

Effect of cooking time on the nutritive value of Lablab Seed in Diets of Young Pigs

G. S. Bawa¹, S. O. Ogundipe¹, T. S. B. Tegbe² and I. I. Dafwang³

¹Department of Animal Science, ²National Animal Production Research Institute, ³National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria, Nigeria.

Abstract

Two trials were conducted using a total of ninety-six cross-bred (Large White X Landrace) young pigs to determine the effect of duration of cooking lablab seed on performance and nutrients digestibility. In the first experiment, 60 cross-bred (Large white X Landrace) young pigs averaging 11.50 ± 0.16 kg were used to determine the effect of duration of cooking lablab seeds on growth performance. The pigs used were fed iso-nitrogenous (20%CP) diets in which lablab seeds were either fed raw or cooked at 100°C for 15, 30, 45 or 60 minutes before incorporation into the diets. A soyabean meal based diet served as the control. Feed intake, daily weight gain, final live weight and feed conversion ratio were significantly ($P < 0.05$) better as the duration of cooking increased. The feed cost per unit gain also decreased significantly ($P < 0.05$) with increasing cooking time. The second experiment involved 36 cross-bred (Large White X Landrace) barrows averaging 10.48 ± 0.09 kg to examine the effect of duration of cooking lablab seeds at 100°C for 15, 30, 45 and 60 minutes on apparent nutrient digestibility. The test diets were similar in composition with those used in Trial 1. Intakes and apparent digestibilities of dietary dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF), Ash, Nitrogen free Extract (NFE) and nitrogen retention increased with increasing duration of cooking. It could be concluded that, for optimal performance and nutrients digestibility, lablab seeds should be cooked at 100°C for 30 minutes before incorporation into diets of young pigs.

Key words: Cooking time, Lablab Seeds, Performance, Digestibility, Young Pigs.

Introduction

In most developing nations of the world, there has always been a short supply of animal protein for the populace. This problem is further compounded by the accelerated increase in

human population, which create pressure on every form of food supply. This necessitates the need for rapid increase of animal production. One of the major constraints to animal production however, is inadequate feed supply. In Nigeria,

soyabean and groundnut cakes are the premium plant protein feedstuffs in livestock feed because of their high protein value and availability. These two feed ingredients are reference protein supplements in the diet of non-ruminants. However, the current pressure on these feedstuffs, resulting in high prices of feed and livestock products call for the need to source for alternative protein sources that will be cheaper and more available. Fajimi *et al* (1993) had earlier opined that evaluation of unconventional feed sources alongside other strategies would reduce pressure on the conventional feed ingredients and accelerate the attainments of feed security for the monogastrics.

Efforts have been made to use other protein sources such as palm kernel cake, cottonseed cake and sunflower seeds with encouraging results. However, there are many other legumes that are presently cultivated as fodder crops for ruminant, the seeds of which can be explored for their nutritional values in pig rations to replace the conventional but more expensive oil seed cakes. One of such under utilized legumes is lablab seeds.

Lablab Purpureus is a high yielding forage that is little known and not utilized as human or animal feed. In the northern part of Nigeria, where it is highly cultivated, it is used as a cover crop and the forage for feeding ruminants. While extensive work has been carried out on the use of the forage as protein supplements for the ruminants (Ummuna *et al*, 1995 and Otaru *et al*, 1998); the value of its seed as a feed stuff in the diet of monogastrics has not been fully explored. The crude protein content of mature seed ranges

from 25-27% on dry matter basis and it has a moderately well balanced amino acid profile with an exceptionally high content of lysine (Mendoza *et al*, 1991 and Souza *et al*, 1992). However, like other legumes, the raw seeds contain anti-nutritional factors such as trypsin inhibitors, phytates, hydrogen cyanide, tannins and haemagglutinins (Deka and Sarkar, 1990 and Seno *et al*, 1996) which can affect its acceptability and utilization as feed ingredients for pigs. Heat treatment among other methods of processing is known to enhance nutrient utilization of legume grains by animals (Balogun *et al*, 2001, Tuleun and Patrick, 2007 and Bawa *et al*, 2007). This study was therefore designed to determine the effect of cooking lablab seeds for different time durations on performance and nutrient digestibility of young pigs.

Materials and Methods

Source and Processing of Lablab Seeds

The lablab seeds used in this study were procured from a local market in Zaria, Kaduna State. Raw lablab seeds were cleaned and poured into a drum of boiling water. The seeds were allowed to cook for 15, 30, 45 or 60 minutes and the cooked seed spread out thinly on a concrete floor with occasional turning to dry to about 10% moisture content. The seeds were ground in a hammer mill and then incorporated into the experimental diets.

Experiment 1

Sixty cross-bred (Large White X Landrace) barrows and gilts averaging 11.50 ± 0.16 kg were used to determine the effect of cooking time on growth performance. The pigs were fed a

common diet and treated for both endo and ecto parasites prior to the commencement of the feeding trial. The animals were allotted to the dietary treatments in a complete randomized design with ten pigs per treatment. The compositions of the diets is presented in Table 1. Diet 1 with soyabean meal as major protein source served as the control. Diet 2 contained raw lablab seeds. Diets 3-6 were formulated with lablab seeds cooked at 100°C for 15, 30, 45 and 60 minutes, respectively. All the diets were formulated to be iso-nitrogenous (20%CP). The pigs were individually fed and watered *ad libitum* in a solid concrete floor pen (2.75 x 2.50 meters) at the Ahmadu Bello University Teaching and Research Farm, Zaria. Pigs were weighed at the beginning of the trial and also at weekly intervals. Refused feeds were weighed every morning to determine feed intake by difference. Average daily feed intake, average daily gain (ADG), feed conversion ratio and cost of feed per kg gain were calculated. The experiment lasted 56 days.

Experiment 2

Thirty six cross-bred (Large White X Landrace) barrows averaging 10.48 ± 0.09 kg were used in a completely randomized block design with cooking period as the blocking factor to test the effect of duration of cooking lablab seeds at 15, 30, 45 and 60 minutes, at 100°C on the apparent digestibility of dry matter, crude fibre, ether extract, ash, nitrogen free extract and nitrogen retention. The compositions of the test diets were similar to those used for the growth study (Table 1). The trial had three periods of faecal and urine collections of five days each and an adjustment period of five days between each collection period. Pigs were housed individually in metal metabolism crates (71.5 x 131.5 x 150.0cm²)

allowing for separate collections of faeces and urine. Each pig was fed at the rate of 4% body weight daily during the first period, of 6% body weight during the second period and 8% of body weight during the third period in two equal quantities at about 8.00 and 16 hours.

Urine was collected daily in plastic buckets into which 15ml of concentrated HCl was previously added. Each daily urine collection was measured and diluted to a constant volume of 4 litres. 100ml aliquot was then taken from each day's collection for each pig and stored in a refrigerator until analyzed for nitrogen. Faeces were collected daily for each period in plastic bags and stored in a deep freezer. The total collection for a period was dried in an oven at 105°C for 24 hours, cooled in a desiccator and weighed. At the end of the first collection period, the procedure was repeated for the subsequent periods with pigs re-allotted at random to the dietary treatments. Ferric oxide powder was added to the feed as an inert marker to identify the beginning and end of each collection period. Water was offered *ad lib*. At the end of the trial, representative feed and faecal samples were analyzed in triplicates for proximate composition according to the AOAC (1990) procedures.

Statistical Analysis

The data generated were subjected to Analysis of Variance and the significant differences between treatment means were determined by using the Duncan's Multiple Range Test according to SAS (1995).

Results and Discussion

Experiment 1

The results of the growth performance of the pigs are presented in Table 3. Feed intake, weight

Table 1: Composition of Diets Based on Soyabean Meal, Raw Lablab Seeds or Lablab Seeds Cooked at 100°C for Varying Time Periods Fed to Young Pigs

Diet	Duration of Cooking of Lablab Seeds (Minutes)					
	1	2	3	4	5	6
Ingredients (%)	SEM	0	15	30	45	60
Maize	55.52	50.90	50.90	50.90	50.90	50.90
Soyabean meal	26.78	-	-	-	-	-
Lablab seeds	-	30.40	30.40	30.40	30.40	30.40
Wheat offal	15.00	10.00	10.00	10.00	10.00	10.00
Blood meal	-	6.00	6.00	6.00	6.00	6.00
Limestone	0.50	0.50	0.50	0.50	0.50	0.50
Bone meal	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50	0.50
Vitamin premix ^a	0.20	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated nutrients levels and cost/kg of diet						
Gross Protein	20.00	20.00	20.00	20.00	20.00	20.00
Metabolizable Energy (Kcal/kg)	3054	3052	3052	3052	3052	3052
Calcium (%)	0.82	0.78	0.78	0.78	0.78	0.78
Phosphorus (%)	0.75	0.67	0.67	0.67	0.67	0.67
Ca:P	1.09	1.16	1.16	1.16	1.16	1.16
Fibre (%)	4.74	4.38	4.38	4.38	4.38	4.38
Lysine (%)	1.17	1.19	1.19	1.19	1.19	1.19
Methionine + cysteine (%)	0.72	0.68	0.68	0.68	0.68	0.68
Cost/kg of diet (N)	21.80	17.40	17.40	17.40	17.40	17.40

^aRoché VM502 contributed the following per kg of diet:

Vitamin A, 12,000 I.U.; Vitamin D₃, 12,000 I.U.; Vitamin E, 3.6 I.U.; Vitamin K, 1.8mg; Vitamin B₂, 3.6mg; Nicotinate, 18mg; Calcium-D-Pantothenate, 9.6mg; Biotin, 0.36mg; Vitamin B₁₂, 0.12mg; Choline Chloride 120mg; Chlortetra cyline, 4.8mg; Manganese, 24mg; Iron, 48mg; Zinc, 96mg; Copper, 60mg; Iodine, 1.8mg; Cobalt, 48mg.

Table 2: Chemical Composition of Experimental Diets Based on Soyabean Meal or Raw Lablab Seeds Cooked at 100°C for Varying Length of Time to Young Pigs

Parameters	Duration of Cooking of Lablab Seeds (Minutes)					
	SBM	0	15	30	45	60
Dry matter (DM) %	91.35	91.12	91.72	92.17	92.30	91.85
Analyses % of DM						
Crude protein (CP)	20.13	20.44	20.31	20.69	20.69	20.44
Crude fibre (CF)	6.19	6.31	6.54	6.80	7.17	7.03
Ether Extract (EE)	6.11	6.85	6.56	5.86	5.39	5.65
Ash	5.03	4.16	5.18	6.09	6.13	5.96
Nitrogen free extract (NFE)	62.54	62.24	64.41	64.56	60.62	60.92

Table 3: The Effect of Duration of Cooking of Lablab Seeds on the Performance of Young Pigs

Parameters	Duration of Cooking of Lablab Seeds (Minutes)					
	SBM	0	15	30	45	60
Average Initial live weight (kg)	11.20	11.78	11.43	11.50	11.28	12.02
Average Final live weight (kg)	34.75 ^a	17.73 ^b	22.43 ^b	30.05 ^a	31.75 ^a	30.10 ^a
Average Daily feed intake (kg)	1.19 ^a	0.49 ^c	0.61 ^c	0.83 ^{ab}	0.95 ^b	0.85 ^{ab}
Average Daily weight gain (kg)	0.42 ^a	0.11 ^c	0.20 ^c	0.34 ^{ab}	0.37 ^{ab}	0.30 ^b
Total weight gain (kg)	23.50 ^a	5.93 ^c	11.00 ^c	18.80 ^{ab}	20.55 ^{ab}	16.96 ^b
Feed conversion ratio	2.83 ^a	4.80 ^c	3.48 ^b	2.65 ^b	2.53 ^b	3.05 ^c
Feed cost per kg gain (N)	61.95 ^a	88.73 ^c	56.30 ^b	48.42 ^b	45.91 ^b	56.60 ^b
Mortality (%)	0	0	0	11	11	11

ab Means within the same row bearing different superscripts are significantly different (P < 0.05)

gain, feed conversion ratio and feed cost per unit gain varied significantly ($P<0.05$) among dietary treatments. Pigs on diets 2 and 3 in which lablab seeds were fed raw or cooked for 15 minutes, respectively, had significantly ($P<0.05$) depressed feed intake compared to those on the soyabean meal diet or diets containing lablab seed cooked for 30, 45 and 60 minutes, respectively. Animals on the control (soyabean meal diet) consumed more feed than those on raw and cooked lablab seed diets.

The significant ($P<0.05$) depression in feed intake of pigs fed raw lablab seed based diets compared to those fed the soyabean meal or cooked lablab seed diets supported the reports of Cooke and Frayley (1995). These authors observed depressed feed intake in pigs fed raw soyabean diet. Lablab seeds in the raw state contain anti-nutritional factors (Deka and Sarkar, 1990; Manjunath and Devaraj, 1995 and Bawa, 2003) which might have possibly imparted undesirable taste to the diet, consequently, lowering the palatability and acceptability by the animals. Most of the anti-nutritional factors in legume grains are known to be heat labile (Liener and Kakade, 1980). The decrease in the concentration of dietary anti-nutritional factors with increase in duration of cooking of the lablab seeds could be responsible for the significant ($P<0.05$) increase in feed intake of pigs fed diets containing lablab seeds cooked for 30, 45 or 60 minutes compared to those on diets containing raw or lablab seeds cooked for 15 minutes.

Dietary treatments resulted in significant ($P<0.05$) growth differences. Pigs fed the raw or lablab seeds cooked for 15 minutes had significantly ($P<0.05$) depressed growth rate

compared to those that were fed the soyabean meal (control) diet or diets containing lablab seeds cooked for 30, 45 and 60 minutes, respectively. This observation is consistent with the report of Kaankuka *et al.* (2000); Tuluen and Patrick (2007) and Bawa *et al.* (2007). These authors reported that raw or improperly heated legume seeds (as could the case with the 15 minutes of cooking) fed as the main source of protein in diets for the monogastrics can depress growth and efficiency of feed utilization. Most legume proteins are globular molecules which are completely folded in the raw bean. This nature shows little susceptibility to proteinases until their internal structure is disrupted. Cooking the lablab seeds for 30-60 minutes in the present study probably altered the chemical structure of the proteins and made them more susceptible for enzyme digestion to bring about increase in weight gain. The slight decrease ($P>0.05$) in weight gain of pigs fed lablab seeds cooked for 60 minutes was in consonance with Chau-chifai *et al.* (1997). These authors reported significant ($P<0.05$) loss of all the sulphur amino acids that are critical in tissue protein synthesis when cooked at 100 °C for 60 minutes. This suggests the need for careful control of cooking conditions to prevent functional, as well as, nutritional damage to protein due to excessive heat.

Feed conversion ratio for diet with lablab seed cooked for 15 minutes, was similar to the raw lablab seed diet ($P>0.05$) but differed significantly from other dietary treatments. This shows that cooking lablab seeds for 15 minutes was not enough to reduce the anti-nutritional factors to tolerable levels for the pigs. The significantly poorer feed conversion ratio of pigs

fed the raw or 15 minutes cooked lablab seeds supported the results of earlier workers (Pontiff *et al.* 1987 and Fashina-Bombata and Tewe, 1995). They observed a significant ($P<0.05$) decrease in feed conversion ratio of pigs fed raw soyabean meal diet compared to those that were fed either soyabean meal or cooked soyabean diets. Rahman *et al.* (1997) in a similar study, reported a significant ($P<0.05$) reduction in feed conversion ratio of rats fed 6% raw lablab seed meal. The poor utilization of the raw and 15 minutes cooked lablab seed based diets could also be an indication of the inability of the young pigs to digest and absorb some proteins and peptides in the raw state.

The significantly higher ($P<0.05$) feed cost per kg weight gain observed for animals on raw lablab seed diet compared to those fed the control or cooked lablab seed based diets could be attributed to the poor rate of conversion of amino acids in raw lablab seeds into meat. The cost per unit weight gain of pigs fed cooked lablab seed based diets were slightly lower (although not significantly) than those on the soyabean meal diet. This could be due to the current high cost of soyabean meal (N50,000.00 per ton as at 2002) than lablab seeds (N25,000 per ton as at 2002). This suggests that the use of cooked lablab seeds to replace soyabean meal in pigs' diet may result in substantial savings in terms of feed cost.

Experiment 2

The results of experiment 2 are presented in Table 4. Intake and apparent digestibility of dietary dry matter, crude protein, ether extract, crude fibre, ash, nitrogen free Extract and nitrogen retention increased significantly ($P>0.05$) with increase in duration of cooking lablab seeds.

Table 4: The Effect of Duration of Cooking Lablab Seeds on Dry Matter Intake and Apparent Digestibility of Dry Matter, Crude Protein, Crude Fibre, Ether Extract, Ash, Nitrogen Free Extract and Nitrogen Retention by Young Pigs

Treatment	1	2	3	4	5	6	SEM
Average daily DM intake (kg/pig/day)	1204.08	1403.60 ^a	1705.00 ^a	1854.00 ^a	1107.00 ^b	1258.00 ^b	5.39
Apparent DM digestibility (%)	83.30 ^a	80.30 ^b	82.50 ^a	83.48 ^a	81.54 ^a	88.62 ^a	1.16
Apparent CP digestibility (%)	78.92 ^a	66.10 ^b	74.47 ^a	78.65 ^a	80.66 ^a	85.81 ^a	4.56
Apparent CF digestibility (%)	70.54 ^b	65.70 ^b	69.51 ^a	69.17 ^a	73.38 ^a	80.39 ^a	2.05
Apparent EE digestibility (%)	89.37 ^a	87.95 ^a	90.83 ^a	90.76 ^a	91.24 ^a	91.46 ^a	1.66
Apparent ash digestibility (%)	49.23 ^b	35.34 ^c	45.60 ^b	61.32 ^a	65.85 ^a	68.07 ^a	6.63
Apparent NFE digestibility (%)	89.82 ^a	85.70 ^a	88.02 ^a	89.28 ^a	88.69 ^a	91.75 ^a	0.906
Apparent Nitrogen retention (%)	60.06 ^a	7.60 ^b	46.50 ^b	60.58 ^a	62.56 ^a	64.85 ^a	3.74

^{a,b} Means within the same row, bearing different superscripts are significantly different ($P<0.05$); SEM - Soyabean meal; SEM - Standard error of mean.

The significantly depressed ($P<0.05$) dry matter intake observed for pigs fed raw or 15 minutes cooked lablab seed diets in relation to the other dietary treatments supported the findings of Fashina-Bombata and Tewe (1995), who reported depressed feed and dry matter intake by pigs fed raw soyabean diet. It is possible that, the inherent anti-nutritional factors in the raw and 15 minutes cooked lablab seeds reduced the palatability and acceptability of the diet with consequent decrease in overall dry matter intake. The observed improvement in dry matter intake of pigs fed cooked lablab seed diets over those fed raw lablab seed diet supported the view that cooking or steaming of legume grains could enhance feed intake (Abiola, 1999). The increased dry matter digestibility as the duration of cooking increased supported the work of Kaankuka *et al.*, (1996). They observed a linear increase in the apparent dry matter digestibility of young pigs as the duration of cooking of the seeds increased. This may be due to the effect of heat on the cell components of the dietary fibre. A denaturation of the structure of the cell wall with increase in duration of cooking might have enhanced the contact between the digestive enzymes and the dry matter components.

The significantly ($P<0.05$) lowered apparent crude protein digestibility observed on pigs fed the raw and 15 minutes cooked lablab seeds could be due to the presence of trypsin inhibitors, haemagglutinins or tannins in the raw seed (Manjuntan and Devaraj, 1995) and this agreed with the reports of Alam *et al.* (1997). However, thirty minutes duration of cooking the raw lablab seeds in this study resulted in significantly ($P<0.05$) improved apparent crude protein digestibility.

Cellulose and other cell wall components are known to affect the digestibility and retention of fibre by pigs (Yaakough *et al.*, 1988). In this trial, crude fibre digestibility increased with increased duration of cooking. This could be due to increased degradation of polysaccharides and cell wall components with increase in the length of cooking of the lablab seeds.

Apparent ether extract digestibility was not significantly affected by duration of cooking. Apparent Nitrogen free Extract (NFE) and ash digestibilities increased significantly ($P<0.05$) with increased duration of cooking. The presence of indigestible carbohydrates and other pectin-like substances in the raw lablab seeds may be responsible for the lowered NFE digestibility observed for pigs on the raw lablab seed diets. The interactions between the phytic acid and the dietary minerals to form chelates and the inability of the animals to break down the chelates to release the minerals as a result of the low phytase activity could be responsible for the lower apparent ash digestibility.

Not much work has been done on the effect of duration of cooking on apparent nitrogen retention of feeds containing lablab seeds by pigs. However, in this study, the apparent nitrogen retention increased significantly ($P<0.05$) as the duration of cooking lablab seed increased. In agreement with this findings, Kaankuka *et al.* (1996) in a similar study with soyabean observed significant ($P<0.05$) increases in nitrogen retention with increased duration of cooking. Vander Grif *et al.* (1983) also observed significantly improved retention of nitrogen in pigs fed heated soyflakes. Lowered nitrogen intakes of pigs on Treatments 2 and 3 could also be a significant factor in explaining the lower

daily nitrogen retention for those diets, than were observed for other diets.

Conclusion

Heat treatment is essential in improving the nutritional value of lablab seeds. Cooking lablab seeds for 30 minutes significantly ($P<0.05$) improved the apparent nutrient digestibilities and retention to bring about significant growth performance. It could therefore be concluded that, thirty minutes cooking time is adequate for processing lablab seeds before incorporation into the diets of young pigs.

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