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Evaluation of Toasted, Cooked and Akanwu-Cooked Sword Bean Meal in Place of Soya Bean Meal in Broiler Starter Diets

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Abstract: In a 4-week feeding trial, evaluation of variously processed sword bean (toasted, cooked and akanwu-cooked) meal in place of soybean meal was carried out using 120 day old Anak broiler chicks. They were randomly assigned to 4 experimental diets, given 30 birds per treatment group in a completely randomized design. Each treatment had 3 replicates of 10 birds each. Diet 1 was soybean based (control), while the test feed stuffs quantitatively replaced 18.18% of soybean meal making 5% of the total diets in diets 2, 3, and 4. Feed intake, weight gain, carcass quality, blood constituents and histopathological effects were evaluated. Broiler chickens placed on toasted and akanwu-cooked diets (diets 3 and 4 respectively) had poor growth performance that was significantly ($P < 0.05$) different from those fed cooked diet (diet 2) and control diet (diet 1). Feed-intake values were (36.43, 36.13, 33.88, 27.18), weight gain values were (16.75, 15.08, 11.01, 11.45), feed-to-gain ratio (2.18, 2.4, 2.94, 2.54) and gross margin (N137, N141.04, N74, N100.93). Cut-parts showed no significantly ($P > 0.05$) difference except for back cut in favour of diet 2. Significant differences were obtained only among values for kidney and liver, with diet 2 comparing favourably with the control diet. For haematological values, the PCV for D3 and D4, HB for D3, RBC for D3, MCV for D3 and D4, MCHC for D3 and D4, and MCH for D3 and D4 were not within the normal range established for broiler chickens. Whereas diet 2 values for these parameters were within the normal range and compared favourably with the control diet. Values for urea, creatinine and globulin were significantly ($P < 0.05$) different from one another. Diet 2 had the lowest value (12.33mg/dl) for urea and diet 3 had the highest value (30.467mg/dl), the creatinine values for diet 1 and 2 were significantly lower than that of diets 3 and 4. The globulin value favoured diet 2. Based on the above result, cooked sword bean meal compared favourably with control diet and hence, diet 2 is recommended.

Key words: Evaluation, processed sword beans, broiler birds, soybean meal

Introduction

In Nigeria, the state of nutrition of the populace is predominantly marked by inadequate protein intake both in quantity and quality (Taiwo *et al.*, 2005). Food and agricultural organization (FAO, 1992) recommended 27g as the animal protein daily requirement for human being. However, the intake per average Nigerian is grossly inadequate (3.24g animal protein / day) (FAO, 1992). This shortage has given rise to high prices of animal protein. Therefore, efforts should be directed towards exploring all reasonable options to meet the recommended level at a reduced cost. Poultry production has been suggested as a means of massively producing animal protein because of its short generation interval and high growth rate (Essen *et al.*, 2005). Nevertheless, the high cost of production involved due to high cost and competition with man and industry for conventional ingredients has not made this possible (Taiwo *et al.*, 2005). This has stimulated huge research interest focusing on the search for alternative low-cost feedstuffs. Such research work has been intensified in the last decade with a view to determine the efficiency of alternative ingredients in terms of growth and production

(Agbede, 2005). One of such alternative ingredients rich in protein and which is envisaged would probably be capable of substituting for the expensive soybean meal in the diet for poultry is sword bean meal (NAS, 1979; Udedibie, 1990a; Akinmutimi *et al.*, 2004a). It thrives well on poor soils where most crops fail due to excellent adaptability to extreme climatic conditions. It yields about 4600kg seeds per hectare with crude protein content of about 22-29 percent. It has fairly good amino acid profile, rarely edible by man and of no industrial usage (Udedibie, 1990b; Akinmutimi and Abasiokong, 1997; Akinmutimi *et al.*, 2004b). However like other grain legumes, anti-nutritional factors such as phytin, tannin, canavalin, con-canavalin-A, gibberellins, hydrocyanide (Cyanogenic glycosides), trypsin inhibitors etc. have been reported in raw sword bean (NAS, 1979; Udedibie 1990a; Akinmutimi, 2003). This calls for detoxification before usage. Toasting, cooking and cooking in 'akanwu' solution are common detoxification methods among rural dwellers (Ewa, 1999, Akinmutimi, 2001). This forms the basis of their usage in this study. The Objective of this study is to investigate the response of broiler birds fed diets containing toasted, cooked and

akanwu-cooked sword bean meal in place of soy bean meal with the aim of choosing the processing technique whose end-product seeds will compare most favourably with the conventional soybean meal in all parameters considered.

Materials and Methods

Experimental site: The experiment was conducted at the live stock unit of the Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Feedstuffs and processing: The raw sword bean seeds were purchased from Agwantashii in Nassarawa State of Nigeria while other feedstuffs and materials were bought from Umuahia and Aba, all in Abia state of Nigeria. One part was cooked in water for ninety minutes, a part cooked in 5% akanwu solution for ninety minutes, a part toasted for about 10 minutes while the remaining part was used in a raw state. They were oven dried at about 60°C before being milled and used for analyses and diets formulation.

Experimental diets and composition: Four diets were formulated (Table 1) Diet 1 was soybean based and it served as the control. Cooked, toasted and akanwu cooked sword bean meal replaced soybean meal (weight to weight) in diets 2, 3 and 4 at 18.18% (5% respectively).

Experimental Birds and their Management: A total of one hundred and twenty day old Anak breed broiler chickens purchased from Owerri Imo State, Nigeria were randomly allotted to the four treatment diets. There were 30 birds per treatment and 10 birds per replicate in a completely randomized design. The chicks were brooded in deep litter pen using wood shaving as litter material. Source of heat was kerosene stove under galvanized metal hovers and additional light was supplied using kerosene lanterns during the night to serve as source of heat and illumination. In order to prevent cold during the brooding period which lasted for 2 weeks, black tarpaulin cloth was used to cover the wire netting part of the building. Necessary routine vaccinations and medications were administered.

Data collection: The birds were weighed at the beginning of the experiment and subsequently weekly in order to measure average weight. Feed-to-gain ratio was calculated by dividing the average feed intake by the average weight gain while percent mortality was calculated by dividing the number of dead birds by the number of birds started with, all multiplied by hundred. Economics of the diet/gross margin was evaluated using the method of Sonaiya *et al.* (1986). Carcass quality was evaluated as described by Akinmutimi *et al.* (2004a). For blood haematology and

Table 1: Composition of the treatment diets containing same levels of differently processed sword bean fed at starter phase levels of processed sword bean

Ingredients	0% Contro	5% Cooked	5% Toasted	5% Akanwu cooked
Maize	49.8	49.8	49.8	49.80
Soybean	27.5	22.5	22.5	22.50
Sword beans	-	5	5	5.00
Blood meal	5.0	5.0	5.0	5.00
Palm Kernel Cake	9.0	9.0	9.0	9.00
Fish meal	3.0	3.0	3.0	3.00
Bone meal	3.0	3.0	3.0	3.00
Oyster shell	2.0	2.0	2.0	2.00
Vitamin premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated composition				
Crude Protein (%)	23.85	23.00	22.84	22.95
Metabolizable energy (kcal/kg)	2848.414	2845.314	2821.264	2828.764

*1kg of premix contains: Vitamins A (5,000,000 I.U), Vitamin D3 (1,000,000 I.U), Vitamin E (16,000mg), Vitamin K3 (800mg), Vitamin B1 (1,200mg), Vitamin B2 (22,000mg), Niacin (22,000mg), Calcium pantothenate (4,600mg), Vitamin B6 (2,000mg), Vitamin B12 (10mg), Folic acid (400mg), Biotin (32mg), Choline chloride (200,000mg), Manganese 948,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), Iodine (600mg), Cobalt (120mg), Selenium (48mg), Anti-oxidant (48,000mg)

blood chemistry evaluation, a bird per replicate was randomly selected and bled at the end of the trial by severing the jugular vein. A set of blood samples were collected into bottles containing EDTA for haematological evaluation while another set of blood samples were collected (without anticoagulant) for blood chemistry evaluation. Blood constituent parameters were determined as described by Dacie and Lewis (1991).

Chemical and data analysis: Raw and processed sword bean meal and the experimental diets were analyzed for proximate composition and gross energy according to methods of A.O.A.C (1990). All data were subjected to analysis of variance (ANOVA) while means with significant differences were separated using Duncan's Multiple Range Tests (Duncan, 1955).

Results and Discussion

The results of the proximate composition and gross energy of the experimental diets and the test feedstuffs is as shown in Table 2. There were observable differences in the composition of the experimental diets and the test feedstuffs. The differences observed among the experimental diets are not surprising since the diets were not formulated to be iso-caloric and iso-nitrogenous. The differences observed in the proximate composition of the test feedstuffs is due to processing (Apata, 1990).

The result of growth performance of boiler birds fed differently processed sword bean (5% cooked, 5%

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Table 2: Proximate composition of experimental diets and test feedstuffs

Determined composition(%)	0% Control	5% cooked	5% toasted	5% Akanwu	Cooked seeds	Toasted seeds	Akanwu cooked
Crude Protein	24.850	23.330	22.600	20.970	25.22	21.78	24.04
Ether Extract	4.190	4.035	4.060	4.070	2.89	2.27	2.81
Crude Fibre	6.300	5.870	5.640	5.720	6.49	12.09	6.95
Ash	9.710	8.780	8.600	10.250	3.72	3.99	3.88
Nitrogen-Free Extract	54.950	57.990	59.100	58.990	52.67	53.53	55.45
Dry matter	89.900	91.290	91.500	91.560	90.99	93.66	93.13
GE (kcal/g)	3.196	3.088	2.996	2.963	4.52	4.42	4.49

Table 3: Growth performance of broiler birds fed differently processed sword bean meal in broiler starter diet

	Processing techniques				±SEM
	D1 control	D2 cooked	D3 toasted	D4 akanwu cooked	
Initial weight/bird (g)	35.00	31.00	34.67	33.33	1.21
Final weight/bird (g)	504.08 ^a	453.33 ^a	333.70 ^b	335.20 ^b	15.95
Feed intake/bird/day (g)	36.43 ^a	36.13 ^a	33.88 ^a	27.18 ^b	0.76
Weight gain/bird/day (g)	16.75 ^a	15.08 ^a	1.01 ^b	11.45 ^b	0.51
Feed conversion ratio (g feed/g gain)	2.18	2.40	2.94	2.54	0.20
% Mortality	0.00	0.00	0.00	0.00	0.00
Gross margin (N)	137.00	141.04	74.00	100.93	

a – b treatment means in the same row with different superscript are significantly different (P<0.05).

toasted, and 5% akanwu cooked) is presented In Table 3.

There was significant (P<0.05) difference between the treatment means for all parameters, with the exception of the feed conversion ratio and percentage mortality. The feed intake for the control diet was significantly (P<0.05) different from that of diet 4 (akanwu-cooked) while the weight gain was significantly different from both diets 3 and 4 (feed intake, 36.43 36.13, 33 88, 27.8) (weight gain, 16.75, 15.08 11.01 and 1145). The lower feed intake of birds fed akanwu-cooked sword bean is in line with the report of Akinmutimi (2001) who reported a significant decrease in feed intake of young broiler birds fed Akanwu cooked lima bean meal even at 5% dietary level of inclusion. He attributed this to the inability of akanwu to completely detoxify the anti-nutrient components of the seed to a safe\tolerable level.

Tannin for example, has been reported to reduce feed intake even at 2% concentration (Vohra *et al.*, 1966; Griffiths and Thomas, 1981; Olumu, 1995). Based on the degree of detoxification of anti-nutrients (tannin, phytin, trypsin inhibitor and cyanogenic glycosides) in raw sword bean as reported by Akinmutimi (2004), the diet containing toasted sword bean seed was supposed to have the least feed intake, but the higher value of feed intake (33.88) than the value of the diet containing akanwu-cooked sword bean (27.18) could be attributed to low metabolizable energy value of the diet containing toasted sword bean, and hence high feed intake, since the birds eat to meet their energy requirements (Emenalon and Udedibie, 1998). Cooked sword bean seeds were better detoxified relative to other processing techniques as reported by Akinmutimi (2004), which perhaps explains better feed intake than other diets formulated from the products of other processing

techniques. The residual anti-nutrient accounts for the slight inferiority of the feed intake of the birds placed on cooked sword bean meal when compared with the birds placed on control diet. The significantly different (P<0.05) value of the control diet from diets containing toasted seeds and akanwu –cooked seeds even at 5% dietary level of inclusion for weight gain could be attributed to poor feed intake for birds placed on account cooked meal (Melansho *et al.*, 1987; Akinmutimi, 2001) and the effect of residual anti-nutritional factors such as tannin, cyanogenic glycosides trypsin inhibitors canavanine, con-canavanine-A etc. on the nutrient utilization and growth for birds placed on both akanwu cooked meal and toasted meal. (Marletta, 1989; Ologhobo *et al.*, 1993; D'mello and Devandra, 1995).

Cyanide for example, has been reported to depress protein utilization and hence, poor weight gain, because dietary methionine could be mobilized via the rhodanese pathway for cyanide detoxification, to the innocuous thiocyanate. In such circumstances dietary protein quality is compromised, resulting in poor performance (Ologun *et al.*, 1998). Also, trypsin inhibitors have been associated with growth retardation (Abiola and Sogunke, 1998). The lower weight gain for diet containing toasted seeds despite reasonable feed intake value could be mainly attributed to poor nutrient utilization as a result of ineffectiveness of toasting in detoxification of anti-nutrients to a tolerable level. (Akinmutimi, 2004) This is confirmed by its highest value for feed conversion ratio. The level of poor performance of the birds is in line with Udedibie and Obaji (1992); Emenalon and Udedibie (1998); who reported poor weight gain of birds fed with toasted Jack bean and Mucuna Puriens respectively. This was attributed to ineffectiveness of toasting in detoxification of the anti-nutrients in the said

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Table 4: Cut-parts expressed as a percentage dressed weight of differently processed sword bean meal in broiler starter diet

	Processing Techniques				±SEM
	Control	Cooked	Toasted	Akanwu Cooked	
Live weight (g)	468.333 ^a	426.667 ^{ab}	396.667 ^{ab}	231.6000 ^b	62.101
Dressing percentage	73.6467 ^b	77.75 ^{ab}	77.1033 ^{ab}	78.9033 ^a	1.148
Thigh	14.7167	14.39	13.5967	14.0067	0.300
Drum stick	11.4167	11.7200	11.6067	10.6633	0.741
Wing	11.3000	11.8300	11.7467	11.5367	0.186
Breast cut	20.5767	18.7867	18.7100	21.0067	0.891
Back cut	16.1167 ^a	19.2133 ^a	15.0533 ^b	14.4933 ^b	0.904

a – b treatment means in the same row with different superscript are significantly different (P<0.05).

legumes. The poor performance of birds placed on akanwu cooked sword bean meal (diet 4) even at 5% dietary level of inclusion is at variance with the report of Akinmutimi (2001) who reported 5% dietary level of akanwu cooking being safe for lima bean, another grain legume. The difference may be due to different anti-nutritional factors present in the beans and hence, different degree of nutrient- utilization. Birds fed with 5% dietary level of cooked sword bean diet compared favourably with those placed on soybean diet. This may be due to better availability of amino acid as a result of moist heating since moist heat treatment makes amino acid more available in *Mucuna conchinchinesis* another grain legume (Onwukwe, 2000). This result is also in line with the work of Udedibie (1990a) who reported good weight gain of young broiler birds fed 10% sword beans. It is also in accordance with the reports of Udedibie and Nkwocha (1990), Udedibie (1990b) and Oyawoye *et al.* (1999), who reported that 10% dietary level of cooked jack bean (*Canavalia ensiformis*), a closely related legume produced no deleterious effect on weight gain.

The 0% (zero percent) mortality for the processed seeds revealed that the residual anti-nutrients is within a tolerable level. The gross margin for control diet was higher than that of diets 3 and 4 but lower than that of diet 2. This may be the product of favorable weight gain, moderate feed cost and good market price of birds fed diet containing 5% cooked sword bean meal. The above result shows that in evaluating the different processing techniques, cooking (diet 2) compared favorably with the control diet (diet 1). Hence, cooking is chosen as the best processing technique.

Table 4 shows the cut parts as percentage dressed weight of broiler starter birds fed variously processed sword bean.

There was significant (P<0.05) difference for the values of back cut only and this did not follow any specific pattern that could be attributed to the effect of the test diets. This shows that any of the diet could be recommended for cut parts. This is confirmed by the good dressing percentage for all the diets, signifying good edible portion of live weight as opposed to inedible offals (Oluyemi and Roberts, 2000). On the average, diet containing cooked seeds gave the best performance particularly when absolute values of thigh drumstick, wing and back cut were considered.

The organ weight expressed as a percentage dressed weight of broiler chickens fed differently processed beans is as represented in Table 5.

There was no significance difference (P>0.05) among all parameters measured, with the exception of liver and kidney. This could be attributed to the effect of processing on the anti-nutrients. The affected organs liver and kidney are major detoxification organs (Ologhobo *et al.*, 1993; Ukachukwu, 2000) and hence enlargement and increase in weight as a result of increase in activity of the organs to detoxify residual anti-nutrients due to poor detoxification of anti-nutrients by the processing techniques employed in the sword bean seed as reported by Akinmutimi (2004). For liver, control diet and the diet containing cooked seeds were significantly different (P<0.05) from diets containing toasted seeds and akanwu-cooked seeds, still confirming the effect of the degree of percentage reduction of anti-nutrient by the processing technique. Akanji *et al.* (2003) reported that any processing method that could not completely remove trypsin inhibitors actively could also not lead to complete removal of haemagglutinin (con-canavanine-A) a heat stable anti-nutrient and of course canavanin, another related heat stable anti-nutrient (Oyawoye *et al.*, 1999). Canavanin has been reported to cause liver hypertrophy, this being an analogue of arginine, it can act as an antagonist in the metabolism of arginine and interferes with normal production of liver proteins, impairing liver functioning and producing hypertrophic effect, leading to an increase in weight (Oyawoye *et al.*, 1999). The values of kidney for diets 1, 2 and 4 were significantly different from that of diet 3, which showed higher anti-nutritional factors in the diet formulated from seeds subjected to toasting processing technique. The weight of the kidney of birds fed diet 2 were slightly lower that of diet 4 though not statistically different, still indicating the effect of the degree of difference in the anti-nutrients in the seeds subjected to these processing techniques.

The increase in weight of the kidney agrees with the report of Ologhobo *et al.* (1993) who reported increase in the weight of kidney of broiler chicken fed raw lima bean and lima bean fractions. They attributed this to the fact that the key enzyme in cyanide detoxification (Rhodenase) is located mainly in the kidney. Therefore the increased activities of the kidney might have led to an increase in the weight of the kidney. From the above

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Table 5: Organ weight expressed as a percentage dressed weight of differently processed sword bean meal in broiler starter diet

	Processing Techniques				±SEM
	Control	Cooked	Toasted	Akanwu Cooked	
Kidney	1.2100 ^b	1.2900 ^b	1.6933 ^a	1.4267 ^b	0.073
Liver	3.3167 ^b	3.34 ^b	3.9767 ^a	4.1400 ^a	0.168
Spleen	0.1267	0.1200	0.1067	0.1333	0.023
Heart	0.8100	0.7667	0.9600	0.9333	0.115
Gizzard	6.5433	6.0133	1.2600	1.1633	0.614
Proventriculus	0.9867	0.9367	1.2600	1.1633	0.108
Intestine	12.8833	13.0533	14.1900	14.6833	0.726

a – b treatment means in the same row with different superscript are significantly different (P<0.05).

result, diet 2 containing cooked sword bean meal compared favorably with diet 1 (control diet) in all parameters considered and hence it is recommended for organ weight values.

The haematological values of starter broiler fed the differently processed bean are as shown in Table 6.

There were significant (P<0.05) differences for all the treatment means for all the parameters considered, with the exception of means corpuscular haemoglobin concentration (MCHC). The packed cell volume (PCV) for control diet varies significantly (P<0.05) from all other diets with the exception of diet containing 5% cooked seeds. The values for control diet and diet containing cooked seeds fall with the normal range of haematological values for broiler birds, as established by Mitruka and Rawnsley (1977) Ross *et al.* (1978).

The values for diets 3 and 4, which were products from the feeding of toasted and akanwu cooked seeds, fall below the normal range suggesting poor quality of protein of the diets (Awoniyi, 2000). This may be due to toxic factors as reported by Oyawoye *et al.*, (1999) in a closely related legume, Jack bean (*Canavalia ensiformis*).

There was significant (P<0.05) difference between the control diet (diet 1) and all the test- diets for HB values. However, all values for haemoglobin for all the diets with the exception of values for birds on diet 3 (toasted seeds) fall within the normal range as established by Mitruka and Rawnsley (1977) and Ross *et al.* (1978). This is a reflection of poor detoxification of the processed seed by toasting. Oyawoye *et al.* (1999) reported reduction in the haemoglobin values due to con-canavanin-A when *canavalia ensiformis*, a closely related legume was fed to broiler chickens. The low level of haemoglobin for diet 3 suggests poor efficiency of oxygen transportation and hence poor tissue respiration (Solomon *et al.*, 1998).

The values of red blood corpuscles (erythrocyte values) (RBC) follow similar trend, in that they all fell within the normal haematological range as established by Mitruka and Rawnsley (1977) and Ross *et al.* (1978), with the exceptions of birds fed on diet 3 (toasted seeds). This still confirms the poor ability of the diet containing toasted seeds to support blood formation, and eventually leading to poor growth.

The white blood cell values for bird placed on diet 1 (control) and 2 (cooked) were significantly lower than those of birds on diet 3 (toasted) and 4 (akanwu-cooked).

The higher values for white blood cells could be due to the effect of toxicity of the diets 3 and 4 due to poor detoxification of toasted seeds and akanwu-cooked seeds (Akinmutimi, 2004) used for the formulation of diets 3 and 4. Hence, production of white blood cells to fight against the foreign substance in the body (Roberts *et al.*, 2003). The values obtained for means corpuscular values (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) followed a similar trend, such that diets 1 and 2 fall within the normal range as established by Mitruka and Rawnsley (1977) and Ross *et al.* (1978) suggesting good quality protein of the diets (Adeyemi *et al.*, 2000).

Values obtained for diets 3 and 4 were either above or below the normal range, established by Mitruka and Rawnsley (1977) and Ross *et al.* (1978).

This may be due to poor values of HB, PCV, and RBC, as applied to each of the diets, since the value of MCH, MCV and MCHC are functions of the above. The abnormal values suggest nutritional inadequacy of the diet (Abu *et al.*, 1999; Onwukwe, 2000).

All these probably explain the poor growth performance observed for the birds placed on these diets. Based on the above points, diets 2 (cooked seeds) is therefore recommended.

The result of blood chemistry of birds fed the differently processed sword bean meal is as shown in Table 7. There was significant (P<0.05) difference for the treatment means for all the parameters measured, with the exception of albumin, total protein and alkaline phosphatase.

The creatinine values for diets 1 (1.100) and 2 (1.100) were significantly (P<0.05) differently from that of diets 3 (1.433) and 4 (1.300) this implies nutritional inferiority of the protein quality of diets 3 (toasted seeds) and 4 (akanwu-cooked seeds) since the higher the value of serum creatinine, the lower the protein quality of the test ingredient (Aletor *et al.*, 1998).

The globulin values for the test diets were not significantly (P>0.05) different from another, signifying similar ability to fight against disease (Roberts *et al.*, 2003).

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Table 6: Haematological values of starter birds fed differently processed sword bean meals

	Processing Techniques				±SEM
	Control	Cooked	Toasted Akanwu	Cooked	
PCV (%)	32.3867 ^a	27.0000 ^{ab}	20.8333 ^b	23.3333 ^b	2.108
HB (g/100ml)	10.9000 ^a	10.3500 ^b	5.6000 ^d	8.4000 ^c	0.152
RBC (x10 ⁶ /cm ³)	3.2833 ^a	3.0000 ^b	1.1333 ^c	3.2000 ^a	0.055
WBC (x10 ⁶ /cm ³)	2.6000 ^b	3.000 ^b	4.2000 ^a	3.4000 ^{ab}	0.300
MCV (mm ³)	98.6267 ^b	90.0000 ^b	182.2000 ^a	73.3733 ^b	14.300
MCHC (pg)	33.6433	38.3333	28.5100	31.8667	3.901
MCH (%)	33.1900 ^b	34.4967 ^b	49.4967 ^a	24.5067 ^c	0.913

a – d treatment means in the same row with different superscript are significantly different (P<0.05).

Table 7: Blood chemistry of broiler chickens fed differently processed sword bean meal in broiler starter diet

	Processing Techniques				±SEM
	Control	Cooked	Toasted Akanwu	cooked	
Urea (mg/dl)	15.100 ^{bc}	12.233 ^c	30.467 ^a	20.900 ^b	2.421
Creatinine (mg/dl)	1.100 ^c	1.100 ^c	1.433 ^a	1.300 ^b	0.017
Albumin (g/l)	19.433	17.700	18.133	20.700	1.434
Globulin (g/l)	16.133 ^a	14.000 ^b	15.300 ^{ab}	14.300 ^{ab}	0.567
Total protein (g/l)	35.033	31.700	33.433	35.000	1.671
Alkaline phosphatase (i/l)	365.000	382.330	484.670	413.000	43.62

a – c treatment means in the same row with different superscript are significantly different (P<0.05).

Considering the values of urea, creatinine and appreciable level of globulin for diets 2, on the average, diets 2 (cooked seeds) is recommended.

Conclusion: Judging from the above results, diet 2 (cooked seeds) is recommended

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