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EFFECTS OF COOKING TIME ON THE NUTRIENTS, ANTI-NUTRIENTS COMPONENTS AND HEMATOLOGICAL PARAMETERS OF BROILER CHICKENS FED DIFFERENTLY PROCESSED SEED OF AFRICAN YAM BEAN (SPHENOSTYLIS STENOCARPA).

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Abstract

The study was conducted to determine the effect of cooking time on the nutrient and anti-nutrient content of African yam bean seeds. Cooking time adopted were 0, 30, 60, 90, and 120 minutes (RAYB, $CAYBM_1$, $CAYBM_2$, $CAYBM_3$ and $CAYBM_4$)

respectively. Data revealed that crude protein, fat, fibre; carbohydrate and gross energy were not significantly (P>0.05) affected by cooking time with the exception of ash and moisture content. The ash and moisture content decreased as the cooking time increased. Ash and moisture content was highest (3.93 and 7.16) in the raw African yam bean (RAYBM) and least (2.00 and 5.59) in African yam bean cooked for 120minutes ($CAYBM_4$). Gross energy was also improved with increased cooking time. In all the parameter assayed, the level of anti-nutrient decreased with increased cooking time, while some were completely eliminated. Cooking time beyond 60 minutes completely eliminated cyanide content and 120 minutes in phytin phosphorus activity. Optimum coking time of 90 minutes at 100^0c has a remarkable effect on the anti-nutrient content of African yam bean. All the hematological indices and the serum chemistry of broiler indicated no significant (p>0.05) difference. Other parameters investigated include total protein, albumin, globulin, creatinine and urea. The serum cholesterol was however decreased significantly (p<0.05) as the level of AYB in the diets increased

Introduction

Ration is the quantity of a feed given to farm animals in order to maintain their body requirement for a given period. The type of ration given to farm animals depends on the age, type and production level. A diet is a type of a ration. The main differences in these ration is in quality rather than quantity. One of the major problems of Nigeria is the inability to adequately feed the rapidly expanding population, currently put at about 170 million. According to Food and Agricultural Organization (F.A.O, 1996), about 41% of sub-Sahara African population are undernourished

In the world's widening search for cheap sources of protein-rich foods, increasing attention has been focused on home-grown under-exploited crops whose seeds contain relatively high amounts of protein that can be used to improve the diets of vast majority of populace. FAO (1986) estimated about 89.5g of protein essential for normal functioning of the body. The protein of legumes is higher in lysine (Akpata and Ologhobo, 1994) which is a much significant factor and of nutritional importance when combined with cereal proteins with lower lysine content. Though, deficient in sulphur containing amino acids (methionine and cystine), the levels of the sulphur containing amino acids in cereals are adequate to compensate for the values in legume seeds to produce a mixture of enhanced biological value (Akpata,1990). Plant protein diets have been successfully used in child feeding programmes (Olowoniyan, 1994); they have also been reported suitable for the treatment of protein malnutrition disease referred to as kwill be hiorkor (Temple, Odewumi and Joseph, 1991). The carbohydrate content ranges from 23% in groundnut to 66% in bambara groundnut, pigeon pea and lima bean(Akpata and Ologhobo, 1994) and in most cases more than 50% of the carbohydrate is mainly starch which is well absorbed and metabolized. The other remaining fraction of the carbohydrate is essentially in the form of fibre. However, the values are not strictly the same due to differences in legume species, varieties, the geographical location and soil condition.

In Nigeria today, the dwindling oil price and COVID -19 Pandemic had triggered up effort in the search for low-priced sources of protein-rich foods. This has led to re-focusing on home-grown crops, under-exploited and neglected legume species whose seeds contain relatively high amount of protein and can be consumed by man and animals which can be used to improve the diets of vast majority of the populace.

The African yam bean (*Sphenostylis stenocarpa)* is a climbing legume with exceptional ability for adaptation to low land tropic conditions. It is an annual non- arable plant which produces a nutritious seed, as well as edible tubers. It twines and climbs to a height of about 3m and requires staking. It flowers profusely in 100 to 150 days, producing a prolific spattering of light brightly coloured flowers, which may be pink, purple or greenish white and mature within 170 days. The ripe slightly woody pods vary between 120 and 300mm in length and contain from 10-30 seeds, with crude protein levels varying from 21 to 26% (Evans and Boulter, 1974). Several species are grown. These are identified by differences in seed coat colour. The farmers have preference for certain particular colour i.e. white, black, and brown, purple, grey and mottled.

African yam bean contains some anti-nutritional or toxic substances, which affects the nutritive values of non–ruminant animals. The major anti-nutritional factors found include protease inhibitors, haemagglutinins, phytic acid, oxalic acid, saponin, tannin and cyanogenic glucosides. These toxic substances could be reduced or totally eliminated from the seeds through heating. This work was designed to determine the effect of cooking time on the nutrients and anti-nutrients components of African yam bean seeds.

Materials and Method

Experimental site: The experiment was carried out in the Department of Animal Science, Ambrose Alli University, Ekpoma, and Edo State, Nigeria.

Processing of African yam bean seeds:

Some African yam bean seeds were purchased from the central market at Ekpoma in Edo State, Nigeria. Two (2) kg of seeds of AYB were pre-soaked for 12 hours to facilitate bean hydration before boiling. The bean samples were boiled for 30, 60, 90 and 120minutes at 100^0c using aluminum pot. The boiling water was not changed. They were considered boiled when they became soft when pressed between fingers. The residual boiling water was drained off and the sample oven-dried over night at 75^0c and later sun-dried. All the processed samples and the raw sample were finally milled using a laboratory hammer mill to form the African yam bean meal (AYBM).

Determination of proximate constituents and energy

The proximate constituents of the raw and processed AYB seeds were determined by the methods of the Association of Official Analytical Chemists (A. O. A. C, 1995).

Gross energy of the dried materials was determined against thermocouple grade benzoic acid using a Gallenkamp ballistic bomb calorimeter (model CBB – 330 – 0104L).

Determination of anti-nutrients

Determination of Phytin Phosphorus was carried out by employing the method of Young and Greaves (1940) for phytin determination. Tannin determination was carried out using the method of Price, Van Scoyoc and Butler (1978). Saponin was extracted using the method of Ruize-Teran and Owens (1996) and Shodipu and Arinze (1985). Cyanogenic glycosides were determined as hydrocyanic acid equivalent using the A.O.A.C Official Method of Analysis (No.915.03B, 1999). Determinations of mono and oligosaccharides soluble sugars were extracted using 80% v/v ethanol (Muzquiz *et. al.,* 1992, Kovac and Rapor, 1997 (while sugar

analysis was carried out using high performance liquid chromatography according to Muzquiz *et. al.* (1992) and Oboh, Muzquiz, Burbano, Caudrado, Pedrosa, Ayet and Osagie (2000).

Statistical Analysis

All determinations reported in this study were carried out in a minimum of triplicates. In each case, the mean value, standard deviation and standard error of deviation were calculated. Analysis of variance (ANOVA) was done using the procedure of Steel and Torrie (1960) and separation of the means values carried out using Duncan's Multiple Range Test at $P < 0.05$ by employing Statistical Analytical Systems, version 6 (SAS, 1990)

Results and Discussion

Result on the chemical constituents of the African yam bean seeds as influenced by cooking time are showed in table 1. Crude protein, fat, fibre, carbohydrate and gross energy were not significantly (P>0.05) affected by cooking time with the exception of ash and moisture content that were significantly (P<00.05) affected. The ash and moisture content decreases as the cooking time increases. Result obtained showed highest ash and moisture content in the raw African yam bean meal (RAYBM) and least in African yam bean meal cooked for 120minutes (CAYBM) 4. On the other hand, ash content values of African yam bean seeds cooked for 30 minutes were statistically similar to that in the raw state, while African yam bean meal cooked for 60 and 90 minutes ($CAYBM_2$ and $CAYBM_3$) were statistically similar. The African yam bean meal cooked for 120minutes ($CAYBM_4$) were significantly different from all other cooked samples and the raw state. The moisture content in the raw African yam bean meal was comparable to that in $CAYBM_1$, while $CAYBM_1$and $CAYB_2$, $CAYBM_3$ and $CAYBM_4$ were also similar. The result in this study collaborates with that of Osho *et. al.* (1995) and Omoikhoje (2004 and 2008).

Table1. Proximate constituents of raw and cooked African yam bean seeds (% Dry matter basis).

	Cooking Time in Minutes					
	0	**30**	**60**	**90**	**120**	
Constituents	RAYBM	$CAYBM_1$	$CAYBM_2$	$CAYBM_3$	$CAYBM_4$	SEM
Ash	3.93^a	3.51^a	2.90^b	2.84^b	2.00^c	0.37
Moisture	7.16^a	6.46^{ab}	6.34^b	6.26^b	5.59^b	0.11
Crude protein	21.92	21.54	21.44	21.38	20.08	0.26
Fat	5.13	5.10	5.21	5.28	5.49	0.14
Fibre	5.55	5.52	5.50	5.47	5.25	0.11
Carbohydrate	56.31	56.55	57.01	58.78	58.79	1.11
Gross energy (Kcal/kg)	307.50	307.91	317.11	317.72	318.01	6.49

Data indicated that cooking time significantly (P<0.05) influenced the tannin, phytin phosphorus, phytic acid, saponin and cyanide content of raw African yam bean (Table 2). In all the parameter assayed cooking time the level of anti-nutrient decreases with increased cooking time, while some were completely eliminated. Values of 1.10, 3.46 and 12.29, 1.03, 2.35 and 8.90, 0.48, 1.46 and 6.44, 0.08, 1.00 and 5.55, 0.01, 0.00 and 4.34mg/100g for tannin, phytin phosphorus and phytic acid were recorded for samples cooked for 0, 30 60 90 and 120 minutes

respectively. Cooking time beyond 60 minutes completely eliminated cyanide content and 120 minutes in phytin phosphorus activity. This agrees with the result of Omoikhoje (2008) Samples cooked for 0, 30, 60, 90 and 120 minutes had 2.00, 1.67, 1.41, 1.37 and 0.88mg/100g saponin. The nutritional significance of saponins stem largely from their hyppocholestremic action, leading to the belief that they prove useful in the control of human cardiovascular disease (Oakenful and Sidhu, 1989). The observed values are far below the lethal dose and cannot have any negative effect in man and his animals. Cyanide content was significantly ($P<0.05$) highest (0.34mg/100g) in the RAYBM, followed by $CAYBM_1$ (0.11mg/100g) and $CAYBM_2$ (0.01mg/100g), but $CAYBM_3$ and $CAYBM_4$ were similar and eliminated.

Table 2: Effect of cooking time on some anti-nutritional constituents (mg/100g) of African yam bean meal

	Cooking Time in Minutes					
	0	30	60	90	120	
Constituents	RAYBM	$CAYBM_1$	$CAYBM_2$	$CAYBM_3$	$CAYBM_4$	SEM
Tannin	1.10^a	1.03^a	0.48^b	0.08^c	0.01^d	0.006
Phytin phosphorus	3.46^a	2.35^b	1.46^c	1.00^d	0.00^e	0.091
Phytic acid	12.29^a	8.90^b	6.44^c	5.55^d	4.34^e	0.042
Saponin	2.00^a	1.67^a	1.41^b	1.37^b	0.88^c	0.061
Cyanide content	0.34^a	0.11^b	0.01^c	0.00^c	0.00^c	0.002

Means in the same row with varying superscripts differ significantly ($P<0.05$).
SEM: Standard error of means

Haematological parameters

The haematological indices assessed in broiler chickens as influenced by varied levels of AYB in the diets are depicted in Table 3.

Results obtained showed that significant ($P>0.05$) differences were not observed among the values recorded for the experimental chickens. This is an indication of good nutritional status observed among the experimental birds.

Packed Cell Volume (PCV %) and Heamoglobin concentration (Hb).

The haemoglobin concentration of chickens were highest in the control 0% AYB, followed by 20%AYB, 40%AYB and 60%AYB (lowest) based diets respectively with corresponding values of 11.87, 11.77, 11.51 and 11.42g/dl. The packed cell volume (PCV %) of 31.43, 30.33, 30.29 and 31.45% were recorded for 0%AYB, 20%AYB, 40%AYB and 60%AYB based diets respectively.

According to Frandson (1981), a decrease in the quantity of haemoglobin below normal might be as a result of poor nutrition including dietary deficiencies of iron, copper, vitamins or amino acids.

Harkbarth, *et.al.* (1983) stated that dietary influence in the haematological traits is very strong. The PCV and Hb concentrations according to Farinu (1984) have been shown to reveal the nutritional status of animals.

Table 3. Haematological paramerters of broiler chickens fed diets containing different levels of AYB inclusion as replacement for soya bean meal protein

	DIETS				
	1	**2**	**3**	**4**	
	(%) levels of AYB inclusion as replacement for SBM protein				
Ingredients	0	20	40	60	
Parameter					SEM
Hb (g/dl)	11.87	11.77	11.51	11.42	0.16
PCV (%)	31.43	30.33	30.29	31.45	0.20
RBC($x10^{12}$/l)	3.75	3.55	3.54	3.66	0.22
WBC($x10^{12}$/l)	21.51	20.94	20.06	21.50	0.19
MCV (fl)	80.01	69.16	68.15	80.15	4.15
MCH (pg)	30.56	29.48	30.28	30.45	1.86
MCHC (g/l)	34.99	33.82	33.95	35.01	0.88

SEM : Standard error of means

The Redblood Cell (Rbc) And White Bloodcell (Wbc):

The red blood cells (RBC) count was highest ($3.75x10^{12}$/l) in birds fed 0% AYB and least in birds fed 40%AYB ($3.54x10^{12}$/l). The white blood cells (WBC) count of 21.51x10, 20.94 x10, 20.60 x10 and 21.50 $x10^{12/}$l were obtained for birds fed diets containing of 0, 20, 40 and 60% AYB based diets respectively. Mean corpuscular volume (MCV) was highest (80.15fl) in birds fed 60%AYB, followed by birds fed 0%AYB (80.01fl), 20%AYB (69.16fl) and least in birds fed 40%AYB (68.15fl). Mean corpuscular haemoglobin (MCH) was highest (30.56pg) in the (control) 0%AYB, followed by 60%AYB (30.45pg), 40%AYB (30.28pg) and 20%AYB (29.48pg) based diets. Mean corpuscular haemoglobin concentration (MCHC) values of 34.99, 33.82, 33.95 and 35.01g/l were recorded for 0, 20, 40 and 60% AYB based diets respectively. The MCV, MCH and MCHC are readily used in the assessment of nutritional status of animals as a result of feed ingested.

Serum Constituent of broiler chickens

The parameters assayed in serum constituent of broilers namely total protein, albumin, globulin, creatinine and urea indicated no significant (P>0.05) difference as influenced by dietary treatments, except the serum cholesterol which varied significantly (P<0.05) as showed in Table 4.

Table 4. Serum Constituent of Broiler Chickens.

Table 6. Serum constituent of broiler chickens.

	DIETS				
	1	**2**	**3**	**4**	
	(%) levels of AYB inclusion as replacement for SBM protein				
Ingredients	0	20	40	60	
Parameter					SEM
Total protein (g/100ml)	7.35	7.40	7.25	7.20	0.11
Albumin (g/l)	3.40	3.41	3.43	3.45	0.15

Globulin (g/dl)	3.91	3.90	3.91	3.90	0.15
Creatinine (g/dl)	1.36	1.35	1.36	1.35	0.004
Urea (g/l)	19.45	18.46	18.36	18.34	0.16
Cholesterol (mg/100ml)	171.11^{a}	140.22^{b}	138.16^{bc}	122.16^{d}	1.20

a-d: Means in the same row with varying superscripts differ significantly ($P<0.05$).

SEM : Standard error of means

Inclusion of AYB in the diet decreased. The values of 171.11, 140.22, 138.16 and 122.1mg/100ml were recorded for 0, 20, 40 and 60% AYB based diets respectively. This variation may be ascribed to the high level of oil in soya bean and invariably low level oil in AYB seeds. It is contrary and paramount to note the positive nutritional and health importance associated with AYB (i.e. arteriosclerosis and other cardiovascular disorder associated with hypercholesterosis) rather than the many hazards which were reported to be associated with the utilization of AYB in the past. This finding therefore agrees with that of Azeke, *et al.,* (2005).

Conclusion

Result indicated that cooking time did not significantly ($P<0.05$) influenced the crude protein of African yam bean meal, but the trends showed that long cooking time progressively reduced the crude protein contents of raw African yam bean seeds . The ash and moisture content decreases as the cooking time increases. Result obtained showed highest ash and moisture content in the raw African yam bean meal (RAYBM) and least in African yam bean meal cooked for 120minutes (CAYBM) 4.

In all the parameter assayed cooking time the level of anti-nutrient decreases with increased cooking time, while some were completely eliminated. Cooking time beyond 60 minutes completely eliminated cyanide content and 120 minutes in phytin phosphorus activity. Optimum coking time of 90 minutes at 100^{0}c has a remarkable effect on the anti-nutrient content of African yam bean. All the haematological indices and the serum constituent of broiler indicated no significant ($P>0.05$) differences.

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