MEDWELL PUBLISHING
Agricultural Journal 4 (1): 1-9, 2009
ISSN: 1816-9155
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Response of Broiler Birds Fed Diets Containing Raw Sword Bean Meal in Place of Soya Bean Meal (Starter Phase)

[1]A.H. Akinmutimi, [2]E.O. Onyekwodiri, [1]S.N. Ibe and [1]O.C. Onwudike
[1]Department of Non-Ruminant Animal Production, College of Animal Science and Animal Production,
[2]Department of Pathology, College of Veterinary Medicine
Michael Okpara University of Agriculture, Umudike, P.M.B. 7267, Umahia, Abia State, Nigeria

Abstract: Feeding trial was conducted using 150 birds of day-old Anak broiler chicks, to assess the optimal level of quantitative replacement of soybean meal with raw sword bean meal in broiler diets. Thirty and Ten birds, respectively constitute a treatment and a replicate. Five experimental diets were formulated. Diet one was soybean based (control), while the test feedstuff quantitatively replaced 5, 10, 15 and 20% soy bean in diets 2, 3, 4 and 5, respectively. The birds were assigned to these diets; feed and water were given *ad-libitum* throughout the experiment. This experiment lasted for 28 days. Feeds given daily were recorded and feed intake and weight gain determined weekly. Data on carcass quality, organ weight, blood constituents and histopathology were obtained. They were subjected to analysis of variance and means were separated using New Duncan's multiple range tests. There was significant ($p<0.05$) difference between the treatment means for all the parameters considered. Broiler chickens placed on the test-diets had severely hindered growth that was significantly ($p<0.05$) different from the results obtained from control diet. Feed-intake values were (43.3333, 31.8567, 25.5267, 19.0133, 16.7367), weight gain (20.3233, 14.4067, 10.34, 5.3933, 2.9990) and the feed conversion ratio (2.1367, 2.2033, 2.4467, 3.5700 and 5.6067). The gross margin of the control diet was higher (137.67) than the test diets (135.59, 106.61) (84.66, 66.88). Values of cut-parts showed significant differences in all parameters considered, with the birds placed on the control diet on the average performing better than others. Organ-weights showed significant ($p<0.05$) differences between the treatment means of the control diet and the test diets for all the parameters considered with the exception of the spleen. The values for heart intestine, proventriculus and gizzard followed no specific pattern that could be attributed to the effects of the diets, while the values for liver and kidney did. The liver values for the test diets became significantly higher than the control diet from diet 3 and above. The values for kidney for the test diets were numerically higher and became significantly ($p<0.05$) higher than the control diet for 15 and 20% diets. The principal effects of dietary raw sword bean on blood constituents were decreased RBC, abnormal MCH, MCV and MCHC when compared with normal range of haematological indices for broiler chickens. Also, there was increase in serum creatinine, alkaline-phosphatase and urea values. The inclusion of raw sword bean in the broiler chicken diets produce histopathological changes within the liver, kidney and spleen. Raw sword bean could not replace soybean meal quantitatively even at 5% dietary level of inclusion for starter broiler chickens.

Key words: Response, broiler birds, raw sword bean meal, soy bean meal

INTRODUCTION

The increasing competition between man and animals for available conventional ingredients for food, feed and industrial raw materials, coupled with Nigeria's sole concentration on the oil sector for revenue to utter neglect of Agriculture has led to high cost of available food/feed resources (Durunna *et al*., 2005). Consequently, the average poultry and livestock farmers have been pushed out of production leading to high cost of available poultry and livestock products. This scenario has since led to closure of a number of poultry and livestock farms with its resultant decrease in meat and egg and increase in the number of unemployed (Durunna *et al*., 2005). There is the need therefore to search for alternative feed materials far removed from

Corresponding Author: A.H. Akinmutimi, Department of Non-Ruminant Animal Production, College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, P.M.B. 7267, Umahia, Abia State, Nigeria

human and industrial interest. One of such promising feed material is sword bean (*Canavalia gladiata*).

It is a large perennial climber with its runner as long as 10 m. The pods are about 30-40 cm long with strongly developed ridges containing about 14 seeds (NAS, 1979; Udedibie, 1990; Akinmutimi *et al*., 2002). The seed is among the largest domesticated legumes. It is widely cultivated in the humid tropics of Africa and Asia, especially in India. It is called Apoje in the western part of Nigeria, being used as yam battle expellant. In Nasarawa state of Nigeria, it is being referred to as Agidagba, where it is being used for cultural dance (Amushie, 1990; Akinmutimi *et al*., 1997). Except for the above usage, the plant or its seeds is neither put to use in industry nor for food or animal production in Nigeria. It yields about 4600 kg of seeds per hectare with crude protein content of about 22-29%. Presence of anti nutritional factors such as canavanine, con-canavanin-A, phytin, tanin, trypsin inhibitors have been reported (NAS, 1979).

This study is undertaken to investigate the response of broiler starter birds fed diets containing raw sword bean meal in place of soya bean meal (weight to weight) with the view point of knowing how far the birds can use the raw sword bean meal before processing, since processing attracts additional cost, time and energy.

MATERIALS AND METHODS

The experiment was conducted at the poultry/live stock unit of the Michael Okpara University of Agriculture Umudike, Abia state, Nigeria. Umudike bears the coordination of 5°28'N and 7°31'E and lies at an atitude of 1 22 m above sea level. It is located within the tropical rainforest zone and the environment is characterized by an annual rainfall of about 2177 mm. The relative humidity during raining season is well above 72% and monthly ambient temperature ranges from 17-36°C March is the warmest month with an average temperature range of 22-30°C.

The raw sword bean seeds were purchased from Agwantashi in Nassarawa state of Nigeria, while other feeds tuffs and materials were purchased from Umuahia and Aba, all in Abia state. The raw sword bean seeds were sun-dried and then oven-dried at 60°C. They were later milled using a hammer mill and then used for analysis and animal trials.

Experimental diets and composition: Five diets were formulated (Table 1). Diet I was soya bean-based and served as control. Raw sword bean meal replaced soya bean meal (weight to weight) in diets 2, 3, 4 and 5 at 5, 10, 15 and 20%, respectively.

Table 1: Composition of treatment diets containing graded levels of raw sword bean meal fed at starter phase

	Levels of raw sword bean meal (%)				
Ingredients	0	5	10	15	20
Maize	49.80	49.80	49.80	49.80	49.80
Soyabean	27.50	22.50	17.50	12.50	7.50
Sword beans	-	5.00	10.00	15.00	20.00
Blood meal	5.00	5.00	5.00	5.00	5.00
Palm kernel cake	9.00	9.00	9.00	9.00	9.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Oyster shell	2.00	2.00	2.00	2.00	2.00
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated composition					
Crude protein (%)	23.85	23.10	22.35	21.61	20.86
Metabolisable energy (kcal kg^{-1})	2848.41	2807.91	2767.41	2726.91	2686.41

1 kg of premix contains: Vitamins A (5,000.000 l.U), Vitamin D3 (1,000.000 I.u), Vitamin E (1200 mg), Vitamin B2 (22,000 mg), Niacin (22,000 mg), Calcium pantothenate (4,600 mg), Vitamin B6 (2,000 mg), Vitamin B12 (10 mg), Folic acid (400 mg), Biotin (32 mg), Choline chloride (200,000 mg)

Experimental birds and their management: One hundred and 50 days old Anak broiler birds, of average weight of 35 g per bird were randomly assigned to 5 treatment diets given 30 birds per treatment group in a Completely Ramdomized Design (CRD). Each treatment group was sub-divided into 3 replicates of ten birds each.

Chicks were brooded in a deep litter pen measuring 2.6×3 m. The litter material used was wood-shaving. Heat was provided with kerosene stoves under galvanized metal hovers. Feed and water were provided to the birds ad-libitum, while additional light was supplied at night using kerosene lanterns. Black tarpaulin cloth was used to cover the wire netting path of the building to prevent cold during brooding that lasted for 2 weeks. The birds were vaccinated against new castle disease at day-old (1\0) and 3rd week lasota. Gumboro vaccine was administered at the 10th day (1\0). Medication such as sugar solution for the first 2-3 days and later biovite for the purpose of relieving stress and E.S.B_3 to prevent coccidiossis were carried out.

Data collection: Initial average weight of the birds were taken on the first day of the experiment. Average weight and weight gain were subsequently taken on weekly basis. Feed-to-gain ratio was calculated by dividing the average feed intake by the average weight again. Percentage mortality was calculated using.

$$\frac{\text{Number of dead birds}}{\text{Overall number of birds}} \times \frac{100}{1}$$

Gross margin profitability test was calculated according to Sonaiya *et al*. (1986).

Evaluation of carcass quality was carried out as described by Ojewola and Longe (1999). For blood constituents evaluation, one 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 colleted into bottles containing EDTA for hematological evaluation, while another set of blood sample were collected without any anticoagulant, for blood chemistry evaluation. Haematological parameters and blood chemistry were determined as described by Dacie and Lewis (1991). Histopathological examination was carried out as described by Drurry and Wallington (1976). It involves collection of samples from various organs such as liver, kidney, heart, spleen, etc. The samples were fixed with 10% normal saline for a minimum of 24 h, after which they were processed and embedded in paraffin wax. This section of 5 cm thick were cut, stained with haematoxylin and Eosin (H and E) and examined using the light microscope to observe the presence of necrosis, hyperplasia, etc.

Chemical and data analysis: Raw sword bean meal and the experimental diets were analyzed for proximate composition according to methods of AOAC (1990). All data were subjected to Analysis of Variance (ANOVA), while means with significant differences were separated using Duncan's Multiple Range Test (DMRT) (Steel and Torrie, 1980).

RESULTS

The result of the proximate composition of experimental diets and the test feedstuff is as shown in Table 2. The raw sword bean meal contained 27.04% crude protein, 8.04% crude fibre, 2.94% ether extracts, 3.72% ash, 5 0.385 NFE (Nitrogen-free Extract) and gross energy value of 4.54 kcal g^{-1}. There were slight differences noticed in the composition of the experimental diets.

The growth performance of the broiler birds fed raw sword bean meal is as shown in Table 3. There were significant ($p<0.05$) differences among treatment means for all parameters measured. The final live weight feed intake, weight gain and gross margin of the birds decreased as the quantity of raw sword bean meal increased in the diets, while the feed-to-gain ratio increased. The percent mortality for diets containing 20% raw sword bean meal was significantly ($p<0.05$) higher than all other treatments. Table 4 shows the mean weight of cut-parts of broiler birds fed raw sword bean meal. There was significant ($p<0.05$) difference for all parameters m easured. The value for thigh, drumstick and breast-cut for the control diet, were numerically higher than all the values for test diets but had statistically similar values for back-cut and wings with the exception of the birds fed diets 4 and 5 for back-cut and wings, respectively. All the diets had high dressing percentage. The result of organ weight is as shown in Table 5. There were significant($p<0.05$) differences for all the parameters measured; only with the exception of spleen. The values of liver and kidney followed specific patterns that could be attributed to the effect of diets but others did not. There was numerical increase in the value of kidney as the quantity of raw sword bean meal increased in the diets and became significantly ($p<0.05$) higher than controlled diet for 15 and 20%. Liver values for the test diets became significantly ($p<0.05$) higher than that of controlled diet at 10% and above.

Table 2: Proximate composition of experimental diets and raw sword bean

Determined composition (%)	(Control %)	5%	10%	15%	20%	Raw sword bean
Crude protein	23.43	23.040	22.040	21.240	20.020	27.04
Ether extract	4.02	3.680	2.110	3.980	4.130	2.94
Crude fibre	6.97	6.060	5.210	4.970	4.870	8.04
Ash	15.29	10.730	16.260	13.710	15.100	3.72
Nitrogen-free extract	38.78	42.850	42.490	45.130	47.820	50.38
Dry matter	88.49	86.360	88.110	89.030	91.490	92.12
Gross energy (kcal g^{-1})	3124.00	3.107	3.014	3.005	3.079	4.58

Table 3: Growth performance of broiler chickens fed raw sword bean meal (starter phase)

	Levels of raw sword bean meal in percentage					
	0	5	10	15	20	±SEM
Initial weight (g)	35.0000	35.0000	35.0000	35.0000	35.0000	0.000
Final weight/bird (g)	604.0000^{a}	438.3300^{b}	324.6700^{c}	186.0000^{d}	118.6700^{e}	14.460
Feed intake/bird/day (g)	43.3333^{a}	31.8567^{b}	25.5267^{c}	19.0133^{d}	16.7367^{d}	0.920
Weight gain/bird/day (g)	20.3233^{a}	14.4067^{b}	10.3400^{c}	5.3933^{d}	2.9900^{e}	0.520
Feed-to-gain ratio	2.1367^{c}	2.2033^{c}	2.4767^{c}	3.5700^{b}	5.6067^{a}	0.180
Mortality (%)	6.7000^{d}	10.0000^{c}	6.7000^{d}	23.3300^{b}	43.3000^{a}	0.367
Gross margin (₦)	137.6700	135.5900	106.6100	84.6600	43.3000	

$^{a-e}$Treatments means in the same row with different superscript are significantly different ($p<0.05$)

Table 4: Cut-part (weight) of broiler birds fed raw sword bean meal in broiler starter diet (expressed as percentage dressed weight)

	Levels of raw sword bean meal in percentage					
	0	5	10	15	20	±SEM
Live weight (g)	763.3300^{a}	645.00000^{b}	370.0000^{c}	181.6700^{d}	100.0000^{e}	13.82
Dressing percentage	74.1000^{a}	76.43300^{a}	73.0000^{a}	61.8333^{b}	61.6000^{b}	2.13
Thigh (DWT %)	13.3000^{a}	13.28330^{a}	11.6800^{ab}	10.8733^{b}	7.7000^{c}	0.55
Drum stick	12.5667^{a}	10.19433^{c}	10.5267^{c}	11.8533^{b}	7.2667^{d}	0.22
Breast cut	23.0000^{a}	21.79670^{a}	19.0567^{b}	17.7333^{b}	11.1000^{c}	0.59
Back cut	16.5333^{a}	16.99630^{a}	17.2033^{a}	11.8000^{b}	13.7000^{ab}	1.33
Wing	11.2000^{ab}	10.11330^{b}	11.4000^{ab}	13.0533^{a}	7.3670^{c}	0.65

$^{a-e}$Treatments means in the same row with different superscript are significantly different ($p<0.05$)

Table 5: Organ weight of broiler chickens fed raw sword bean meal in broiler starter diet

	Levels of raw sword bean meal in percentage					
	0	5	10	15	20	±SEM
Kidney	1.05000^{b}	1.1833^{b}	1.6367^{ab}	1.8867^{a}	2.0667^{a}	0.21
Liver	3.17330^{c}	3.1133^{c}	4.4833^{b}	5.3800^{ab}	5.9867^{a}	0.38
Spleen	0.06333	0.1100	0.1300	0.1400	0.1000	0.02
Heart	0.68670^{c}	0.8633^{b}	0.7933^{bc}	1.1833^{a}	0.8000^{bc}	0.05
Gizzard	6.40670^{ab}	5.0033^{b}	5.8300^{b}	11.5267^{a}	11.400^{a}	1.82
Intestine	8.29670^{c}	8.1767^{c}	11.0433^{b}	9.3133^{bc}	19.5300^{a}	0.79
Proventriculus	3.70000^{d}	8.3967^{b}	6.7900^{bc}	5.4900^{cd}	12.5500^{a}	0.88

$^{a-d}$Treatments means in the same row with different superscript are significantly different ($p<0.05$)

Table 6: Haematological parameters of broiler birds fed raw sword bean meal in broiler starter diet

	Levels of raw sword bean meal in percentage					
	0	5	10	15	20	±SEM
Hb (g 100 mL^{-1})	9.50000	8.3000	9.2667	9.0667	8.5000	0.488
PCV (%)	28.33000^{b}	31.0000^{ab}	35.0000^{a}	33.3300^{a}	32.0000^{ab}	1.200
WBC (×106 cm^{-3})	2.73330	2.0667	2.2000	2.0667	1.5330	0.424
RBC (×106 cm^{-3})	2.88667^{a}	1.8330^{c}	2.3667^{b}	2.0667^{bc}	2.1330^{bc}	0.112
MCH (%)	33.73000^{b}	45.2833^{a}	39.1267^{ab}	44.5067^{a}	39.8667^{ab}	0.162
MCHC (pg)	34.12670^{a}	27.4900^{b}	26.8330^{b}	26.8330^{b}	26.5600^{b}	0.690
MCV (μm^{3})	100.04000^{a}	169.2000^{a}	147.5967^{b}	163.8900^{ab}	150.0700^{ab}	6.187

$^{a-d}$treatment means in the same row with different superscript are significantly different ($p<0.05$)

Table 7: Blood chemistry values of broiler chickens fed raw sword bean meal in broiler starter diet

	Levels of raw sword bean meal in percentage					
	0	5	10	15	20	±SEM
Total protein (g L^{-1})	36.8000	34.2330	35.3330	35.3330	33.7670	1.799
Albumin (g L^{-1})	19.5300^{ab}	18.9000^{c}	19.2333^{bc}	19.8667^{a}	19.9000^{a}	0.163
Globulin (g L^{-1})	17.2700	15.7333	16.1000	15.4667	13.8667	0.636
Creatinine(mg dL^{-1})	1.5600^{c}	1.5833^{bc}	1.6133^{abc}	1.6400^{ab}	1.6767^{a}	0.020
Alkaline phosphatase (μ L^{-1})	386.0000^{b}	633.6700^{a}	548.3300^{ab}	565.0000^{a}	535.6700^{ab}	51.553
Urea (mg dL^{-1})	29.7000^{c}	32.4000^{b}	33.8000^{ab}	34.2000^{a}	34.3670^{a}	0.519

$^{a-c}$Treatment means in the same row with different superscript are significantly different ($p<0.05$)

The result of the haematological parameters is as shown in Table 6. There was significant ($p<0.05$) difference for all the parameters measured with the exception of haemoglobin and white blood cells. The PCV, HB and RBC values (with the exception of diets 2 for RBC) for all the treatments fall within the established standard range of haematological indices for broiler chickens.

For the values of RBC there was a significant decrease for test diets when compared with control diet ($p<0.05$).

Although, the value did not follow a specific pattern that could be attributed to the effect of the test diets. The value for M C H, MCHC and MCV for the control diet fall within the established normal range of broiler birds, but the values for the test diets were either abnormally low or abnormally high.

Table 7 shows the result of blood chemistry values of broiler chickens fed raw sword bean meal.

There was significant ($p<0.05$) difference for the values of all the parameters measured with the exception of total protein and globulin values. The values of

albumen do not follow any definite trend that can be attributed to the effect of test diets. The values for creatinine, urea and alkaline phosphatase for control diet were lower that the values obtain for test diets. The histopathological examination shows that the three organs-liver, kidney and spleen were mostly affected.

Increasing dietary level of raw sword bean meal from 5% through 10 and 15-20% in starter diet shows liver sections with mild to moderate hyperaemia and erythrophagoctytosis with corresponding pyknosis of hepatocytes. The severity of the circulatory disturbances was directly related to the level of sword bean meal fed Kidney, feeding of raw sword bean to the starter birds was characterized by mild to moderate haemorrhages and hyperaemia in kidney (Plate 1). In addition, there was necrosis of epithelial lining cells of the tubulesc (Plate 2), with focal areas of mononuclear infiltration at the highest level of dietary inclusion.

Spleen: The inclusion of raw sword bean diets at 5-20% dietary level of inclusion was characterized by hyperaemia of the splenic red pulp, which was mild to moderate at the higher levels (15 and 20%).

In addition, there was mild haemosiderin deposition in the spleen at 20% dietary level of inclusion (Plate 3). However, there was no histomophologic change in the splenic follicles, except at the 20% level of inclusion where they were mildly reactive.

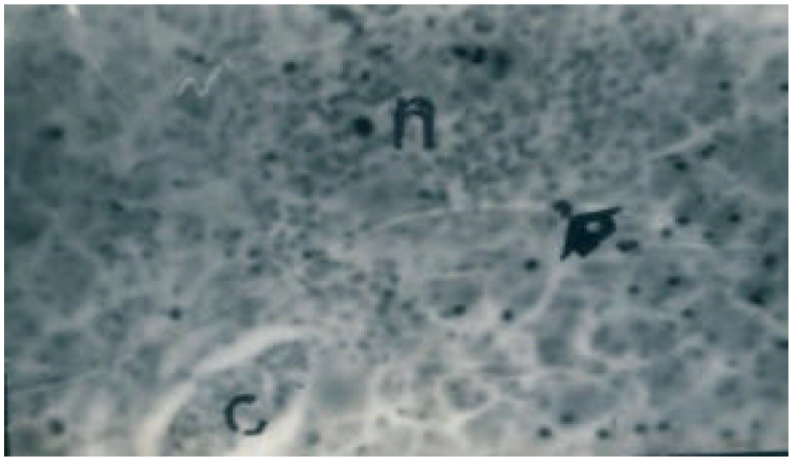

Plate 1: Liver section of birds fed starter diet containing raw sword bean meal at 20% level (closed arrow-head). Note congestion of central vein (C), pyknosis of hepatocyte nuclears and focal area of hepacytocyte necrosis (n), H and E stain ×100

Plate 2: Kidney section of bird fed raw sword bean meal at 10% dietary level of inclusion showing moderate necrosis of epithelia cells lining the tubules (closed arrow-head) and moderate hyperaemia (Open arrow-head) H and E stain ×100

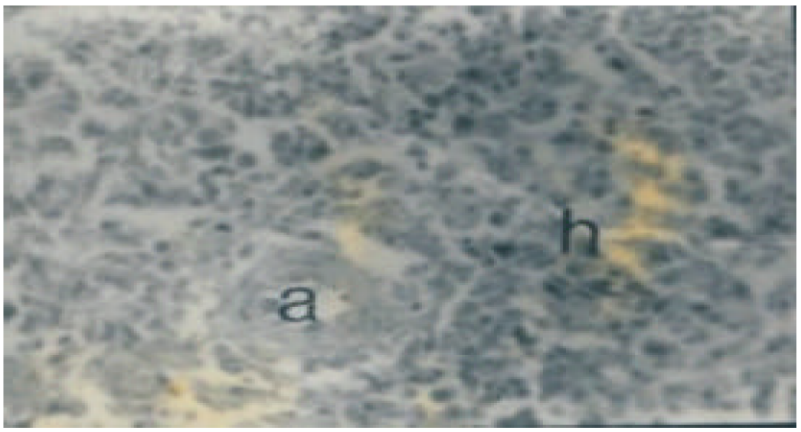

Plate 3: Spleen section of birds fed starter diet containing raw sword bean meal (10%) showing splenic artery (a) surrounded by moderately depopulated follicle (f) the red pulp (arrow-head margin) is moderately depopulated. H α E stain ×100

DISCUSSION

The observed proximate composition values is in agreement with earlier workers (NAS, 1979; Udedibie and Nkwocha,1990; Sagarika *et al*., 1999) and confirmed its potential as alternative protein source for livestock and poultry (NAS, 1979). The slight difference among the experimental diets is expected since the diets were not formulated to be iso-energetic and iso-nitrogenous. The decrease observed in the final live weight, feed-in-take and weight gain as the quantity of raw sword bean meal increase in the diets agree with the research of who reported similar trend in a closely related legume, jackbean (*Canavalia ensiformis*). This could be attributed to inherent anti nutritional factors present in the raw swordbean seeds, such as Tannin, Trypsin in hibitors, cyanogenic glycosides, phytin, saponin, canavanin and con canavanin-A as reported in the literature. Con canavanin-A for example had been reported to reduced the appetite of birds by moderating endocrine activity (D'mello and Devendra, 1995). Also, Olomu (1995) reported that saponin impairs performance through its irritating effect on the linings of the mouth and guts and through its bitter taste.

The poor weight gain that resulted in poor final live weight of birds placed on test diets may be partly due to feed intake (D'mello and Devendra, 1995) as well as poor nutrient utilization, which are due to the effects of anti nutritional factors such as cyanogenic glycosides, trypsin inhibtors, tannins, phytins, saponins, canavanin and con canavanin-A. Cyarogenic glycosides, on hydrolysis release Hydrogen Cyanide (HCN), a substance reported to have the ability to cause marked weight reduction (Aletor and Fasuyi, 1997). Cyanide detoxification route in man and animals is through cyanide thiocyanate sulphur transferase (Rhodenase pathway), which generally requires organic sulphur donors in the form of methionine and cysteine, thereby precipitating methionine deficiency in an otherwise balanced diet (Aletor and Fasuyi, 1997). It is this methionine deficiency that results in poor growth.

Con canavanin-A, another toxic component of raw sword bean has been reported by Udedibie and Carlini (1998) to negatively affect nutrient utilization, by binding the glycoproteins and glycolipids of the digestive tract mucosa. It inhibits the activity of the enzymes of the brush border of enterocytes, interferes with the adherence of entro-bacteria to the intestinal wall, possibly leaving side effects on immune functions, protein metabolism, enzymes activities and hormonal regulation.

The increase in the value of feed to gain ratio and increase in percent mortality as the quantity of raw sword bean increased in the diets that were significant at above 10% dietary level of inclusion of raw sword bean for feed to gain ratio and 20% of dietary level of inclusion for percent mortality could be attributed to the same reasons given. The gross margin for control diet is higher that for the test diets making it a more profitable diet since the higher the numerical value of gross margin, the more profitable the diet in question (Ojewola *et al*., 2005).

This could be attributed to poor feed intake, utilization of nutrients and growth resulting in the poor market price of the birds placed on the test diets. The above results show that raw sword bean meal cannot be substituted for soya bean even at 5% level (weight to weight) replacement of soya bean meal.

This result contradicts the reports of Udedibie and Ihegbu (1992), who reported 5% dietary level of raw sword bean as a safe level for broiler chicks, the disparity in the

result may be due to the fact that they balanced up the deficient nutrients in raw sword bean making the experiment an iso-caloric and iso-nitrogenous. This implies then that the result obtained was an associative effect of nutrients whereas in the above experiment, the deficient nutrients were not balanced for. Thus, results obtained depict an actual effect of raw sword bean. The higher numerical value for control diet over the test diets for thigh drumstick and breast-cut imply better profitability of birds placed on control diet than others since there are highly priced cut-parts. The high dressing percentage for all the diets shows that their final live weight were not due to inedible offal such as shank, intestine etc. (Oluyemi and Roberts, 2000). Superiority of control over the test diets may be due to efficient utilization of nutrients in terms of digestion, absorption and assimilation (Bamgbose *et al*., 1998).

The numerical increase in the value of kidney, which became significantly ($p<0.05$) different from the control diet for 15 and 20% could be attributed to increase metabolic activities that probably leads to increase in weight. This is perhaps due to the fact that kidney contains rhodenase, a key enzyme in cyanide detoxification (Ologhhobo *et al*., 1993).

The significantly higher values of liver for diet 3 and above when compared with the diet 1 is in line with the report, who reported same when raw jack bean (a closely related legume) was fed to broiler birds. They attributed it to the effect of canavanin, being an analogue of arginine. It acts as an antagonist in the metabolism of arginine and interferes with the normal production of liver proteins, thus, impairing liver functioning and producing the hypertrophic effect Also, this result agrees with the findings of Ukachukwu (2000), who reported that liver is a major detoxification organ and hence, increase in its activity may result in enlargement and probably, increased weight.

Value of haematological parameters that fall within the established standard range suggests good performance, despite this, the higher numerical value for control diet than others for HB RBC suggest better performance of the diet.

The abnormally high MCV, MCH and low MCHC suggest poor quality protein of the test diets (Awoniyi *et al*., 2000). This also confirms the inability of raw sword bean meal to quantitatively replace soya bean meal even at 5% dietary level of inclusion.

The lower values of control diet than the test diets for creatinine, urea and alkaline phosphatase suggest that the control diet is superior in protein quality to the test diets (Eggum, 1970; Ologhhobo *et al*., 1993). Green (1972) reported that high urea level implies renal failure due to the damage of the glomerular, which cause poor glomerulus filtration and excretion, leading to an increase in blood urea. He also noted that high alkaline phosphatase and high creatinine suggest liver damage and kidney problem, respectively.

The high level of serum creatinine is an indication of poor protein utilization, wastage and animal surviving at the expense of body reserves (Adeyemi *et al*., 2000). The above points probably explain the observed weight loss, high feed to gain ratio and mortality of birds placed on test diets as the dietary inclusion of raw sword bean meal increases.

Judging from these results, the raw sword bean meal could not replace soya bean meal (weight-to-weight) even at 5% dietary level of inclusion for starter broiler chickens.

The histopathological lesion observed in the liver of the birds fed raw sword bean meal is in line with who reported such in rats inoculated with various dosage of heamagglutinin extracted from lima bean. This they attributed to effect of heamagglutinin. Heamagglutinin has been reported as a toxic component in raw sword bean (Udedibie and Nkwocha, 1990), which probably accounts for the above result. The liver damage observed has been associated with high alkaline phosphatase and poor blood formation (Green, 1972). This further explains the high alkaline phosphatase and poor blood constituent values for the test diets, especially in 20% dietary levels of inclusion of raw sword bean meal.

For kidney, the observed result is in agreement with the findings Ologhobo *et al*. (1993), who reported serious pathological changes in the kidney of broiler chicken fed raw lima bean. This also confirms the enlargement and significant increase in weight of the organ starting form 10% dietary level of inclusion as shown in (Table 5). These also highlight the high value of urea, which is the product of organize detoxification by the kidney (Ologhobo *et al*., 1993; Olorde *et al*., 2002). The observed histopathological result supports the. Findings, who reported that the spleen heamaggluttinin extracted from lima bean showed mean depression of tymphoid follicles. This probably explains the numerical differences observed in the weights of the organ (Table 5).

For spleen, the observed histopatological result supports the findings, who reported that the spleen of rats fed with lethal dose of haemagluttinin extracted from lima bean showed mean depression of lymphoid follicles. This probably explains the numerical differences observed in the weights of the organ. The significantly low values for RBC for the test diets may be partly due to spleen disease.

Wekhe *et al*. (2001) reported that spleen produces a humoral factor containing erythropoiesis, leading to decrease in the value of RBC as a result of spleen disease.

All these pathological changes have been attributed to anti-nutritional factors, particularly heamagluttinin and canavanin. These same anti-nutritional factors have been reported to be responsible for depressed feed intake and weight loss of broiler birds (D'mello and Devendra, 1995). From the above results, the histopathological changes confirm the poor performance of birds fed the test diets for starter phase.

CONCLUSION

From the above results and discussion 5% raw sword bean meal cannot quantitatively replace soya bean meal in broiler starter diet.

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