aJava

Asian Journal of Animal and Veterinary Advances

Academic
Journals Inc.

www.academicjournals.com

Asian Journal of Animal and Veterinary Advances 3 (2): 85-91, 2008
ISSN 1683-9919

Effect of Duration of Cooking *Lablab purpureus* Beans on its Utilization by Broiler Finishers (4-8 Weeks)

[1]F.O. Abeke, [1]S.O. Ogundipe, [1]A.A. Sekoni,
[2]I.I. Dafwang, [1]I.A. Adeyinka, [1]O.O. Oni and [1]A. Abeke
[1]National Animal Production Research Institute, ABU, Zaria, Nigeria
[2]National Agric Extension and Research Laison Services, ABU, Zaria, Nigeria

Abstract: This study was conducted to determine the effect of duration of cooking of *Lablab purpureus* beans on the performance, carcass characteristics and haematological profile of broiler finishers from 4-8 weeks of age. Seven isonitrogenous and isocaloric diets were formulated to contain 50% of *Lablab* beans boiled at 100^{O}C for 0.0, 10.0, 20.0, 30.0, 40.0, 50.0 and 60.0 min, respectively together with a control diet which was a conventional groundnut cake-maize based broiler finisher diet. This amounted to a total of eight dietary treatments. Each treatment was replicated three times, in a complete randomized design. There were 25 broiler chicks (4 weeks old) per replicate. Feed and water were given *ad libitum*. The experiment lasted for four weeks. Results obtained show that increasing the duration of cooking of lablab seeds up to 30 min had significant ($p<0.05$) positive effect on final weight, weight gain, feed intake, feed efficiency and mortality rate. The performance of the birds became better as the duration of cooking increased up to 30 min. Beyond that, performance began to decline as the cooking time increased beyond 30 min. It was observed that birds fed the control diet performed significantly ($p<0.05$) better than all the lablab based diets.

Key words: Broiler finishers, *Lablab purpureus* beans, cooking duration, antinutritional factors, haematological parameters, carcass

INTRODUCTION

The nutritive value of *Lablab purpureus* beans is masked by the occurrence of antinutritional factors such as haemagglutinin, trypsin inhibitors, saponins, phytic acids, tannins, alkaloids and polyphenolic compounds. These toxic components inhibit protein and energy utilization in poultry birds (Abeke, 2005; Taiwo *et al*., 2005; Emenalon *et al*., 2007; Ani and Omeje, 2007; Igene *et al*., 2002). Attempts have been made to reduce or eliminate the toxicity of this legume but only a few breakthroughs have been made, while other solutions are still being investigated. Improved utilization of this legume can only be achieved by the elimination or considerable reduction in the antinutitional factors. A variety of processing procedures such as soaking, boiling, roasting or fermentation are commonly used to eliminate the negative effects of antinutritional factors present in tropical legumes and other vegetable protein sources (Kperegbeyi and Onwumere, 2007; Ani and Adiegwu, 2005; Oladunjoye *et al*., 2005; Akinmutimi, 2003). Little is known about the effects of these processes on the nutritive value of lablab seeds and there is scarcity of information on the use of this legume as a component of poultry diet. This experiment was therefore carried out to determine the effect of duration of cooking of *Lablab purpureus* beans on the performance of broiler finishers from 4-8 weeks.

Corresponding Author: F.O. Abeke, National Animal Production Research Institute, ABU, Zaria, Nigeria

MATERIALS AND METHODS

This study was carried out at the poultry research unit of the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika, Zaria, Nigeria, from March to May 2003. Shika is geographically located between latitude 11° 12'N and longitude 7° 33'E at an altitude of 640 M above sea level (Akpa *et al*., 2002). Shika is located about 20 km along the Zaria Sokoto road in Kaduna state, North Western Nigeria. It has three distinct climatic seasons. These are the cold dry season (November-February), the hot dry season (March-May) and the wet season (June-October). The total annual rainfall ranges from 617 to 1365 mm with a 50-year average of 1041 mm Most of the rains fall between July and September (Bawa *et al*., 2003b).

The *Lablab purpureus* beans used for this experiment is the Rongai variety. It is milky white in colour. They were obtained from the Sabon-gari market in Zaria, Nigeria. The heating duration to properly process lablab beans was determined. For this 25 kg lablab bean samples were subjected to various cooking duration of 0, 10, 20, 30, 40, 50 and 60 min.

For each cooking time 50 L of water was first brought to boiling in a 200 L metal drum container. The batch (25 kg) of lablab bean was then poured into the boiling water. From this point, the specified time of cooking was taken. At the end of the period of cooking, the excess water was drained off and the cooked beans were sun dried for 3 days before milling. The average ambient temperature for the three days of drying was 32°C and average relative humidity was 35%. After sun-drying chemical evaluation of the processed lablab beans was done. Each duration of cooking represented a treatment (treatment1-7).

Eight isonitrogenous (20.40% crude protein and approximately 3000 kcal kg^{-1} metabolizable energy) broiler finisher diets were formulated (Table 2). Diets 1-7 contained lablab seeds at 50% of the diets. Diet 8, which served, as the control was a standard corn-groundnut cake-based broiler finisher diet. The only difference between diets one to seven were the variations in the durations of cooking the lablab seeds used for the ration. Each of diets 1-8 represented a treatment and each of the treatment was replicated three times. There were 25 (4 weeks old) broiler chicks per replicate.

Feed and water were given *ad libitum*. The experiment lasted for four weeks. Data were collected on feed consumption, weight gain and mortality. Before the commencement of the experiment, five birds from each replicate group were bled using a 2 mL syringe at the wing. This was repeated when the birds were six and eight weeks old, respectively. These represented the initial, mid and final blood analysis, respectively (Table 3). The blood samples were analysed for Packed Cell Volume (PCV) Haemoglobin (Hb) and Total Protein (TP). At the end of the experiment, five birds representing the average weight per replicate were fasted but given water overnight before being slaughtered by cutting the neck at the first cervical vertebrae for carcass analysis. All data were subjected to the analysis of variance using the (SAS, 1985) general model procedure. Differences between treatment means were separated using the Duncans Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The chemical composition of the cooked lablab beans used for the experiment (Table 1), the composition of rations fed the performance of the broiler finishers (Table 2), the carcass analysis (Table 3) and haematological profile are shown in Table 1-3, respectively.

Results obtained show significant ($p<0.05$) response of the broiler finishers to the duration of cooking of the lablab beans. Weight gain was significantly ($p<0.05$) better for the 30 min cooked lablab beans diet than for all other cooking time. It was however significantly ($p<0.05$) lower than that of the control diet. A significant ($p<0.05$) increase in weight gain was observed as the duration of cooking the

Table 1: Effect of duration of cooking of *Lablab purpureus* beans on the performance of broiler finishers

		Duration of cooking of lablab beans (min)							
Parameters	Control	0	10	20	30	40	50	60	SEM
Initial wt. (g b^{-1})	440.67	440.67	440.67	440.67	440.68	440.67	440.67	440.67	0.020
Final wt. (g b^{-1})	1910.00^{a}	1300.00^{h}	1495.00^{g}	1580.00^{f}	1700.00^{b}	1687.01^{c}	1636.00^{d}	1625.96^{e}	0.120
Wt. gain (g b^{-1})	1369.33^{a}	859.34^{h}	1055.33^{g}	1139.33^{f}	1259.33^{b}	1246.35^{c}	1195.33^{d}	1185.29^{e}	0.110
Feed intake (g b^{-1})	1910.06^{a}	1741.50^{h}	1745.50^{g}	1750.50^{f}	1762.50^{e}	1768.52^{d}	1772.50^{c}	1903.50^{b}	0.230
Feed intake (g/b/d)	68.22^{a}	62.20^{h}	62.34^{g}	62.52^{f}	62.95^{e}	63.16^{d}	63.31^{c}	67.98^{b}	0.010
Feed efficiency	0.77^{a}	0.49^{h}	0.60^{g}	0.65^{e}	0.71^{b}	0.70^{c}	0.67^{d}	0.62^{f}	0.002
Feed-gain ratio	1.39^{h}	2.03^{a}	1.65^{b}	1.54^{d}	1.40^{g}	1.42^{f}	1.48^{e}	1.61^{c}	0.002
Feed cost (N/kgfeed)	41.48^{a}	28.64^{h}	29.70^{g}	30.76^{f}	31.82^{e}	32.88^{d}	33.94^{c}	35.02^{b}	0.020
Feed cost (N/b)	79.23^{a}	49.88^{h}	51.84^{g}	53.85^{f}	56.09^{e}	58.15^{d}	60.16^{c}	66.65^{b}	0.030
Feed cost N/kg gain	57.87^{b}	58.04^{a}	49.12^{e}	47.27^{f}	44.54^{h}	46.66^{g}	50.33^{d}	56.23^{c}	0.030
IAFE (N)	292.13^{e}	291.96^{e}	300.88^{c}	302.73^{b}	305.46^{a}	303.34^{b}	299.67^{c}	293.77^{d}	0.740
Mortality (%)	0.00^{a}	16.00^{d}	16.00^{d}	12.00^{c}	0.00^{a}	0.00^{a}	4.00^{b}	0.00^{a}	1.420

Means within the same row with different letter superscripts are significantly ($p<0.05$) different; SEM = Standard error of the means. FE = Feed Efficiency; FGR = Feed Gain Ratio; FI = Feed Intake; IAFE = Income Above Feed Expenses, Calculated at N350 per kg liveweight

Table 2: Effect of duration of cooking of *Lablab purpureus* beans on carcass composition of broilers (4-8 weeks)

		Duration of cooking (min)							
Parameters	Control	0	10	20	30	40	50	60	SEM
Live wt. (g b^{-1})	1900.95^{a}	1290.50^{h}	1486.95^{g}	1571.00^{f}	1692.09^{b}	1678.26^{c}	1627.00^{d}	1616.96^{e}	0.730
Slaught wt. (%LW)	95.85^{a}	93.77^{g}	94.62^{f}	94.92^{e}	95.28^{b}	95.24^{c}	95.02^{d}	94.93^{e}	0.007
Defeather wt. (%LW)	91.06^{a}	82.15^{h}	85.73^{g}	87.09^{f}	88.67^{b}	88.49^{c}	87.82^{d}	87.68^{e}	0.014
Dress (%)	81.06^{a}	72.10^{h}	75.73^{g}	77.15^{f}	78.83^{b}	78.44^{c}	77.77^{d}	77.56^{e}	0.028
Breast wt. (%LW)	19.73^{a}	17.44^{h}	17.49^{g}	17.51^{f}	19.21^{b}	18.47^{c}	17.83^{d}	17.63	0.008
Thigh wt. (%LW)	22.64^{a}	19.20^{f}	19.45^{e}	19.89^{d}	21.59^{b}	20.78^{c}	19.99^{d}	19.88^{d}	0.120
Wing wt. (%LW)	9.60^{a}	7.52^{e}	7.73^{de}	7.95^{d}	9.12^{b}	9.35^{ab}	8.39^{c}	8.21^{cd}	0.124
Back wt. (%LW)	17.70^{a}	16.25^{f}	16.62^{d}	16.95^{c}	17.65^{a}	17.06^{b}	17.10^{b}	16.85^{e}	0.068
Neck wt. (%LW)	3.98^{a}	3.35^{g}	3.55^{f}	3.72^{d}	3.97^{b}	3.84^{c}	3.70^{d}	3.60^{e}	0.022
Leg wt. (%LW)	4.50^{a}	3.59^{g}	3.69^{f}	3.82^{ef}	4.22^{b}	3.92^{c}	3.87^{d}	3.84^{de}	0.022
Head wt. (%LW)	3.60^{a}	2.89^{f}	2.96^{e}	3.06^{d}	3.39^{b}	3.20^{c}	3.08^{d}	3.07^{d}	0.025
Liver wt. (%LW)	1.03^{h}	1.90^{a}	1.85^{b}	1.74^{c}	1.55^{d}	1.45^{e}	1.40^{f}	1.34^{g}	0.024
Gizzard wt. (%LW)	2.61^{a}	2.11^{e}	2.18^{de}	2.24^{d}	2.55^{b}	2.38^{c}	2.19^{de}	2.20^{de}	0.029
Spleen wt. (%LW)	0.12^{f}	0.21^{a}	0.19^{b}	0.17^{c}	0.15^{d}	0.13^{e}	0.13^{e}	0.12^{f}	0.003
Pancreas wt. (%LW)	0.38^{d}	0.48^{a}	0.46^{b}	0.40^{c}	0.38^{d}	0.37^{e}	0.38^{d}	0.37^{e}	0.002
Heart wt. (%LW)	0.42^{g}	0.57^{a}	0.53^{b}	0.52^{c}	0.49^{d}	0.48^{e}	0.43^{f}	0.42^{g}	0.004

Means within the same column with different letter superscripts are significantly ($p<0.05$) different; SEM = Standard error of the means; LW = Liveweight

Table 3: Effect of duration of cooking of *Lablab purpureus* beans on PCV, Hb and TP status of broiler finishers (4-8 weeks)

		Duration of cooking of lablab (min)							
Parameters	Control	0	10	20	30	40	50	60	SEM
Initial PCV (%)	28.56	28.56	28.11	28.72	28.30	28.51	28.61	28.59	0.730
Mid PCV (%)	29.30^{a}	24.65^{e}	26.10^{d}	27.02^{c}	28.07^{b}	27.91^{b}	26.95^{c}	26.73^{c}	0.231
Final PCV (%)	29.27^{a}	25.00^{d}	26.00^{c}	27.28^{b}	28.00^{b}	27.52^{b}	27.04^{bc}	26.93^{bc}	0.421
Initial Hb (%)	9.52	9.52	9.37	9.57	9.43	9.50	9.54	9.53	0.243
Mid Hb (%)	9.77^{a}	8.22^{e}	8.70^{d}	9.01^{c}	9.36^{b}	9.30^{b}	8.98^{c}	8.91^{c}	0.077
Final Hb (%)	9.76^{a}	8.33^{d}	8.67^{c}	9.09^{b}	9.33^{b}	9.17^{b}	9.01^{bc}	8.98^{bc}	0.140
Initial TP (g dL^{-1})	5.65	5.75	5.70	5.75	5.60	5.80	5.55	5.75	0.322
Mid TP (g dL^{-1})	5.75^{a}	4.25^{b}	4.65^{b}	5.20^{ab}	5.50^{a}	5.50^{a}	5.30^{ab}	5.20^{ab}	0.281
Final TP (g dL^{-1})	5.70^{a}	4.35^{b}	4.50^{b}	5.22^{ab}	5.55^{a}	5.57^{a}	5.39^{a}	5.27^{ab}	0.318

Means within the same row with different letter superscripts are significantly ($p<0.05$) different; SEM = Standard error of the means; PCV = Packed Cell Volume; Hb = Haemoglobin; TP = Total Protein

lablab beans increased up to 30 min before declining as the cooking time increased beyond 30 min. This result suggests that some level of cooking is necessary for rendering lablab purpureus beans safe for incorporation into poultry diets. This level of cooking seems to be achieved at about 30 min of cooking at 100°C. It is generally believed that heat treatment is one of the means of reducing the

antinutritional factors of legume beans (Akinmutimi, 2007; Tuleun and Igba, 2007; Akanji and Osho, 2007; Bawa *et al*., 2003a, b). This fact is based on the principle that heat denatures protein and since antinutritional factors such as antitrypsin, phytic acid, haemaglutinin and lectins found in raw lablab beans are protein substances they tend to be denatured by heat treatment which can be through cooking, toasting, autoclaving or steaming. However the rate of denaturation of protein differs from protein to protein. It seems that antinutritional factors are denatured more quickly from legume beans than the real protein content of the beans itself. There seems also to be a relationship between the duration of cooking and the efficiency with which the legume beans being cooked is utilized by chickens. There is therefore the danger of overcooking or undercooking, which will not result in the desired performance of the birds. Undercooking of the beans may result in the antinutritional factors not being properly destroyed while overcooking may result in the denaturation of the real protein content of the beans. This study is focused on moist cooking as a means of rendering lablab purpureus beans safe for incorporation into broiler finishers' diets to achieve better performance. However other methods such as toasting, autoclaving, steaming or soaking need to be explored. Ogundipe *et al*. (2003) had earlier reported increase in weight of pullet chicks fed 30 min cooked lablab purpureus beans meal diets as opposed to decline in weight for those fed raw lablab beans meal diets. According to the author, cooking lablab beans for 30 min before incorporation into pullets' diets gave the best result in terms of growth and feed efficiency. The author reported that diets, which had lablab beans, cooked below or above 30 min at 100°C gave significantly ($p<0.05$) lower performances

This implies that a minimum of 30 min is required to cook lablab seeds at 100°C to effectively eliminate or reduce to the barest minimum most of the antinutritional factors in the beans such that poultry birds can utilize them efficiently. According to Bawa *et al*. (2003a), about 76% destruction of typsin inhibitor, which is the major antinutritional factor in lablab seed, is achieved in 30 min cooking at 100°C. This reduced level of antinutritional factors, according to the authors is safe for incorporating lablab beans into diets of monogastric animals. Cooking time of below 30 min may imply that a lot of the antinutritional factors still remain in the beans and may exert their negative influence on protein utilization by the birds. In the same vein, cooking the seeds beyond 30 min could have resulted in the denaturation of the protein and hence reduction in their bioavailability to the birds. Bawa *et al*. (2003b) also reported that there were no significant ($p>0.05$) differences for final live-weight, weight gain, feed intake, feed conversion ratio and feed cost per kilogram gain when lablab seeds cooked for 30 min was compared to 45 min cooking before being incorporated in weaker pig diets at the same level of inclusion. This indicates that there is no need to cook beyond 30 min so as to save cost on fuel. Etuk (2001), Amaefule and Onwudike (2000) and Abeke *et al*. (2003) have all worked on a number of unconventional legume seeds to replace the conventional groundnut and soyabean cakes in broiler diets. They have all reported that heat treatment of these seeds for at least 30 min before incorporation into diets resulted in significantly ($p<0.05$) better performance of the birds than those heated for less time period.

Feed intake was found to increase significantly ($p<0.05$) as the duration of cooking of the lablab beans increased (Table 1). This could be attributed to increased palatability and better utilisation of the feed as the level of antinutritional factors was reduced. Balogun *et al*. (2001) and Ani and Okeke (2003) have reported better feed intake in broilers fed well-processed soyabean and pigeon pea diets, respectively. They argued that palatability is enhanced by cooking the seeds for at least 30 min because the pleasant aroma of cooked beans can be perceived at that duration of cooking. Bawa *et al*. (2003b) also reported improved feed intake in weaker pigs as the duration of cooking of the lablab seeds used in their diets increased.

Feed conversion efficiency was significantly ($p<0.05$) better for the broilers fed the 30 min cooked lablab beans diets than for all other diets except for the control diet which gave the best feed conversion efficiency (Table 1). This result agrees with the report of Amaefule and Onwudike (2000) and Ja'afaru (2001) who reported increased feed conversion efficiency in broilers fed well cooked pigeon pea and lablab beans meal as opposed to poor feed conversion efficiency observed when the raw forms of the

legumes were fed in the diets. The authors believed that the destruction of the antinutritional factors in the legume as a result of adequate cooking might have enhanced their nutrient status and availability for use by the birds. Negative interference by antinutritional factors such as trypsin inhibitors has been a major problem in the efficient utilization of protein contained in tropical legume seeds. Cooking the beans for 30 min was found to have reduced these factors to a level that the birds were able to utilize the feedstuff efficiently.

Feed cost (N/kg feed, N/bird) and total cost (N/bird) increased significantly ($p<0.05$) as the duration of cooking of the lablab seeds increased. This is due to the cost of fuel and the level of feed consumption of the birds. However, feed cost (N/kg gain) was significantly ($p<0.05$) better for treatment 4, which contained lablab seed cooked for 30 min than for all the other treatments. This implies that the better efficiency of feed utilization observed in the birds fed this diet, coupled with the relative cheap prices of the diet may have resulted in this better feed cost per kilogramme gain. The significantly ($p>0.05$) higher feed cost per kg gain observed for birds that were fed raw lablab seed diets compared to those fed the cooked lablab seed diets could be attributed to the poor rate of conversion of the raw lablab seed protein into body tissues.

The cost per unit weight gain of broilers fed cooked lablab based diets was significantly ($p<0.05$) lower than those on the groundnut cake diets. This suggests that the use of cooked lablab seeds to replace groundnut cake in broiler finisher diets may result in savings in the cost of production.

Income above feed expenses was found to be significantly ($p<0.05$) better for the birds fed the 30 min cooked lablab seed diet than for all the other treatment including the control (Table 1). The reason for this is because lablab beans are far cheaper than groundnut cake. According to Ogundipe *et al.* (2003), the main objective of inclusion of well-processed unconventional grain legume in poultry diets is to lower feed cost and increase profit margin.

There was a significantly ($p<0.05$) reduction in percent mortality as the duration of cooking of the lablab beans increased. This result agrees with the observation of Amaefule and Onwudike (2000) who reported reduce mortality when cooked pigeon pea beans was incorporated in broiler diets as opposed to when the raw samples of the seeds was fed in the diets. This could be due to reduction of the antinutritional factors which are harmful to poultry birds as the cooking duration increased..

Results obtained for the carcass analysis indicate significant ($p<0.05$) positive responses for live weight, slaughter weight, defeathered weight, dressing percentage and weights of the breast, thigh, wing, back, neck, leg and head. There were increases in these body parts as the duration of cooking of lablab seeds increased up to 30 min before declining as the duration of cooking continued to increase beyond 30 min (Table 2). However, results obtained for birds fed the control diet were significantly ($p<0.05$) higher for these parameters than for those fed the lablab diets.

The pancreas, liver, spleen and the heart were found to be significantly ($p<0.05$) heavier in birds fed the raw lablab diet than for those fed the control and cooked lablab diets. This agrees with the report of Omeje (1999) and Ogundipe *et al.* (2003) that hypertrophy of these organs may occur as a result of their attempt to increase protein availability or in the process of detoxifying the antinutritional factors in the body of the birds. This hyperactivity of the organs is a normal body reaction to counteract the short fall in body nutrient supply, especially protein (Oladele, 2000). Pancreatic hypertrophy is particularly observed in birds feeding on low or poor quality protein diets. Pancreas is the site for the production of trypsin, the enzyme responsible for protein breakdown. Therefore any short fall in protein supply in the body activates the pancreas to produce more trypsin. This increase in their activity results in the enlargement of the organ. The high level of trypsin inhibitor from the raw lablab seed diets may result in an inefficient digestion of the protein in the feed. As a result, the pancreas responds by increasing its activity in trypsin enzyme synthesis to meet the short fall. The liver may also have been over tasked in its attempt to detoxify many of the toxic compounds found in raw legume seeds such as tannins, phytic acids and alkaloids. These increased activities may result in the enlargement of the organs as is noticed in the birds fed the raw lablab seed based diets. There were decreases in percent weights of the heart, liver, pancreas and the spleen as the duration of cooking of the lablab beans increased (Table 2).

Analysis of the haematological parameters show a significant ($p<0.05$) response of the birds to the various cooking time applied for processing the lablab seeds (Table 3). The final packed cell volume haemoglobin and total protein in the blood increased significantly ($p<0.05$) as the duration of cooking of the lablab seeds increased up to 30 min of cooking the lablab seeds. This is an indication of not only a better nutrient status for the birds as the lablab seed is properly cooked but also a better health status. The birds fed diets containing lablab seeds cooked for at least 30 min and the control diet gave significantly ($p<0.05$) better TP, PCV and Hb in their blood than those fed diets containing raw lablab seed and lablab seeds cooked below 30 min. This implies that the lablab seeds are better utilized and assimilated into the blood stream for use by the birds when the seeds are cooked for at least 30 min. The significant finding of this study is that *Lablab purpureus* beans are a good source of protein for broiler finishers. However the beans need to be cooked for at least 30 min in water at 100°C before broilers finishers can efficiently utilize them.

CONCLUSION

From the results obtained in this study it can be concluded that lablab purpureus beans can be processed by cooking for 30 min before being incorporated in the diets of broiler finishers for optimum performance.

REFERENCES

Abeke, F.O., S.O. Ogundipe, A.A. Sekoni, I.I. Dafwang and S.B. Oladele, 2003. Effects of duration of cooking of lablab (*Lablab purpureus*) beans on organ weights and blood parameters of pullet chicks. Proceeding of the 28th Annual NSAP Conference Ibadan, 28: 240-242.

Abeke, F.O., 2005. Evaluation of the nutritive value of *Lablab purpureus* beans in replacement for groundnut cake in poultry diets. Ph.D Thesis, Ahmadu Bello University, Zaria, Nigeria, pp: 100-128.

Akanji, A.M. and S.M. Osho, 2007. Effect of processing on biochemical composition of lima beans. Proceeding of the 32nd Annual conference of the Nigerian Society of Animal Production (NSAP) held at the University of Calabar, Nigeria from 18th-21st March, pp: 261-263.

Akinmutimi, A.H., 2003. Effect of processing on metabolisability of energy content of Sword beans (*Canavalia gladiata*) using broiler chicks (starter phase). Proceeding of 28th NSAP Ibadan, Nigeria, pp: 194-196.

Akinmutimi, A.H., 2007. Effect of cooking period on the nutrient composition of velvet beans (*Mucuna pruriens*). Proceeding of the 32nd Annual conference of the Nigerian Society of Animal Production (NSAP) held at the University of Calabar, Nigeria from 18th-21st March, pp: 223-226.

Akpa, G.N., J.O. Ifut and F. Mohammed, 2002. Indegenous management of dystocia in ruminant livestock of Northern guinea savannah of Nigeria. J. Anim. Prod., 29: 264-270.

Amaefule, K.U. and O.C. Onwudike, 2000. Evaluation of processing methods of pigeon pea seeds (*Cajanus cajan*) as protein source for broiler starter. J. Sust. Agric. Environ., 2: 134-138.

Ani, A.O. and G.C. Okeke, 2003. The substitution of pigeon pea (*Cajanus cajan*) seed meal for soyabean in broiler finisher ration. Proc. 8th Ann. Conf of ASAN, pp: 10-12.

Ani, A.O. and L.I. Adiegwu, 2005. The Feeding Value of Velvet beans (*Mucuna pruriens*) to weaker rabbits. Proceeding of 30th Annual Conf. of Nig Soc. of Anim. Prod. (NSAP) 20th-24th March at University of Nigeria Nnsukka, Nigeria, pp: 186-189.

Ani, A.O. and O.D. Omeje, 2007. Effect of supplementation with enzyme on growth performance of broiler chicks fed diets containing raw bambara nut (*Voandzeia subterranean* L.) waste. Proceeding of the 32nd Annual conference of the Nigerian Society of Animal Production (NSAP) Held at the University of Calabar, Nigeria from 18th-21st March, pp: 278-281.

Balogun, T.F., F.G. Kaankuka and G.S. Bawa, 2001. Effect of boiling full-fat soya beans on its amino acid profile and on performance of pigs. NJAP., 28: 45-51.

Bawa, G.S., T.S.B. Tegbe and S.O. Ogundipe, 2003a. Effect of feeding graded dietary levels of lablab seeds as a replacement for soyabean on performance characteristics of young pigs. Proc. 28th NSAP Conf., Ibadan, Nigeria, 28: 230-232.

Bawa, G.S., T.S.B. Tegbe, S.O. Ogundipe, I.I. Dafwang and E.A. Abu, 2003b. The effect of duration of cooking of lablab seeds on the level of some antinutritional factors. Proceeding 28th Ann. Conf. NSAP, Ibadan, Nigeria, 28: 213-215.

Emenalon, O.O., M.C. Chima, E.B. Etuk and B.O. Esonu, 2007. Comparative evaluation of processed velvet bean (*Mucuna pruriens*), Soyabean and groundnut meals on the performance and internal organ characteristics of broilers. Proceeding of the 32nd Annual Conference of the Nigerian Society of Animal Production (NSAP) held at the University of Calabar, Nigeria from 18th-21st March, pp: 220-222.

Etuk, E.B., 2001. Determination of the optimal replacement level(s) of soyabean meal and maize with toasted and cooked pigeon pea (Cajanus cajan) seed meal for broilers. M.Sc. Thesis, Fed. Univ. of Tech. Owerri, Nigeria.

Igene, F.U., J.O. Omueti and A. Arijeniwa, 2002. Nutrient and anti-nutrient components of some raw tropical pulses. Proc. NSAP, Akure, Nigeria, pp: 119-121.

Ja'afaru, M.H., 2001. Carcass evaluation of broiler fed *Lablab purpureus* seed meal as a replacement for groundnut cake. Unpublished undergraduate project. Dept. Anim. Sci. Uthman Danfodio Univ. Sokoto, Nigeria.

Kperegbeyi, J.I. and O.S. Onwumere, 2007. Effects of raw and toasted bambara groundnut (*Vigna subterranean* (L.) *verdcourt*) on performance of growing cockerels. Proceeding of the 32nd Annual Conference of the Nigerian Society of Animal Production (NSAP) Held at the University of Calabar, Nigeria from 18th-21st March, pp: 188-191.

Ogundipe, S.O., F.O. Abeke, A.A. Sekoni, I.I. Dafwang and I.A. Adeyinka, 2003. Effects of duration of cooking on the utilization of *Lablab purpureus* beans by pullet chicks. Proceeding of the 28th Annual Conf. of NSAP. Ibadan, Nigeria, 28: 233-235.

Oladele, S.B., 2000. Haematological parameters of some apparently healthy and some clinically sick indigenous poultry species in Zaria. M.Sc. Thesis, Ahmadu Bello University Zaria, pp: 98.

Oladunjoye, O.I., A.D. Ologhobo, O.A. Amao, S.R. Amao and A.O. Gbile, 2005. Feeding value of raw breadfruit (*Artocarpus altilis*) meal for broilers. Proceeding 30th Annual Conf. of Nig Soc. of Anim. Prod. (NSAP) 20th-24th March at University of Nigeria Nnsukka, Nigeria, pp: 172-174.

Omeje, S.I., 1999. Issues in animal science. Raykennedy Scientific Pub. Enugu, Nigeria.

SAS, 1985. Statistical Analysis System Institute Inc. Users guide. Statistic Version 6th Edn., Carry, North Carolina, USA.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Practice of Statistics. A Biometric Approach. 2nd Edn., McGraw-Hill Book Co. Inc., New York.

Taiwo, A.A., A.D. Adejuyigbe, A.A. Olusegun, M.B. Gbadamosi, O.J. Obe and E.A. Adebowale, 2005. Effect of varying levels of inclusion of soyabean residue on the performance of broiler finisher birds. Proc. 30th Annual Conf. of Nig Soc. of Anim. Prod. (NSAP) 20th-24th March at University of Nigeria Nnsukka, Nigeria, pp: 207-209.

Tuleun, C.D. and F. Igba, 2007. Growth and carcass characteristics of broiler chickens fed water soaked and cooked velvet bean (*Mucuna utilis*) meal. Proc. of the 32nd Annual Conference of the Nigerian Society of Animal Production (NSAP) Held at the University of Calabar, Nigeria from 18th-21st March, pp: 240-243.