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Dietary substitution of soya bean meal with processed African yam bean meal as protein source in the diets of finisher broilers

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Abstract

Considering the inherent attributes of processed African Yam bean meal (Sphenostylis stenocarpa), it's appropriate utilization for chicken diets may enhance performance of finisher broilers. The study was therefore carried out to determine the dietary substitution of soybean meal with processed African yam bean meal as protein source in the diets of finisher broilers. The Processed African yam bean meal was used to substitute soya bean meal at various levels to determine the best substitution that would give optimal performance in finisher broilers. The seeds of the African yam beans were soaked in water for 24 hours The soaked seeds were thereafter air dried for three days. The seeds were toasted for 35 minutes in a frying pan and milled using hammer mill. In the finisher feeding trial, the substitutions were 20%, 40%, 60% and 80% processed African yam bean meal respectively. Each finisher diet was fed to a group of 30 broilers for 4 weeks using completely randomized design. Each treatment group was divided into 3 replicates of 10 broilers chicks each. The finisher broilers were kept in pens in deep litter and given feed and water ad libitum. The parameters measured included initial body weight, final body weight, feed intake, body weight gain, feed conversion ratio, cost of production and carcass characteristics. The proximate composition of processed African yam bean meal showed that it contained 8.29% moisture, 91.71% Dry matter, 3.40% ash, 21.12% crude protein, 5% ether extract, 5.73% crude fiber and 56.4% nitrogen free extract. In the finisher feeding trial, the broiler group on 40% processed AYBM significantly (P<0.05) recorded higher body weight gain than the rest of the treatments possibly because of the proper substitution of soya bean meal with processed AYBM in their diets and it appeared that the finisher broilers could tolerate high levels of processed AYBM in their diets. The group on diet 2 (20% AYBM) and control diet recorded similar body weight gain (P>0.05) which were significantly (P<0.05) superior to the groups on diets 4 (60% AYBM) and 5(80% AYBM). The internal organs expressed as percent of the live weight were not affected by the treatments. Cost of production (cost/kg feed x feed conversion ratio) was lowest for diet 2 (N450.64) as against N480 for the control diet. The finisher broiler on diet 3 (40% AYBM) recorded the highest dressing out percentage of 78.78. The results of the trial have shown that processed African yam bean meal can be used to substitute soya bean meal in the diet up to 40% for optimum performance of the finisher broilers without affecting the body weight gain, feed intake, feed conversion ratio and carcass characteristics as indicated in this study.

Keywords: Dietary substitution, processed African yam bean meal, protein source, finisher broilers

Introduction

One third of humanity suffers from quantitative malnutrition according to Food and Agricultural Organization (FAO, 1982). Statistics has shown that the average daily intake of animal protein stands at about 6.3gms as against 35gms/caput/day recommended by Food and Agricultural Organization for the maintenance of the health of the population (Aduku and Olukosi, 1990, and Oyenuga, 1997). The cost of feed has invariably raised the cost of

animal production and hence the selling price of animal products such as eggs, pork and meat. This has worsened the low animal protein intake by Nigerians. (Adejinmi *et al.,* 2000) reported the rising cost of feed resources in livestock production has been established as a serious impediment to meeting the demand for animal protein particularly in developing countries. The high cost of feed materials is as a result of the increasing the competition for grains between man, livestock and industries. The high cost of feed can be reduced by compounding of feed in a way that all required nutrients should come from cheap alternative energy and protein sources (Onyimonyi and Okeke, 2005). Therefore, the discovery and replacing of some feedstuffs will help to reduce the cost of feed and in turn the cost of animal production.

African yam bean seeds (*Sphenostylis stenocarpa*) has been successfully applied in weaner rabbit diets as a substitute for soya bean meal at 10% inclusion (Akinmutimi *et al.,* 2006). In Nile Tilapia, fingerlings, African yam bean seed meal was used at 15 to 60% of the dietary protein to substitute for full fat soya beans (Alegbeye *et al.,* 2002).

African yam bean is a perennial climbing bush, 1-3m high generally grown as an annual. Its leaves are trifoliate with oral leaflets (2.7 to 13cm long and 0.2 to 5.5cm broad). It is cultivated for its edible tubers, which look like elongated sweet potatoes, and for its seed which are contained in hard and tough 20-30cm pods. It is mainly used as food but can be used to feed animals. African yam bean (*Sphenostylis stenocarpa*) is a native to tropical west and central Africa. It is cultivated in Southern and Eastern African. It thrives on deep, loose sandy and loamy soil with good organic matter content and drainage. It grows better in regions where annual rainfall range between 800-1400mm between 19-27^{0}C (Ecocrop 2009). The plant flowers after 90 days and the pods mature in 140 to 210 days. The tubers are ready to be harvested at 150 to 240 days after sowing (Ecocrop, 2009).

African yam bean seeds are rich in protein (22-25% Dm). with low fibre content (crude fibre 10% Dm). The protein is particularly rich in lysine (up to 9% of protein), a value higher than that of soya bean. The percentage of the hull from the whole seed of African yam bean according to (Agunbiade and Long, 1999) was 7.3%. The composition of the hull of African yam bean are as followed: crude protein 11.4%, crude fat 2.6%, phytic acid (8.2mg/100g), potassium and minerals are the major minerals in the hull (Heuze *et al.,* 2015). Processes such as heating, soaking or fermentation can be used to decrease anti-nutritional factors and improve the nutrition value of *Sphenostylis stenocarpa* products and its by products (Onyike *et al.,*1995).

Considering the various attributes of African yam bean (S*phenostylis stenocarpa*), it would appear that appropriate utilization of this feedstuff can be used to replace soya bean meal as protein source to produce low cost diets that can be efficient in promoting the performance of finisher broilers and reduce demand pressure on soya bean meal as well as cost of production.

Materials and methods

Experimental site

The experiment was carried out at the poultry unit of the teaching and research farm of Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria. The area is located on latitude 5^{0}21^1 North, longitude 7^{0}32^1 East, in the rain forest zone in Umuahia, Abia State. This site has a mean daily temperature of

between 27^0C-36^0C and minimum of 20^0-26^0C with relative humidity between 57% and 91% Eburuaja (2010) and annual rainfall of 200mm per annum and an attitude of 122m above sea level. It is therefore, a humid tropical environment with temperature and relative humidity that are significant for agricultural production Eburuaja (2010).

Procurement of feed ingredients

African yam bean seeds (*Sphenostylis stenocarpa*) were procured at Ndioro market in Abia State, while other feed ingredients like maize, soyabean meal, palm kernel cake, spent grain, blood meal, methionine, lysine and bone meal were bought from Jocan livestock services in Umuahia.

Sorting and processing of test ingredients

The African yam bean seeds were sorted to remove stones and dirt by sieving. The seeds were soaked in water for 24 hours and then the water was removed and the seed air dried for 3 days. The seeds were toasted for 35 minutes in a frying pan, milled using hammer mill to obtain African yam bean meal (AYBM) and stored in bags for use.

Chemical analyses of feed ingredients

All the processed feed ingredients, processed African yam bean meal, palm kernel cake, Brewer' dried grains, blood meal, fish meal, were subjected to proximate analysis according to AOAC (1995) to determine their nutrients composition and gross energy. All analysis were based on 100% dry matter.

The proximate analysis of the processed ingredients was done so as to use the values obtained to determine the nutrient composition of the experimental diets which were formulated from them. The components that were determined include Dry Matter (DM), Crude Protein (CP), Ether Extract (EE) and Nitrogen Extract (NFE).

Anti-nutrient determination

The test materials fresh and processed African yam bean seed meal (AYBM) were analyzed for anti-nutrients contents such as oxalate, tannins, saponin, trypsin inhibitors, hydrogen cyanide, and phytate.

Experimental design

The design of the study was completely Randomized Design (CRD). The statistical model was

$Yij = \mu + Ti + eji$

Where

Yij = Individual observation
μ = Population mean
Ti = Treatment effect
eij = Error effect.

Experimental diets

Five experimental finisher broiler diets were formulated for the finisher phase of the feeding trial (Table 1). The control diet (Diet 1) contained 15% soya bean meal while diets 2, 3, 4 and 5 contained processed African yam bean seed meal (AYBM) at 20%, 40%, 60% and 80% respectively to replace soya bean meal. Other ingredients remained the same for the diets.

A four week feeding trial was conducted using unsexed one hundred and fifty Anak Finisher broiler chicks (cheeky broilers) at 4 weeks of age. They were divided into 5 groups of 30 broilers each and each treatment was subdivided into 3 replicates of 10 broilers each. Each replicate was housed in a pen. The broilers were weighed individually at the beginning of the experiment and their average initial weight and sex balanced and weighed weekly thereafter for determination of their growth performance. The broilers were assigned the experimental diets using completely randomized designed for 4 weeks. Both water and feed were given *ad libitum.*

Carcass evaluation

At the end of the feeding trial, two (2) birds from each treatment were randomly selected, starved of feed but not water for 24

Table 1: Percentage and nutrient composition of finisher broiler diets containing different levels of processed African yam bean seed meal (AYBM)

Ingredients (%)	Diet 1 (control)	Diet 2 (20% AYBM)	Diet 3 (40% AYBM)	Diet 4 (60% AYBM)	Diet 5 (80% AYBM)
Maize	60.00	60.00	60.00	60.00	60.00
Soybean meal	15.00	12.00	9.00	6.00	3.00
AYBM*	-	3.00	6.00	9.00	12.00
Palm kernel cake	5.30	5.30	5.30	5.30	5.30
Brewer's dried grains	10.00	10.00	10.00	10.00	10.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Vit/mineral premix**	0.25	0.25	0.25	0.25	0.25
L-methionine	0.10	0.10	0.10	0.10	0.10
L-lysine	0.10	0.10	0.10	0.10	0.10
Common salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Crude protein (%)	20.59	20.03	20.00	19.00	18.37
ME Kcal/kg	2908.1	3064.43	2968.76	2999.09	3029.42

*African yam bean meal

** To provide per kg diet: vit A,2000000iu, vit D3, 4000iu; vit E, 80g, vit k, 0.49; choline48.00g; BHT, 32.00g; Manganese, 16.00g; Iron, 8.00mg; Zinc, 72g; Copper, 0.32g; Iodine, 0.25g, Cobalt, 36.00mg; Selenium, 16.00g.

hours and then weighed and slaughtered for the determination of the following: internal organ weights (heart, livers, kidney, spleen, lungs), cut part weights (thigh muscle, wings, back cut, drumstick and breast muscle), abdominal fat and dressed weight. The internal organs weights were expressed as percentage of the live weight.

Data collection

Parameters determined were initial live weight, final live weight, body weight gain, feed intake, feed conversion ratio and cost of production.

Data analysis

The data collected were subjected to one way Analysis of Variance (ANOVA) according to Snedecor and Cochran (1989), where significant treatment effects were detected from the ANOVA, means were separated using Duncan's New Multiple Range Test (Steel and Torrie. 1980).

Results

Anti-nutrients composition of African yam bean meal (AYBM)

Data on the anti-nutrient composition of Raw and Processed African Yam Bean meal was shown in (Table 2).

There were significant difference ($P<0.05$) in the anti-nutrients composition of raw and processed African yam bean meal. Soaking and Toasting reduced the anti-nutrients in the African yam bean meal.

Table 2: Anti-nutrient composition of raw and processed African yam bean meal

Parameter	Raw (AYBM)	Processed (AYBM)	SEM
Oxalate (mg/kg)	8.01^{a}	3.12^{b}	1.73
Hydrogen cyanide (mg/kg)	224.02^{a}	48.06^{b}	62.40
Tannins (mg/100g)	18.06^{a}	3.34^{b}	5.23
Phytate (mg/100g)	428.90^{a}	120.11^{b}	109.50
Trypsin Inhibitory (mg/100g)	4.47^{a}	1.26^{b}	1.13

^{ab} means within the same row with different superscripts are significantly different ($P<0.05$)

Table 3: Proximately composition of raw and processed African yam bean meal.

Parameter	Raw (AYBM)	Processed (AYBM)	SEM
Moisture (%)	8.89[a]	8..29[a]	0.21
Dry matter (%)	91.11[a]	91.71[a]	0.21
Ash (%)	3.00[a]	3.40[a]	0.14
Crude Protein (%)	22.52[a]	21.12[a]	0.50
Ether Extract (%)	2.50[a]	5.00[b]	0.89
Crude Fibre (%)	3.27[b]	5.73[a]	0.87
NFE (%)	59.82[a]	56.46[b]	1.19

[ab] means within the same row with different superscripts are significantly different (P<0.05)

Data on the proximate composition of Raw and Processed African Yam Bean Meal was shown in (table 3) above. There were no significant (P>0.05) difference in crude protein, moisture, dry matter, ash and Nitrogen free extract of the two samples but their crude fibre content difference significantly (P<0.05) with processed African yam bean meal containing the higher quantity.

Table 4: Proximate composition of experimental finisher broiler diets

Parameters	Diet 1 (control)	Diet 2 20% AYBM	Diet 3 40% AYBM	Diet 4 60% AYBM	Diet 5 80% AYBM	SEM
Moisture (%)	91.00	91.80	92.70	92.71	92.71	0.31
Dry matter (%)	9.00	8.20	7.30	7.29	7.29	0.31
Ash (%)	6.48	6.19	5.98	5.30	4.89	0.26
Crude Protein (%)	19.60	23.45	19.60	18.50	14.70	1.28
Ether Extract (%)	3.76	3.84	3.78	3.89	3.95	0.03
Crude Fibre (%)	5.43	5.07	4.50	5.20	5.53	0.16
NFE (%)	53.73	53.25	58.84	60.82	63.64	1.63

Table 5: Performance of experimental finisher broilers fed p rocessed African yam bean m eal (AYBM)

Parameters	Diet 1 (control)	Diet 2 20% AYBM	Diet 3 40% AYBM	Diet 4 60% AYBM	Diet 5 80% AYBM	SEM
Initial body wt (kg)	695.24	671.43	495.24	490.47	485.70	42.33
Final body wt (kg)	2.08[b]	2.14[a]	2.06	1.53[c]	1.52[c]	0.13
Body wt. gain (kg)	1.39[ab]	1.47[ab]	1.57[a]	1.04[b]	1.03[b]	0.10
Daily body wt gain (kg)	49.64[ab]	52.50[a]	50.25[a]	48.00[b]	40.00[b]	0.76
Daily feed intake (g)	182.00[a]	268.60[a]	265.42[b]	262.23[b]	260.05[b]	14.64
Feed conversion ratio	3.67[a]	5.12[a]	5.28[ab]	5.46[b]	6.50[c]	0.43

[abc] means within the same row with different superscripts are significantly different (P<0.05)

Feed intake

The average daily feed intake of the experimental groups were 182.10g, 268.60g, 265.42g, 262.23g and 260.05g for the control diet, diets 2 (20% AYBM), diet 3 (40% AYBM), diet 4 (60% AYBM) and diet 5 (80% AYBM) respectively. Significant differences (P<0.05) also existed among the groups in feed intake. The finisher broilers on 20% AYBM (diet 2) recorded the highest feed intake of 268.60g and were higher than those on the control diet (soyabean meal

based diet). The reason for the high feed intake by those on African yam bean meal diet could be due to the high fibre content (Nwokolo, 1996). Birds eat more of the high fibre diet to satisfy their energy needs (Oluyemi and Roberts, 2000).

Body weight gain

There were significant difference (P<0.05) in the average body weight gain of the finisher broilers. The finisher broilers on 40% AYBM diet recorded the highest body weight gain of 1.57kg which was significantly different (P<0.05) from others. The body weight gain of the group fed control diet and diet 2 (20% AYBM) were similar (P>0.05) and significantly (P<0.05) higher than the groups on 60% and 80% AYBM diets. It seemed that the finisher broiler could tolerate higher levels of processed African Yam bean meal in their diets.

Feed conversion ratio

The feed conversion ratio of the group on the control diet (soybean meal based diet) was significantly (p<0.05) superior to those on other diets.

The feed conversion ratio of the finisher broilers on diets 2 (20% AYBM) and diet 3 (40% AYBM) were similar and significantly (p<0.05) better than those on 60% and 80% African yam bean meal based diets.

Percentage dressed weight

The percentage dressed weight of the experimental broilers was shown in (Table 6). Significant differences (p<0.05) existed among the groups in their dressing percentage. The finisher broilers on 40% AYBM diet recorded the highest dressing percentage of 78.78 which was significantly different (p<0.05) from other groups.

Internal organs and cut part weights of the experimental finisher broiler chickens

The weight of the internal organs and cut parts weights of the finisher broilers were shown in Table 7 and Table 8. The weights of the organs (livers, gizzards, hearts, kidney, spleens, etc.) and cut parts of all the groups were not affected by the treatment (p>0.05). The finisher group on 20% AYBM recorded significantly (p<0.05) the highest abdominal fat then others indicating higher efficiency of the bird in converting the carbohydrates of the diet into fat.

In the finisher broiler trial, the cost of production of 1kg of finisher broiler was cheaper with diet 2 (N450.64) versus (N480.00) for the control diet.

Discussion

Anti-nutrient content and proximate composition of raw and processed African yam bean meal

There were significant differences (p<0.05) in the reduction of anti-nutrients in the processed African Yam Bean Meal. The trypsin inhibitor of raw African Yam Bean seed was 4.4mg/100g but it was reduced in processed seed 1.26mg/100g. This agrees with the fact that trypsin inhibitors are heat labile and that the use of heat treatment can readily inactivate them (Liener, 1980; Akanji *et al.,* 2003; Akinmutimi, 2 004).

The value of tannin in the seed ranged from

Table 6: Percentage dressed weight of experimental finisher broilers fed processed African yam bean meal diets

Parameter	Diet 1 (Control)	Diet 2 (20% AYBM)	Diet 3 (40% AYBM)	Diet 4 (60% AYBM)	Diet 5 (60% AYBM)	SEM
Dressed weight	63.57^{b}	67.57^{ab}	78.78^{a}	66.04^{b}	66.10^{b}	2.40

^{ab} means within the same row with different superscripts are significantly different (p<0.05).

Table 7: Percentage internal Organ weight of the experimental finisher broiler chickens fed processed African yam bean meal diets

Parameter	Diet 1 (Control)	Diet 2 (20% AYBM)	Diet 3 (40% AYBM)	Diet 4 (60% AYBM)	Diet 5 (60% AYBM)	SEM
Liver (%)	2.18[a]	2.32[a]	2.06[a]	2.89[a]	2.89[a]	0.16
Gizzard (%)	2.47[a]	2.24[a]	2.05[a]	2.47[a]	2.55[a]	0.08
Heart (%)	0.55[a]	0.48[a]	0.47[a]	0.56[a]	0.51[a]	0.02
Spleen (%)	0.17[a]	0.17[a]	0.19[a]	0.19[a]	0.19[a]	0.01
Abdominal fat (%)	0.28[c]	1.08[a]	0.61[b]	0.76[ab]	0.49[c]	0.12
Large intestine (%)	0.71[a]	0.62[a]	0.61[a]	0.75[a]	0.69[a]	0.02
Small intestine (%)	2.91[a]	3.18[a]	3.27[a]	3.48[a]	3.46[a]	0.09
Proventiculus (%)	0.51[a]	0.67[a]	0.49[a]	0.62[a]	0.58[a]	0.04
Kidney (%)	0.38[a]	0.48[a]	0.37[a]	0.48[a]	0.57[a]	0.04
Lungs (%)	0.68[c]	0.70[a]	0.55[a]	0.66[a]	0.58[a]	0.02

[abc] means within the same row with different superscript are significantly different ($p<0.05$)

Table 8: Percentage cut part weight of the experimental finisher broiler chickens fed processed African yam bean meal diets

Parameter	Diet 1 (Control)	Diet 2 (20% AYBM)	Diet 3 (40% AYBM)	Diet 4 (60% AYBM)	Diet 5 (60% AYBM)	SEM
Thigh (%)	19.74[a]	18.27[a]	15.27[a]	16.21[a]	17.90[a]	0.71
Drumstick (%)	16.67[a]	14.90[a]	13.98[a]	14.37[a]	16.71[a]	0.51
Breast muscle (%)	24.66[a]	24.18[a]	23.73[a]	26.41[a]	23.96[a]	0.42
Wing (%)	14.48[a]	13.54[a]	11.82[a]	13.87[a]	13.70[a]	0.40
Back cut (%)	24.18[a]	22.00[a]	18.04[a]	22.04[a]	21.31[a]	0.88

[abc]means within the same row with different superscripts are significantly different ($p<0.05$)

Table 9: Economics of finisher broiler chickens fed processed African yam bean meal diets

Parameter	Diet 1 (Control)	Diet 2 (20% AYBM)	Diet 3 (40% AYBM)	Diet 4 (60% AYBM)	Diet 5 (60% AYBM)	SEM
Cost/kg feed (₦)	121.70[c]	120.17[b]	118.64[a]	117.11[a]	115.58[a]	0.96
Cost of prod./kg broiler (₦)	480.00[b]	450.64[a]	468.32[ab]	497.11[c]	509.91[c]	9.32

[abc] means within a row with different superscripts are significantly ($p<0.05$)

18.06mg/100g in raw seed to 3.34mg/100g in the processed seed of African Yam Bean. Soaking and toasting as processing techniques brought a reduction in the quantity of tannin in the processed seeds. This confirms the thermostability of tannin (D'mello and Devendra, 1995; Okwu, 2002). Poor detoxification of tannin by boiling and toasting has been reported (Akinmutimi, 2004; Ewa, 1999; Izundu, 1999). This could be due to inability of the method to hydrolyse the intra-molecular forces that exist within tannin (Akinmutimi, 2004). He also reported that the use of seed containing tannins could result in formation of complex linkage with protein by tannins

leading to loss of protein and consequent poor growth.

This concentration of hydrocyanic acid in the raw seed was significantly higher ($p<0.05$) than that in the processed seed. There was high reduction in hydrocyanic acid from 224.04mg/kg to 48.06mg/kg. This may be due to the volatile nature of HCN (Oke *et al.,* 1996) and its boiling point (Montgomery, 1995).

There was no significant difference ($p>0.05$) in the value of phytic acid obtained for both raw and processed African Yam Bean seed. There was low reduction of phytic acid by soaking and toasting. Phytic acid is heat stable (Oke *et al.,* 1996). Usage of seeds containing high percentage of phytic acid may result in formation of insoluble salt with minerals like calcium and magnesium making them unavailable for metabolic processes (Roberts *et al.,* 2006). Ene-obong (1992) reported that African Yam Bean Seed has lesser phytic acid than pigeon pea (8.31-11.31mg/g) and cowpea (7.29-9.92mg/g).

Performance of finisher broiler chickens fed processed African yam bean meal (AYBM)

The response of the finisher broilers to processed African Yam Bean Meal diets was quite different in terms feed intake, body weight gain and feed conversion ratio. The finisher broilers on 20% AYBM recorded the highest feed intake of 268.60g and were higher than those on the control diet (soya bean meal based diet). The reason for the high feed intake by those on African Yam Bean Meal diet could be due to the high fibre content and anti-nutritional factors (Nwokolo, 1996). Birds eat more of the high fibre diets to satisfy their energy needs (Oluyemi and Robers, 2000).

The finisher broilers on 40% AYBM recorded the highest body weight gain of 1.57kg which was significantly different ($p<0.05$) from others. It appeared that the finisher broiler tolerated high soaked and toasted African Yam Bean Meal in their diets and it could be possibly due to the proper replacement of soya bean meal with AYBM in the diet. The feed conversion ratio of the control group on soya bean meal based diet was superior to those of the other four groups.

The percentage dressed weight of the finisher broilers fed diet 1 (control 1) (63.57), 2 (20% AYBM) (67.57), 3 (40% AYBM) (78.78), 4 (60% AYBM) (66.040, 5 (80% AYBM) (66.10) fell within the normal range for broiler chicken (65-70%) as reported by Oluyemi and Roberts (2000).

The percentage values obtained for wings (11.82- 14.48%) fell within the normal range for broiler chicken as reported by Oluyemi and Roberts (2000). The range of values obtained for thigh (15.27- 19.74%), breast (23.96 – 26.41%), back (18.04-24.18%), drumstick (13.98 – 16.17%) were higher than those observed by Oluyemi and Roberts (2000), in broiler chicken. This suggested that, the inclusion of soaked and toasted AYBM up to 40% supported the release of essential nutrients that aided the deposition of tissue for the various cut parts considered.

The internal organs expressed as percent of the live weight were not affected by the treatments. The result obtained agrees with the values reported by many authors when legume seeds were fed to broiler chicken (Emenalom *et al.,* 2007; Akinmutimi, 2004; Akinmutimi, 2006).

This showed that soaking and toasting as a processing technique are efficient in reducing anti-nutritional factors of AYBM to a tolerable level. Enlargement of the liver occurs when there is increased activity of the liver occurs when there is increased activity of the liver due to poor detoxification of anti-nutrients (Akinmutimi *et al.,* 2006). The values of the

heart, spleen and gizzard for the control and diets 3 (40% AYBM) were similar. This made soaking and toasting good processes for Detoxifying African yam bean seeds.

Conclusion

The study showed that soaking and toasting as processing techniques are efficient for reducing the anti-nutrients in African Yam Bean Meal (AYBM) to a tolerable level for finisher broilers.

Processed African Yam Bean Meal could be used up to 40% in the diet of finisher broilers without affecting weight gain, feed intake and feed conversion ratio.

References

A.O.A.C. 1995. Official methods of official and analytical chemist. Washington DC.

Adejinmi, O. O., Adejinmo, J. O. and Adeleya, I. O. A. 2000. Replacement values of fish meal with soldier fly larvae meal in broiler diets. *Nigerian Poultry Science Journal,* (1): 52-60.

Aduku, A.O., and Olukosi, J.O. 1991. Rabbit management in the tropics, production, processing, utilization, marketing economics, practical training, research and future prospects. G.U. Publications, Abuja, pp. 33-75.

Agunbiade, S.O., and Longe, O.G. 1999. Essential amino acid composition and biological quality of Bean AYB (Hoch rich) harms 43(1): 22-24.

Akanji, A.M., Ologbobo, A.D., Emiola, I.A., and Adedeji, O.S. 2003. The effect of various processing on haemaglutinin and other anti-nutritional factors in Jackbean. NSAP Proceeding, IARST, Ibadan. Pp. 189-193.

Akinmutimi, A.H. 2004. Evaluation of swordbean (*Canavalca gladiata*) as an alternative feed resources for broiler chicks. Ph.D Thesis. College of Animal Science and Animal Health, Michael Okpara University of Agriculture, Umudike. Pp. 4-17.

Akinmutimi, A.H., Amaechi, N., and Unogu, M. 2006. Evaluation of Raw African Bean as Substitute for Soya bean in the Diet of Weaner Rabbits. *Journal of Animal Vet. Advances,* 5(11): 907-911.

Alegbeleye, S.O. 2002. Evaluation of African Yam Bean (*Sphenostylis stenocarpa*) hotchst ex a rich) as a replacement for soyabean in the diets of *Nile tilapia* (*Oreochromis niloticus*) fingerlings. *Asset Services Agriculture and Environment,* 2(2): 73-79.

D'mello, J.P., and Devendra, F. 1995. Tropical Legumes in Animal Nutrition. United Kingdom. Pp. 96-133.

Eburuaja, A.S. 2010. Chemical and nutrition evaluation of African yam bean as an alternative protein source in broiler diets. Ph.D Thesis, Michael Okpara University of Agriculture, Umudike.

Ecocrop, (2009). Ecocrop database. FAO. Heuze, V., Tran. G. 2016. African yam bean (*Sphenostylis stenocarpa*), Feedipedia, a programme by INRA CIRAD, AFZ and FAO. http://www.feedipedia.org/node/704 last updated on March 16, 2016, 11:56.

Emenalom, O.O., Chima, M.C., Etuk, E.B., and Esonu, B.O. 2007. Comparative evaluation of processed velvet bean (*Mucuna pruriene*), soyabean and groundnut meals on the performance and internal organ characterictics of broilers. Proceeding of the 32nd Annual Conf. Nigeria Soc. Animal

Production, pp. 220-222.

Ene-obong, H.N. 1992. Nutritional evaluation, consumption pattern and processing of the African yam bean (*Sphenostylis stenocarpa*) Ph.D Thesis, Department of Home Science and Nutrition, University of Nigeria, Nsukka, Enugu State.

Ewa, U.E. 1999. Evaluation of the metabolizable energy and true digestive protein of jackbean (*Canavalia ensiformis*). B.Sc. Thesis. Michael Okpara University of Agriculture, Umudike. Pp. 25-33.

Food and Agricultural Organization, 1982. Metabolizable energy predicated by the equation proposed by FAO in the book, Tropical feeds

Heuze, V.V., Tran, G., Archimede, H., Regner, C., Bastianelli, D., and Lebas, F. 2015. Cassava roots, feedipedia, a programme by INRA (IRAD, AFZ and FAO) http://www/feedipedia.org/node/527

Izundu, R.O. 1999. Effect of processing on energy and protein digestibility of swordbean (*Canavalia gladista*) using Muscovy duck (*Carina mushata*). B.Sc. Project, Michael Okpara Okpara University of Agriculture, Umudike. Pp. 1-25.

Liener, J.E. 1962. Toxic factors in edible legumes and their elimination. *Anim. J. Clin. Nutri.,* 11: 281-284.

Montgomery, R.D. 1995. Observation on the cyanide content and toxicity of tropical pulses. *W. India Med.,* 3(13): 1-11.

Nwokolo, E.A. 1996. The need to increase the consumption of pulse in the developinf world. Food and feed from legumes and oil seeds. Chapman and Hall, London. Pp. 3-11.

Oke, D.B., Fetuga, B.L.A., and Tewe, O.O. 1996. Effect of autoclaving on anti-nutritional factors of cowpea varieties. *Nigerian Journal of Animal Production,* 23(1): 33-38.

Okwu, N.D.E. 2002. The effect of cooked *Mucuna utilis* as a substitute for soyabean meal in broiler finisher diet. B.Sc. Project, Michael Okpara University of Agriculture, Umudike. Pp. 1-5.

Oluyemi, J.A., and Robert, F.A. 2000. Poultry production in warm wet climates (2nd Ed.) Macmillan Press Ltd. London. Pp. 195-199.

Onyeike, E.N., Ayalogu, E.O., Uzogara, S.G. 1995. Influence of heat procession of African Yam Bean Seed (*Sphenostylis stenocarpa*) Flour on the Growth and Organ Weight of Rats. *Plant Foods Hum. Nutr.,* 49: 85-93.

Onyimonyi, A.E., and Okeke, G.C. 2005. Carcass organ and pathological characteristics of grower pigs fed cassava peel meal. *J. Agric. Food Environ. Ext.,* 1: 1-4.

Oyenuga, V. A. 1997. Nigeria food and feeding stuffs. Ibadan University Press, Nigeria.

Roberts, K.M., Daryl, K.G., Peter, A.m., and Victor, W.R. 2006. Harpes illustrates biochemistry, 27th Edition. McGraw Hill, New York. 27: 489-506.

Snedecor, G.W., and Cochran, W.G. 1989. Statistical methods 8th edition Ames: IOWA State University Press.

Steel, R.D.G., and Torrie, J.H. 1980. Principal and procedures of statistics: A biometrical approach 2nd edition, pp. 623.

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