# Proximate, Amino Acid, Anti-Nutritional Factor And Mineral Composition Of Different Varieties Of Raw Lablab Purpureus Seeds

Shaahu, D.T., Kaankuka, F.G., Okpanachi, U

**Abstract:** Proximate chemical, amino acid, anti- nutritional factors (ANF) and mineral composition of Highworth, Rongai White and Rongai Brown varieties of Lablab purpureus seed were determined. Lablab purpureus seed irrespective of the variety was lower in crude protein but higher in crude fibre than FFSB. The three varieties of lablab seed analyzed in the present study contained between 7.22-9.23% of crude fibre while the crude protein content ranged between 24.88-34.33g/100g. The ether extract (EE) content (2.99-5.87%) of lablab seed is low compare to other legume seeds such as soyabeans and groundnuts. Due to this low oil content, lablab seed may not be suitable as a commercial source of oil, reducing the competition for lablab seed from vegetable oil industries. The natural limiting amino acid lysine in cereals is satisfactorily high (mean value is above FAO reference pattern) in lablab seed. The mean values of the essential amino acids (lysine, histidine, valine, methionine, isoleucine, leucine and phenylalanine) in lablab seed are higher than the values reported for FFSB. This suggests that lablab seed can be exploited in feed formulation as an excellent source of amino acid. The aniti-nutritional factors identified in lablab seed are trypsin inhibitors, hydrogen cyanide, phytate, tannin, oxalates, alkaloids, saponin and haemagglutinins which must be deactivated to improve seed utilization. Lablab seed contained 0.3-5.3g/100g of major and 14.9-54.5mg/kg of minor minerals assayed, and this is also low compared to soyabean and groundnut.

**Key words**: Nutrient, anti-nutritional factors, raw lablab seeds

## 1 INTRODUCTION

CONVENTIONAL feedstuffs such as soyabean and groundnuts have been used extensively in monogastric animals' diets; but they are becoming difficult to source, and when available, the cost is very high, that is unaffordable, especially for small and medium scale farmers. One common cause for the high cost of raising animals is the developing countries is the high cost of feeding ingredients, and poor feeding strategies. For these, animal protein consumed by an average Nigerian decreases on daily basis due to the high cost of meat and eggs in the market. It is observable that the demand for animal protein in developing countries like Nigeria has far outstripped the supply. The increase in the production of the minor legumes, many of which have low preference or are unsuitable for human consumption, could help in reducing the over dependence on the conventional ones, notably, soyabean and groundnut (Shaahu et al., 2012). Therefore, the need for increase in the livestock production in such countries like Nigeria must require the exploitation of the nonconventional feed ingredients. One such legume that could be exploited to serve as an alternative source of nutrients in monogastric diets is the seed of Lablab purpureus (Lablab). Of the two hundred types of lablab recognised, only two cultivars, Rongai and Highworth, are available commercially (Cameron, 1988). Additionally, three subspecies have been identified: ssp purpureus, ssp benghalensis and ssp uncinatus.


- *Department of Animal Production, University of Agriculture PMB 2373, Makurdi, Benue State, Nigeria. 07039239677 E-mail: dtshaahu@gmail.com*
- *Department of Animal Nutrition, University of Agriculture Makurdi, Benue State*


Rongai is a late maturing white flowering cultivar that will continue to grow for several months until cut (Cameron, 1988; Oram, 1990), seeding poorly in frosty areas. Highworth cultivar was originally intended for grain production in districts (Australia) where early frosts prevented the seeding of Rongai (Cameron, 1988; Oram, 1990). The study is aimed at evaluating the nutritional value different varieties of the seed of lablab. The study is aimed at evaluating the nutritional value of different varieties of the seed of lablab. The objective is therefore to determine the proximate chemical, amino acid profile and anti-nutritional factor and Mineral composition of three varieties (Highworth, Rongai White and Rongai Brown) of lablab seed.

## 2 MATERIAL AND METHODS

The lablab purpureus beans used in this study were the Highworth (black), Rongai White and Rongai Brown varieties. They were obtained from the National Animal Production Research Institute (NAPRI), Zaria, Nigeria. The raw samples of these three varieties were milled and analysed for proximate chemical composition (to include gross energy), mineral composition and the antinutritional factors according to standard procedures of analysis. Proximate chemical composition of lablab seeds was determined according to official methods of analysis (A.O.A.C., 1995). Nitrogen free extract (NFE) was obtained by difference, while gross energy was determined using the adiabatic oxygen bomb calorimeter technique. Tannin was determined according A.O.A.C., (1995) using methanol/paraffin impregnated double layered Whatman No 41 filter paper, and Folin-Denis reagent. Trypsin inhibitory activity was determined according to the method of Kakade et al. (1974), according to which one trypsin inhibitor unit (TIU) is defined as an increase of 0.01 absorbance units at 280nm per 10ml of the reaction mixture under the conditions of the procedure. Saponin was also determined according to the procedures of Kakade et al., (1974), and phytate was determined according to Maga, (1983). Haemagglutinin was determined according to Liener,

(1955), Oxalate and Alkaloid according to the methods of Henry, (1993) and hydrocyanic acid using the modified alkaline titration method (A.O.A.C, 1995). Amino acid profile was determined using the methods of A.O.A.C. (1995), and a chemical score was calculated using the concept of Block and Mitchell (1946). Mineral content was determined by wet-ashing, followed by refraction in an Atomic Absorption Spectrophotometer (Model: Philip Analytica PU 9100X).

## 3 RESULTS AND DISCUSSIONS

The proximate chemical composition of the three varieties of lablab seed studied is shown in Table 1. The dry matter ranged between 90.27-94.11g/100g while the crude fibre and ash respectively ranged from 7.22-9.73 and 4.77-8.82g/100g The Highworth variety contained lower dry matter, crude fibre and ash, but was higher in crude protein and ether extract than the Rongai varieties. The crude protein and ether extract ranged between 24.88-34.33g/100g and 2.99-5.87g/100g respectively. This study has shown that the mean crude protein (CP) content of the three varieties of lablab seed was 29.20% with the Highworth variety having the highest content of 34.30%. The crude protein of each of the Rongai varieties is within 23-28% range reported by Murphy and Colucci, (1999) and Ogundipe et al. (2003). The crude protein value of the Highworth variety is closer to that of full fat soyabean (FFSB) compared to the Rongai varieties. The mean crude protein content of the three varieties of lablab seed assayed in the present study is similar (P>0.05) to the 29% crude protein content of mucuna seed; a wild leguminous plant (6), but higher than 21% crude protein content of pigeon pea seed (Iorgyer, 2010) and 24% CP of cowpea (8). Each of the three varieties of lablab seed analyzed in the present study contained less (7.22-9.23%) crude fibre (CF) than the 11.19% CF reported by Murphy and Colucci (1999) for lablab seed. The CF values obtained from this study are higher than the amount of CF in FFSB (5.55%), pigeon pea (5.00%) and Mucuna (5.53%) as reported by Tuleun and Patrick (2007); Ogundipe et al. (2003); Murphy and Colucci (1999) respectively. The ether extract (EE) content (2.99-5.87%) of lablab seed in the present study is low compare to the 9.13% EE (5), but higher than the 1.9% EE (Osman, 2007) for lablab seed. The values are also higher than the ether extract content (2.10% and 1.41%) of pigeon pea reported by Ogundipe et al. (2003); Iorgyer, (2010) respectively. Compared with other legume seeds such as FFSB and mucuna, the mean value (3.95%) of EE obtained for lablab seed in the present study is low, indicating that lablab seed may have lower energy value from fat than the other legume seeds. The unavailability and when available, the high cost of FFSB is implicated by the numerous use it is being put to by human especially as an oil source in the oil industries. Due to this low oil content, lablab seed may not be suitable as a commercial source of oil, reducing the competition for lablab seed from vegetable oil industries. Therefore, lablab seed when produced would always be available at a lower cost for livestock feed than FFSB. Amino acid analysis of the three varieties of lablab seed in the present study revealed that lablab seed contains (fairly) high levels of both essential and non essential amino acids. The chemical scores indicate that all the essential amino acids except methionine, compare favourably with the FAO reference pattern, and have overall score of 84.38% on the index of protein quality.

Table 1: PROXIMATE CHEMICAL COMPOSITION OF THREE VARIETIES OF RAW *Lablab purpureus* SEEDS

| Nutrient | Highworth | Rongai Brown | Rongai White | Mean | SD | CV (%) |
|---|---|---|---|---|---|---|
| Drymatter (g/100g) | 90.27 | 93.77 | 94.11 | 92.72 | 2.13 | 2.29 |
| Crude protein (g/100g) | 34.33 | 24.88 | 28.38 | 29.20 | 4.77 | 16.33 |
| Crude fiber (g/100g) | 7.22 | 9.73 | 8.04 | 8.33 | 1.28 | 15.37 |
| Ether extract (g/100g) | 5.87 | 3.00 | 2.99 | 3.95 | 1.66 | 41.99 |
| Ash (g/100g) | 4.77 | 6.85 | 8.82 | 6.81 | 2.03 | 29.81 |
| *NFE (g/100g) | 47.81 | 55.54 | 51.77 | 51.71 | 3.87 | 7.48 |
| GE (kcal/kg) | 3771 | 3831 | 3791 | 3798 | 30.55 | 0.80 |

*NFE= 100-(%Moisture + %CP + % CF +%EE +%ASH)
+Each value represents a mean of three determinations
-Proximate values are on as fed basis
SD= Standard deviation
CV= coefficient of variation

Lablab seed contains comparably high level of lysine, which is the most limiting amino acid in many cereals (Olumu, 1995). The mean value of lysine in lablab seed is above FAO reference pattern. The mean values of the essential amino acids (lysine, histidine, valine, methionine, isoleucine, leucine and phenylalanine) in lablab seed are higher than the values reported (Olumu, 1995). The essential and non essential amino acids in lablab seed in this study are also higher than reported values for Tephrosia seed (Carew, 1986). The findings of the present study disagree with the conclusion (Onochie, 1965), that soyabean protein contains more lysine than all other sources of plant protein. On the other hand, the implication could be that lablab seed has more lysine than any other plant protein source. Anti nutritional factors of three varieties of lablab seed The mean tannin content (1.74%) of raw lablab seed observed in the present study is higher than the 0.42 % tannin in raw lablab seed reported (Osman, 2007). This amount is also higher than the 1.41% found in mucuna (Tuleun and Patrick, 2007), 0.34% in African oil bean seed (Enujiugha and Agbede, 2000) and 0.94g/100g reported for winged bean (Igene et al., 2001).

**Table 2: Amino acid composition (%) of three varieties of *lablab purpureus* seed**

| Amino acid | High-worth | Rongai Brown | Rongai White | Mean | SD | CV (%) | FFSB[a] (%) |
|---|---|---|---|---|---|---|---|
| Lysine* | 5.78 | 5.20 | 6.22 | 5.73 | 0.51 | 8.92 | 6.84 |
| Histidine* | 2.99 | 2.59 | 3.10 | 2.89 | 0.27 | 9.34 | 3.03 |
| Arginine* | 6.64 | 5.30 | 4.95 | 5.63 | 0.89 | 15.84 | 7.47 |
| Aspartic acid | 9.83 | 9.32 | 10.06 | 9.74 | 0.38 | 3.89 | 11.90 |
| Threonine* | 3.03 | 3.04 | 3.26 | 3.11 | 0.13 | 4.18 | 3.85 |
| Serine | 3.52 | 3.32 | 2.99 | 3.28 | 0.27 | 8.23 | 4.15 |
| Glutamicacid | 15.68 | 13.20 | 12.82 | 13.9 | 1.55 | 11.17 | 18.60 |
| Proline | 3.05 | 2.85 | 3.05 | 2.98 | 0.12 | 4.03 | 5.10 |
| Glycine | 3.48 | 5.15 | 4.76 | 4.46 | 0.87 | 19.51 | 3.93 |
| Alanine | 4.63 | 4.19 | 5.02 | 4.61 | 0.42 | 9.00 | 4.19 |
| Cystine | 1.19 | 1.19 | 1.06 | 1.15 | 0.08 | 6.55 | 1.64 |
| Valine* | 4.82 | 5.09 | 4.83 | 4.91 | 0.15 | 3.12 | 4.72 |
| Methionine* | 1.30 | 1.41 | 1.25 | 1.32 | 0.08 | 6.20 | 1.39 |
| Isoleucine* | 4.02 | 3.62 | 3.18 | 3.61 | 0.42 | 11.65 | 3.98 |
| Leucine* | 6.80 | 7.45 | 6.80 | 7.02 | 0.38 | 5.35 | 7.61 |
| Tyrosine | 3.17 | 3.18 | 3.18 | 3.18 | 0.006 | 0.18 | 4.94 |
| Phenylalanine* | 4.62 | 6.35 | 4.81 | 5.26 | 0.95 | 18.04 | 5.76 |

*= Essential amino acids a= Vasconcelos *et al.*, (1997) FFSB= Full fat soyabean
SD=Standard deviation CV= Coefficient of variation

The poor palatability associated with high tannin diets can be ascribed to its astringent property which is a consequence of its ability to bind with protein of saliva and the mucosal membrane of the mouth during the mastication of food (Aletor, 1999). The values (2.17% and 2.25%) of alkaloids obtained in lablab seed in this study may be fatal if much of the seed is consumed. Twenty mg/100g alkaloid is considered toxic level (Aletor, 1999). The range of saponin in lablab seed analysed in the present study can be compare to 1.1% found in mucuna seed (Tuleun and Patrick, 2007). The range of 0.96-1.33% in the present study is at variance with the range of 0.23-0.57mg/100g reported (Abeke et al., 2008). Saponin in seeds imposes an astringent taste that affects palatability, reduce feed intake, affects the utilization of protein (Aletor, 1993), and consequently body growth. The Rongai varieties of lablab seed assayed in the present study has higher trypsin inhibitor than the value (28.96mg/kg protein) obtained (Osman, 2007) for raw lablab seed. The value of trypsin inhibitor obtained for the Highworth variety (29.64mg/kg protein is in agreement with the finding (Osman, 2007), for lablab seed. Highworth variety seed contain lower value while the Rongai varieties contained higher values of trypsin inhibitor than 33.59TIU/mg found in mucuna seed (Tuleun and Patrick, 2007). The haemaglutinin range (41.37-53.64HU/mg) obtained for lablab seed in the present study is high compared to 4.0HU/mgN for winged bean (Igene et al., 2001) and 8.0 HU/mgN for M. pruriens seed flour (Agbede and Aletor, 2005). The binding of hemagglutinins to intestinal membrane of animals is believed to impair the normal absorption of dietary nutrients when feed stuffs containing these factors are consumed. The mean hydrogen cyanide value of 73.23mg/kg found in lablab seed in the present study is above the safe upper limit stipulated by FAO (10mg/kg) (Makkar and Becker, 1998) as safe for human consumption. The lethal dose of cyanide has been variously put at between 0.5 and 4.0 mg/kg of HCN/kg of body weight (Montgomery, 1969). The range of 0.36-0.88% oxalates obtained for lablab seed varieties in the present study with an average of 0.55% is below the established toxic level (Umaru et al., 2007). Oxalate content in the lablab seed assayed in the present study is also less than 1.95% found in raw mucuna seed (Tuleun and Patrick, 2007). Oxalates can bind to calcium present in food thereby rendering calcium unavailable for normal physiological and biochemical role such as the maintenance of strong bone, teeth, co-factor in enzymatic reactions, nervous impulses transmission and as clotting factor in the blood (Ladeji et al., 2004). The level of phytate in Highworth variety is less than 1.56% reported for mucuna by Tuleun and Patrick (2007); their value is however, lower than the values in the Rongai varieties and the mean (1.72%) of the three varieties in the present study.

**Table 3: Anti-nutritional factor content[+] of three varieties of *lablab purpureus* seed**

| Anti-nutritional factor | High-worth | Rongai Brown | Rongai White | Mean | SD | CV (%) |
|---|---|---|---|---|---|---|
| Tannin (%) | 1.95 | 1.54 | 1.73 | 1.74 | 0.21 | 11.79 |
| Alkaloids (%) | 2.25 | 2.25 | 2.17 | 2.22 | 0.05 | 2.08 |
| Saponin (%) | 0.96 | 1.33 | 1.24 | 1.18 | 0.19 | 16.40 |
| T I (TIU/mg) | 29.64 | 41.67 | 44.24 | 38.52 | 7.79 | 20.24 |
| HA (HU/mg) | 41.37 | 42.71 | 53.64 | 45.91 | 6.73 | 14.66 |
| HCN (mg/kg) | 81.75 | 64.67 | 73.28 | 73.23 | 8.54 | 11.66 |
| Oxalates (%) | 0.88 | 0.36 | 0.40 | 0.55 | 0.29 | 52.73 |
| Phytate (%) | 1.25 | 1.88 | 2.04 | 1.72 | 0.42 | 24.42 |

TI=trypsin inhibitor; HA=haemagglutinin; HCN=hydrogen cyanide +Each value represents a mean of two determinations SD= Standard deviation CV= coefficient of variation

The ash content in each of the three varieties of lablab seed in the present study is higher than the ash content of lablab seed reported by Ogundipe et al. (2003). The ash values obtained for lablab seed in the present study are also higher than values reported for pigeon pea (5.50), FFSB (4.0) and mucuna (4.43), by Amaefule and Obioha, 2001; Ikurior et al., 1993: and Tuleun and Patrick, 2007 respectively. The high level of ash in lablab seed is an indication of the level of mineral matter in the seeds compared to other legume seeds. The role of ash in digestibility of feed nutrient however depends on the mineral composition of the ash. The mineral composition of three varieties of Lablab purpureus is shown in Table 2. The Highworth variety is superior in P and Mg content and similar in its content of Ca and Na to the other varieties. The variability in the mineral elements among varieties of lablab seed in the present study is highest for Mg, Zn, Cu, P and K in that order, while Na, Ca, Fe, Mn and Cl were most uniformly distributed, judging by the coefficients of variation. Variation in mineral contents in plants is largely due to genetic origin, geographic source, level of soil fertility, and efficiency of mineral uptake. It appears as though varietal differences, expressed by capability of the plants to absorb mineral elements do exist, just as differences in soil types affect the availability of the mineral elements to plants generally. This agrees with the report by Stansbury et al. (1953) that varietal and environmental factors have significant influence on the mineral, especially P content of cotton seeds. Compared to other oil seed like sunflower and cotton seed, lablab seed varieties in the present study have low mineral content (Ikurior and Fetuga, 1987). This could limit the use of lablab seed in young animal diets if mineral supplements are not added.

Table 4: MINERAL COMPOSITION OF THREE VARIETIES OF *Lablab purpureus* SEI

| Mineral | Highworth | Rongai Brown | Rongai White | Mean | SD | CV(% |
|---|---|---|---|---|---|---|
| K(%) | 0.49 | 0.50 | 0.59 | 0.53 | 0.06 | 10.46 |
| Na(%) | 0.03 | 0.03 | 0.03 | 0.03 | 0.00 | 0.00 |
| P(%) | 0.34 | 0.28 | 0.36 | 0.33 | 0.04 | 12.74 |
| Ca(%) | 0.16 | 0.16 | 0.16 | 0.16 | 0.00 | 0.00 |
| Mg(%) | 0.09 | 0.06 | 0.07 | 0.07 | 0.02 | 20.83 |
| Fe (mg/kg) | 56.00 | 53.65 | 53.90 | 54.52 | 1.29 | 2.37 |
| Mn (mg/kg) | 38.45 | 36.65 | 38.45 | 37.85 | 1.04 | 2.75 |
| Cu (mg/kg) | 12.45 | 15.55 | 16.75 | 14.92 | 2.22 | 14.88 |
| Zn (mg/kg) | 62.65 | 45.40 | 50.05 | 52.70 | 8.93 | 16.94 |
| Cl (mg/kg) | 2220 | 2191.00 | 2270.50 | 2227.17 | 40.23 | 1. |

+Each value represents a mean of two determinations
SD= Standard deviation CV= coefficient of variation

## 4 CONCLUSION RECOMMENDATIONS

Lablab purpureus seed is a good source of amino acid but it contained some antinutritional factors that must be deactivated for effective utilization in monogastric nutrition. It has a low mineral content which preclude it from been a good mineral feed ingredient. Lablab seed could serve as a valuable feed ingredient in the developing nations like Nigeria where feed is a very important limiting factor to livestock production. Where it will serve as a close substitute for soyabean, though with lower crude protein and higher crude fibre levels.

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