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Response of Laying Hens to Dietary Levels of Cooked *Lablab purpureus* Beans

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Abstract: This study was conducted to determine the response of laying hens to graded dietary levels of cooked *Lablab purpureus* beans. Six isonitrogenous diets with similar calorie levels were formulated to contain lablab seed meal at 0.0, 7.5, 15.0, 22.5, 30.0 and 37.5%, respectively. Diet 1, which contained no lablab, served as the control diet. It was a normal groundnut cake-maize based layers ration. Each treatment was replicated three times in a completely randomized design. There were 25 laying hens per replicate. Feed and water were provided *ad libitum*. The birds were managed under the deep litter system. The experiment lasted for 6 months. There was a significant ($p>0.05$) decrease in final weight, percent change in body weight, feed intake (g bird^{-1} day^{-1}), feed efficiency, percent hen-day and hen-housed egg production, percent production at peak, average egg weight (g) and income above feed expenses (₦) as the level of lablab beans in the diets increased but feed cost (₦/12 eggs), age at 25, 50 and at peak egg production (days) and the Roche Yolk Colour Fan (RYCF) score increased significantly ($p<0.05$) as dietary level of lablab seeds increased. It was concluded that lablab seed meal can be fed up to 7.5% dietary level in layers ration without any significant ($p>0.05$) adverse effect on percent hen-day and hen-housed egg production.

Key words: Lablab purpureus beans, egg production, antinutritional factors, laying hens, egg quality, hen day

INTRODUCTION

The poultry industry has suffered more than any other livestock sector as a result of the problem arising from inadequate supply of feed. There is high cost of feeding poultry arising largely from fluctuations in feed supplies, rising prices of ingredients, poor quality feeds and inefficiency in production and distribution in the feed industry (Kperegbeyi and Onwumere, 2007; Emenalom *et al*., 2007). This situation has caused many small and large-scale poultry farmers to fold up. However efforts have been made in the use of other cheap sources of ingredients for poultry feed such as palm kernel cakes, cottonseed cakes and sunflower meal in order to lower feed cost and these have yielded encouraging results. However, more needs to be done because the improvement in the poultry industry will depend largely on the availability of good quality and cheap feeds compounded from well-processed unconventional legumes (Toleun and Igba, 2007; Adebimpe *et al*., 2007; Oladunjoye *et al*., 2005; Ani and Adiegwu, 2005). Fortunately, there is abundance of seeds of several legumes, which are presently being cultivated as fodder for ruminant feed which can be explored for poultry ration formulation. Among these are lablab purpureus beans.

Presently there is much interest in the cultivation of lablab purpureus because of its nature as a dual-purpose legume. It remains green far into the dry season, easy to cultivate, very rich in nutrient,

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the leaves are quite palatable to ruminants and it is rapidly gaining acceptance by farmers in northern Nigeria. Indeed *Lablab purpureus* looks promising as the legume of the future for both ruminant and monogastric nutrition (Bawa *et al*., 2003a). In view of this the objective of this study is therefore to determine the response of laying hens to dietary levels of *Lablab purpureus* beans with the aim of using this unconventional feedstuff in laying hen's ration.

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 August 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 cooking duration to properly process lablab beans was 30 min as determined in an earlier experiment (Abeke *et al*., 2003).

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 beans was then poured into the boiling water. From this point, the beans were cooked for 30 min. 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 according to AOAC (1990) procedure (Table 1).

Six isonitrogenous and isocaloric rations were formulated to contain lablab bean meal at 0.0, 7.5, 15.0, 22.5, 30.0 and 37.5 percent respectively (Table 2). Each diet constituted a treatment and each treatment was replicated three times in a complete randomized design. There were 25 layers per replicate. The birds used were the Shika brown commercial layers. Feed and water were provided *ad libtum*. The experiment lasted for six months. The average initial weight of the birds per replicate was taken before the commencement of the feeding trials. They were again weighed at the end of the experiment to determine weight gain or loss. Data collected included feed intake, which was measured weekly and egg production were recorded daily. For the egg quality analysis, three freshly laid eggs were sampled per replicate, weighed, using the mettler PM 4600 electronic platform scale. The eggs were broken in a flat white plate. The yolk and albumin width and height were measured using a vernier caliper. This was done for 3 consecutive days for each month for the duration of the experiment. The shells were sun-dried for three days before being we had used the mettler scale while the shell thickness was measured using the vernier caliper.

Table 1: Chemical composition of cooked *Lablab purpureus* beans

Components	Percentage
Dry matter	95.97
Crude protein	23.29
Crude fibre	11.19
Ether extract	9.13
Ash	3.85
Calcium	1.32
Total phosphorus	0.11

These are average values of 3 determinations of the cooked lablab beans

All data collected were subjected to the analysis of variance using the SAS (1985) general linear model procedure. Differences between treatment means were separated using Duncans Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The result obtained for the chemical composition of the cooked lablab beans (Table 1) shows that lablab beans has fairly high level of crude protein, ether extract and calcium which can be utilize for poultry diet formulation. The result also demonstrate that as the level of inclusion of lablab beans in layer diets increased (Table 2), there was a corresponding significant ($p>0.05$) reduction in the performance of the birds in terms of final weight, feed intake, feed efficiency, hen-day and hen-housed egg production, percent peak egg production and average final egg weight (Table 3). Feed intake and feed cost per 10 eggs, 12 eggs and per kilogram eggs increased significantly ($p<0.05$) as the level of lablab beans in the diets increased. The same trend was observed for age at 25, 50% and at percent peak egg production (Table 4). For the egg quality parameters, the result shows that there was a slight but significant ($p<0.05$) increase in egg weight, weight of eggshell and RYCF scores at 25, 50% and at percent peak egg production as the level of lablab beans in the diets increased (Table 5). This increase in average egg weight at 25, 50% and at percent peak egg production did not however translate into final average egg weight which were found to decrease as the level of lablab beans in the diets increased (Table 3). This shows that the birds on lower dietary levels of lablab beans possibly laid bigger eggs towards the end of their laying period. Other egg quality parameters such as yolk index, haugh unit, percent shell and shell thickness were not significantly ($p>0.05$) affected by feeding graded dietary levels of *Lablab purpureus* beans in the diets of laying hens (Table 5).

The final live weight of the laying hens showed a significant ($p>0.05$) decrease as the level of lablab in the diet increased. The same trend was observed for the percent change in body weight. This result agrees with the report of Ja'afaru (2001), Najime (2003) and Adeyemi and Adeyemi (2000). These authors fed lablab beans and soyabeans, respectively as replacement for groundnut cake in the diets of laying hens and reported decreases in weight gain as the levels of these unconventional legume seeds increased in the diet. The authors attributed this to the low quality of the protein contained in these legumes. Igene *et al*. (2002) had earlier reported that lablab seed is deficient in essential amino acids such as methionine, lysine and tryptophan, which are necessary for optimum performance of chickens.

Feed intake (g bird^{-1} day^{-1}) was significantly ($p<0.05$) higher for the control diet, which had no lablab seed meal when compared to other diets containing lablab seed meal. The result showed a gradual decrease in feed intake as the level of lablab in the diets increased. This result is similar to the result obtained by Ani and Okorie (2003) who reported reduced feed intake when graded level of castor oil bean was fed in the diets of broiler finisher. Similarly, Bawa *et al*. (2003b) reported reduced feed intake in young pigs when graded levels of lablab seeds were incorporated in their diets. Amaefule and Onwudike (2000) also reported reduced feed intake in rabbits fed graded levels of pigeon pea meals. Akanji *et al*. (2003) reported a decrease in feed intake when sesame seeds were fed in the diet of broilers. Ja'faru (2001) reported decreases in feed intake when graded level of lablab was fed in the diets of broiler finishers. All these authors attributed the reduction in feed intake when these unconventional legume seeds were fed to monogastric animals to lower palatability of these seeds compared to groundnut cake. The authors also argued that phytic acid and tannin present in most legumes are not easily destroyed by heat and they are implicated in reduced feed intake in monogatric animals. Report by Bawa *et al*. (2003a) shows only 31 and 45% destruction of phytic acid and tannin after boiling lablab seeds for 30 min at 100°C. Igene *et al*. (2002) had earlier reported that lablab seed contain high level of phytic acid and tannin, which impairs their utilization by monogastric animals.

Table 2: Composition of graded levels of *Lablab purpureus* beans diets fed to layers

	Treatments					
Ingredients	1	2	3	4	5	6
Maize	45.70	41.13	36.56	31.99	27.42	22.85
Groundnutcake	18.25	15.32	12.39	9.46	6.53	3.60
Lablab	0.00	7.50	15.00	22.50	30.00	37.50
Soyacake	5.00	5.00	5.00	5.00	5.00	5.00
Maize offal	20.00	20.00	20.00	20.00	20.00	20.00
Bonemeal	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	7.50	7.50	7.50	7.50	7.50	7.50
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Premix (Layers)	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
CP (%)	17.00	17.00	17.00	17.00	17.00	17.00
ME (kcal kg^{-1})	2609.00	2606.00	2604.00	2602.00	2600.00	2597.00
Crude fibre (%)	4.35	4.96	5.56	6.17	6.77	7.38
Calcium (%)	3.02	3.02	3.02	3.01	3.01	3.01
Phosphorus (%)	0.73	0.73	0.73	0.72	0.72	0.72
Lysine (%)	0.84	0.84	0.84	0.83	0.83	0.82
Meth+Cystine (%)	0.64	0.64	0.64	0.63	0.63	0.62
Feed cost (₦ kg^{-1} feed)	29.34	28.84	28.61	28.00	27.02	26.41

Biomix layers premix supplied the following per kg diet; Vit A,8500 iu; Vit D_3; 1500 iu;Vit E,10 iu; Vit K, 1 mg; Thiamine B_1, 1.5 mg; Riboflavin B_2 4.5 mg; Pyridoxine B_6 3 mg; Niacine, 15 mg; Vit B_{12} 0.015 mg; Pantothenic acid, 4.5 mg; Folic acid, 0.6 mg; Biotin, 0.5 mg; Choline chloride, 175 mg ; Anti oxidant, 1.25 mg; Manganese, 40 mg; Zinc, 30 mg; Iron, 20 mg; Copper, 3 mg; Iodine,1 mg; Selenium,0.2 mg; Cobalt,0.2 mg

Table 3: Response of laying hens to graded levels of *Lablab purpureus* beans diets

	Levels of lablab beans						
	1	2	3	4	5	6	
Parameters	0.00	7.50	15.00	22.50	30.00	37.50	SEM
Initial wt (g $bird^{-1}$)	1512.20	1508.51	1505.50	1511.84	1515.88	1512.12	4.75
Final wt (g b^{-1})	2146.73^{a}	2106.07^{ab}	2063.10^{ab}	2055.57^{ab}	2038.90^{b}	2005.57^{b}	21.27
Change in bw (%)	41.51^{a}	39.63^{ab}	37.05^{ab}	35.97^{ab}	34.50^{ab}	32.67^{b}	1.58
FI. (g $bird^{-1}$ day^{-1})	139.88^{a}	137.24^{b}	134.02^{c}	133.62^{c}	133.20^{c}	132.44^{c}	0.56
FE (No. of egg kg^{-1} feed)	5.96^{a}	5.52^{b}	5.42^{bc}	5.31^{c}	4.95^{d}	4.54^{e}	0.04
Hen-day (%)	79.83^{a}	77.12^{a}	72.49^{b}	72.47^{b}	67.85^{c}	65.43^{c}	0.95
Hen-housed (%)	79.83^{a}	78.88^{a}	72.49^{b}	70.22^{c}	67.85^{d}	63.54^{e}	0.53
Production at peak (%)	83.33^{a}	79.16^{b}	75.00^{c}	73.33^{d}	70.83^{e}	68.35^{f}	0.02
Av. final egg wt. (g)	62.56^{a}	61.37^{b}	60.69^{c}	59.67^{d}	58.47^{e}	58.45^{e}	0.03
Mortality (%)	0.00	2.78	0.00	2.78	0.00	2.78	1.39

Means within the same row with different superscripts are significantly different ($p<0.05$), SEM = Standard Error of the Means, FI = Feed Intake, FE = Feed Efficiency, BW = Body Weight, Wt = Weight

Feed efficiency (No of. eggs kg^{-1} feed), hen-day and hen-housed egg production, percent production at peak and average egg weight were found to be significantly ($p<0.05$) higher for the control diet than for all other diets, which contained lablab seed. This is understandable because the biological value of groundnut cake in terms of nutrient profile and digestibility and hence, the ability to supply necessary body nutrients for maintenance and production is better than that of lablab seeds (Bawa *et al*., 2003b; Ogundipe *et al*., 2003; Ani and Okeke, 2003). According to Bawa *et al*. (2003a), the digestibility of lablab seed for monogastrics is very low, usually below 50%. This low protein digestibility according to the authors is often associated with the presence of trypsin inhibitors, haemagglutinins and tannins. Igene *et al*. (2002) reported that two haemagglutinins isolated from the seed of some Indian varieties of lablab when fed to rats caused a marked depression in intake and weight gain. The authors went further to state that even after heat treatment, lablab seed proteins

Table 4: Effect of graded levels of lablab purpureus beans on feed efficiency, feed cost and age to 50% production of laying hens

	Levels of lablab beans						
	1	2	3	4	5	6	
Parameters	0.00	7.50	15.00	22.50	30.00	37.50	SEM
Feed/10 eggs	1.68^{a}	1.82^{b}	1.85^{c}	1.89^{cd}	2.03^{d}	2.21^{e}	0.01
Feed/12 eggs	2.02^{a}	2.18^{b}	2.22^{c}	2.27^{cd}	2.43^{d}	2.65^{e}	0.02
Feed kg^{-1} eggs	2.81^{a}	2.99^{b}	3.01^{b}	3.02^{b}	3.46^{c}	3.77^{d}	0.02
Feed cost/10 eggs	49.29^{a}	52.49^{b}	52.93^{b}	52.92^{b}	54.85^{c}	58.37^{d}	0.38
Feed cost/dozen eggs	59.27^{a}	62.87^{b}	63.51^{b}	63.56^{b}	65.66^{c}	69.99^{d}	0.46
Feed cost kg^{-1} eggs	82.45^{a}	86.23^{b}	86.12^{b}	84.56^{b}	93.49c	99.57^{d}	0.64
Income above feed expences (₦) at N10/egg	60.73^{a}	57.13^{b}	56.49^{bc}	56.44^{bc}	54.34^{c}	50.01^{d}	0.52
Age at 25% prod (days)	172.00^{c}	173.67^{c}	176.67^{c}	176.00^{c}	186.67^{b}	202.00^{a}	2.01
Age at 50% prod (days)	182.00^{c}	183.67^{c}	186.67^{c}	187.67^{c}	193.33^{b}	212.33^{a}	2.02
Age at peak prod (days)	206.33^{c}	208.00^{c}	210.67^{c}	215.00^{c}	220.67^{b}	236.67^{a}	1.92

Means within the same row with different superscripts are significantly different ($p<0.05$), SEM = Standard Error of the Means

Table 5: Effect of graded levels of lablab seed meal diets on egg quality parameters

	Levels of lablab beans						
	1	2	3	4	5	6	
Parameters	0.00	7.50	15.00	22.50	30.00	37.50	SEM
Haugh 25%	86.57	86.87	86.87	87.41	86.50	86.04	1.48
Eggwt 25%	54.35^{abc}	55.33^{ab}	55.72^{ab}	57.27^{a}	53.98^{bc}	51.70^{c}	0.68
RYCF 25%	2.20^{c}	2.41^{c}	2.48^{c}	2.60^{c}	3.50^{b}	4.45^{a}	0.25
Shell thick (cm)	0.04	0.05	0.05	0.05	0.05	0.05	0.10
Shell wt. (g)	5.89^{a}	5.89^{a}	5.92^{a}	5.94^{a}	5.51^{b}	5.36^{b}	0.06
Shell (%)	10.84	10.63	10.45	10.35	10.21	10.37	0.14
Yolk index	0.46	0.45	0.45	0.44	0.45	0.46	0.15
Haugh 50%	86.56	85.99	86.41	86.55	86.38	86.40	1.24
Egg wt. (g)	61.35^{abc}	61.81^{abc}	63.15^{ab}	63.99^{a}	60.21^{bc}	59.30^{c}	0.70
RYCF	2.03^{cd}	2.30^{c}	2.45^{c}	2.53^{c}	3.20^{b}	4.37^{a}	0.27
Shell thick (cm)	0.04	0.05	0.05	0.05	0.04	0.04	0.01
Shell wt. (g)	6.02^{abc}	6.07^{ab}	6.08^{ab}	6.18^{a}	5.97^{bc}	5.87^{c}	0.04
Shell (%)	9.83	9.83	9.83	9.66	9.92	9.90	0.15
Yolk index	0.46	0.46	0.47	0.47	0.46	0.45	0.11
Haugh Peak prod	86.47	86.24	86.45	86.55	86.26	86.46	1.12
Egg wt. (g)	63.34^{ab}	63.76^{a}	63.83^{a}	63.95^{a}	62.25^{bc}	61.92^{c}	0.29
RYCF	1.97^{d}	2.26^{cd}	2.43^{c}	2.51^{c}	3.52^{b}	4.35^{a}	0.12
Shell thick (cm)	0.04	0.05	0.05	0.05	0.04	0.04	0.02
Shell wt. (g)	6.07^{abc}	6.09^{abc}	6.13^{ab}	6.17^{a}	6.04^{abc}	5.98^{c}	0.03
Shell (%)	9.58	9.55	9.61	9.64	9.70	9.66	0.07
Yolk index	0.46	0.46	0.48	0.47	0.46	0.46	0.11

Means within each column with different superscripts are significantly ($p<0.05$) different, SEM = Standard Error of the Means, RYCF = Roche Yolk Colour Fan

were utilized for rat growth, only 25% as efficiently as Casein. This they attributed to polyphenolic compounds (tannins) in the seed coat. Legume grain proteins generally have a low biological value and this is often associated with low levels of the essential amino acids, methionine and cystine. The levels of lablab in the diet did not affect mortality rate. This indicates that the heat treatment applied rendered the seed adequately safe for consumption by the birds. Balogun *et al.* (2001) also did not record any mortality when cooked soyabean was incorporated in broiler diets. Feed per ten eggs, per dozen eggs and per kilogramme eggs produced were found to be significantly ($p<0.05$) better for the control group, which contained no lablab seed than for all the other groups fed graded levels of lablab in their diets (Table 4). This is attributed to better efficiency of feed utilization by birds in the control group. This in turn may be attributed to better nutrient supply by the groundnut cake based diet as opposed to the diets containing lablab seeds. Similar results have been reported by Balogun *et al.* (2001), Kaankuka *et al.* (2000), Bawa *et al.* (2003b) and Apata (2003).

A similar trend was observed for feed cost (₦/10 eggs, ₦/dozen eggs and ₦/kg eggs) where the control diet significantly ($p<0.05$) out-performed other diets in terms of lowering cost of producing eggs (Table 4). This is against the background that although increasing the level of lablab in the diets lowers feed cost per kilogram feed, the most important factor that determines cost of production and returns on input is the efficiency with which the birds convert the feed they eat to edible meat or eggs and not feed cost perse (Abeke *et al*., 2003; Apata, 1998). It had earlier been stated that the better nutrient profile of the control diet as compared to the other diets in terms of higher levels of the essential amino acids especially methionine and lysine, which are higher in groundnut cake than in lablab seeds, may have been responsible for the better utilization of the control diet.

Income above feed expenses was found to be significantly ($p<0.05$) better for the birds on the control diet than for all the other birds on lablab diets. As the level of lablab increased in the diet, there was a corresponding decrease in the profit margin.

The value obtained in this experiment for age of birds at 25, 50% and at peak egg production (Table 4) showed that the layers in the control group reached this production level faster than those on other diets. This suggests the possibility that the control diet may have met the maintenance and production requirements of the layers better than other diets containing lablab seeds. This result is similar to that obtained by Apata (2003). The author reported that higher production in laying hens is attained faster when there is adequate and balanced nutrients in their diets.

Egg quality parameters showed significances ($p<0.05$) for egg weight, Roche Yolk Colour Fan Score (RYCF score) and weight of shell (Table 5). Egg weight increased as the level of lablab increased in the diet up to 22.5% inclusion level before decreasing. The reason for this trend is not clear. The Roche Yolk colour Fan Score which is an indication of the intensity of the colour of the egg yolk, increased significantly ($p<0.05$) as the level of the lablab in the diet increased. This showed that lablab seeds contained some yolk-pigmenting factor. However, none of the lablab seed diet could give the consumer the minimum acceptable RYCF score of 4 (Abeke *et al*., 2003; Olorede and Longe, 2000). The weight of the egg shell followed the same trend as the egg weight. There was a gradual increase in weight of the eggshell up to the 22.5% lablab inclusion level before it started to decline. The reason for this is obvious. It is known that the bigger the egg, the bigger the need to secret more calcium and phosphorus for the shell to accommodate the egg. A similar result was obtained by Abeke *et al.* (1997) in an experiment to determine the effect of sun-dried sheep manure on egg quality parameters of laying hens. Other egg quality parameters such as Haugh unit value, shell thickness, percent shell and yolk index were not significantly ($p>0.05$) affected by including lablab in the diets of laying hens.

CONCLUSION

From the result obtained in this experiment it can be concluded that cooked *Lablab purpureus* beans can be included up to 7.5% in the diets of laying hens without any adverse effect. This will help to reduce feed cost (₦/kg feed) by at least 1.7%.

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