Fed Diets Containing Raw and Toasted Bambara nut Sievate Supplemented With or Without Biozyme**

PARAMETERS	T1	T2	T3	T4	T5	SEM
Total Protein (g/dl)	5.60	5.60	6.17	5.47	6.13	0.28
Albumin (g/dl)	3.23	3.20	3.50	3.17	4.33	0.21
Glubolin (g/dl)	2.63	2.40	2.67	2.30	2.57	0.11
Glucose (mg/dl)	168.23	175.53	177.03	164.70	198.93	10.35
AST (u/l)	118.83	118.80	130.37	116.40	131.90	6.13
ALT (u/l)	42.90	42.67	46.80	41.80	47.30	2.21
ALP (u/l)	91.47	93.33	80.67	91.87	100.67	4.27

AST- Aspartate amino transferase, ALT- Alanine amino transferase, ALP- Alkaline phosphatase, T<sub>1</sub>- Control diet, T<sub>2</sub>- Diet containing raw bambara nut sievate, T<sub>3</sub>- Diet containing raw bambara nut sievate plus Biozyme, T<sub>4</sub> Diet containing toasted bambara nut sievate, T<sub>5</sub> Diet containing toasted bambara nut sievate plus Biozyme.

**Effect of Inclusion of Raw and Toasted Bambara nut Sievate with or without Biozyme Supplementation on Organs weight of Broiler Chickens**

Table 6 shows the results of internal organs weight of broiler chickens fed diets

containing raw and toasted bambara nut sievate with or without enzyme supplementation. Organ's weight was expressed as percentage of live weight of broiler chicken. There was no significant difference ( $P > 0.05$ ) in weight of all visceral

components evaluated in the study. The liver, gizzard, heart, lungs, pancreas, spleen, proventriculus, intestine and abdominal fat values ranged from 1.66 – 1.98, 0.63 – 0.7, 0.39 – 0.56, 0.46 – 0.60, 0.21-0.28, 0.09-0.11, 0.42-0.56, 2.57-3.10 and 0.39-0.95%, respectively.

The non-significant variation in weights of organs is consistent with the reports of [14] who reported no significant effect on internal organs of broiler chickens fed diets containing processed and unprocessed bambara nut offal. The result of the present

study implied that, the anti-nutritional factors level in the raw bambara nut sievate contained in the diets were tolerable and therefore did not cause any significant effect in organs weight of the birds. Nonetheless, the level of anti-nutrients was further reduced by toasting of bambara nut sievate and enzyme supplementation of the diets. Enzyme addition may have enhanced fibre digestion by hydrolyzing the non-starch polysaccharides in raw and toasted bambara nut sievate and also reduced intestinal viscosity.

**Table 6: Effect of Inclusion of Raw and Toasted Bambara nut Sievate with or without Biozyme Supplementation on Organs of Broiler Chickens**

Parameters (%)	T1	T2	T3	T4	T5	SEM
Liver	1.98	1.87	1.95	1.66	1.75	0.06
Kidney	0.64	0.74	0.65	0.67	0.63	0.03
Gizzard	1.44	1.43	1.34	1.59	1.61	0.05
Heart	0.45	0.44	0.39	0.45	0.46	0.03
Pancreas	0.28	0.23	0.21	0.26	0.21	0.05
Lungs	0.56	0.52	0.49	0.60	0.46	0.03
Spleen	0.11	0.10	0.09	0.10	0.11	0.01
Proventriculus	0.50	0.56	0.50	0.54	0.42	0.02
Intestine	3.06	3.09	2.57	3.10	2.76	0.09
Abdominal fat	0.87	1.09	0.95	0.72	0.39	0.11

abc Mean within each row with different superscripts are significantly different ( $P < 0.05$ ) T1, - Control diet Containing no bamabaranut Sievate, T2, - diet containing raw bamabaranut sievate, T3, - Diet containing raw bamabaranut sievate + Biozyme, T4, - Diet containing toasted bamabaranut sievate and T5 - Diet containing toasted bamabaranut sievate + Biozyme

### Conclusion and Application

1. Inclusion of raw and toasted bambara nut sievate with or without enzyme supplementation had no negative effect on blood profile and internal organs weight of broiler chickens.
2. 15% percent raw or toasted bambara nut sievate can be included in finisher broiler chickens diet with or without enzyme supplementation. Hence, this level did not introduce

any toxins in the organs and circulatory system that will alter the normal physiological and metabolic status of the birds.

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