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Nutrient Composition and Antinutritional Factors of *Dolichos lablab* L. Seeds

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ABSTRACT

The mature seeds of five cultivars of dolichos bean (Dolichos lablab *L.) were analysed for some nutritional and antinutritional factors. The cultivars showed considerable variation in their composition. On a dry matter basis, the percentage of crude protein varied from 22·4 to 31·3, crude fibre, 7·62 to 9·63 and total carbohydrate, 54·2 to 63·3. The amounts (mg/100 g) of calcium, phosphorus, phytate phosphorus and iron ranged from 36·0 to 53·5, 388 to 483, 282 to 380 and 5·95 to 6·90, respectively. All the cultivars tested contained moderately high levels of TIA and 2400–3200 TIU* g^{-1}*, on a dry weight basis, of the seeds. Phytic acid and tannins varied from 1000 to 1350 and 2000 to 2205 mg/100 g, respectively.*

INTRODUCTION

Food legumes generally are important sources of proteins (Chung & Satterlee, 1979; Martinex, 1979; Platt, 1980). Therefore, they may be utilized to relieve the problem of protein deficiency in many parts of the world. Despite their low digestibility (Koehler *et al.*, 1986) and occurrence of antinutritional factors such as hemagglutinins, saponins, trypsin inhibitors and phytins (Kakade & Evans, 1963; Liener, 1966; O'Dell & Savage, 1969), legumes are an important source of protein for countries having short supplies of animal proteins. Some legumes are rich, not only in protein, but also in other chemical entities such as starch, oils, vitamins and mineral elements (Oyenuga, 1968; Lolas & Markakis, 1975; Ukhun, 1986). They

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have, therefore, been exploited economically in the diet in combination with cereals in the right proportion to make them nutritionally balanced and this appears to be the only feasible approach to eliminate 'Protein-calorie malnutrition' in the developing countries.

The dolichos bean (*Dolichos lablab* L.) is one such group of leguminous crop, known as country bean and locally as *Urahi*, and is evaluated in the present study; it is believed to have originated in India as wild forms. It is a herbaceous perennial plant but cultivated as an annual. The cultivated strain is a vine. The bean is commonly used for cooking purposes with or without green shell or dry seeds as pulse and is consumed in several parts of India.

The present study was initiated to determine the nutrient composition of dolichos bean seeds, because they might provide a useful protein food in India. In view of the reports that overeating of the bean is associated with toxicity, the seeds were also examined for the presence of some antinutritional factors.

MATERIALS AND METHODS

Seeds of five local dolichos bean cultivars, namely, Kala Urahi, Boga Urahi, Rangee Urahi, Kajala Urahi and Mattar Urahi were collected from mature plants in and around the compound of the Assam Agricultural University, Assam, India and were utilized for the present investigation.

Description of materials

Table 1 describes the cultivars selected for the present study.

TABLE 1
Description of Cultivars of *Dolichos lablab*

Cultivars (local name)	*100 seed weight (g)*	*Approximate length of seed (cm)*	*Description of seed*
Kala Urahi	55·63	1·15	Black, white eye, oval shape
Boga Urahi	26·13	1·05	Coffee-brown, shrunken, white eye, flattened shape
Rangee Urahi	64·38	1·25	Reddish brown, white eye, oval shape
Kajala Urahi	43·63	1·45	Mottled black, shrunken, white eye, elongate shape
Mattar Urahi	33·12	0·95	Brown, white eye, round

Sample preparation

The seeds were ground in an electric sample grinder to pass through a 0·25-mm screen and stored in airtight containers for chemical analysis.

Proximate analyses

The proximate composition of seeds was determined according to the procedures of the AOAC (1975). Crude protein was calculated using the factor 6·25. Total carbohydrate content was determined by subtracting the sum of the percentage of crude protein, crude fibre, crude fat and ash from 100. The energy values of the seeds were determined by multiplying % crude protein, % crude fat and % carbohydrate by the factors 4, 9 and 4, respectively (Osborne & Voogt, 1978).

Mineral content

Total phosphorus (Fiske & Subbarow, 1925) and iron (Wong, 1928) were determined colorimetrically and calcium was determined according to the AOAC method (1970).

Antinutritional factors

The trypsin inhibitor was extracted with phosphate buffer (0·1 M, pH 7·6) and the trypsin inhibitor activity (TIA) was determined by the method of Kakade *et al.* (1969) and expressed as the number of units inhibited (TUI) per gram dry matter.

Phytic acid was determined by the ferric hydroxide precipitation method of Wheeler and Ferrel (1971). Phytate phosphorus was calculated from the ratio of Fe:P in the ferric phytate as 3·5:6 (Fe:P ratio). Phytic acid content was determined by assuming the empirical formula $C_6P_6O_{24}H_{18}$. Tannins were determined by the vanillin–HCl method (Swain & Hills, 1959).

Statistical analysis

The data obtained from laboratory determinations were subjected to statistical analysis by following a standard method (Snedecor & Cochran, 1967).

RESULTS AND DISCUSSION

The low moisture content of the bean seeds accounts for its correspondingly high dry matter content, and the low crude fat content of the seeds makes

TABLE 2

Proximate Composition of *Dolichos lablab* Seed (in g per 100 g on Oven-Dry Basis)

Cultivars	*Moisture*	*Crude protein*	*Crude fat*	*Ash*	*Crude fibre*	*Total carbohydrate*	*Energy value (in kcal per 100 g)*
Kala Urahi	10·90	29·7	1·60	3·70	8·12	56·8	361
Boga Urahi	11·16	31·3	1·50	3·30	9·63	54·2	356
Rangee Urahi	12·91	27·7	1·80	3·40	7·62	59·5	365
Kajala Urahi	12·98	22·4	2·00	3·90	8·37	63·3	361
Mattar Urahi	13·29	26·5	1·90	3·40	8·75	59·4	361
SED±	0·23	0·16	0·06	0·06	0·07	0·51	2·39
'*F*' test	51·73**	878·11**	24·29**	35·71**	226·00**	86·28**	3·68*

Figures are the means of four independent determinations.
SED± is the standard error of difference of two means.
* Significant at 5% level of probability.
** Significant at 1% level of probability.

them uneconomic sources of commercial oil (Table 2). Compared with other plant foods and exclusive of the legumes, the 22·4–31·3% crude protein content with a SEd (standard error of the difference between the mean of any two cultivars analysed) of ±0·16, is high and showed significant differences between the cultivars at $P \leq 0{\cdot}01$. However, compared with winged bean (Misra *et al.*, 1987) its protein content is somewhat low. Nevertheless, barring limitations that could be posed by limiting amino acids and antinutritive factors, *Dolichos lablab* seed represents a possible additional source of protein. The percentage of crude fat, ash, and crude fibre varied significantly from 1·50 to 2·00, 3·30 to 3·90 and 7·62 to 9·63, respectively. The ash content of the bean shown in Table 2 is important to the extent that it contains the nutritionally important mineral elements, some of which are shown in Table 3; ash showed significant variation in contents among the cultivars. Generally, the data presented in Table 3 may be related to the soil type in which the bean plant was found growing and/or to the efficiency of uptake from the soil by the plant. The high total carbohydrate content of the bean makes the seed a good source of calories.

The presence of antinutritional factors is one of the major drawbacks limiting the nutritional and food quality of legumes (Kakade *et al.*, 1969). A preliminary evaluation of some of these factors in dolichos bean seeds was carried out (Table 4).

The TIA values for all the cultivars showed highly significant ($P \leq 0{\cdot}01$) differences between cultivars and were comparable to those reported for winged bean and lima bean (*Phaseolus lunatus* L.), but higher than those for cowpea, chickpea, and kidney bean (de Lumen & Salamat, 1980). However, cooking was found to completely inactivate the trypsin inhibitor in dolichos bean seeds.

TABLE 3
Mineral Element Content of *Dolichos lablab* Seed (in mg per 100 g on Oven-Dry Basis)

Cultivars	*Calcium*	*Iron*	*Phosphorus*	*Phytate-P*	*Phytate-P as percentage of total-P*
Kala Urahi	36·0	6·90	448	359	88·4
Boga Urahi	53·5	6·05	430	331	77·0
Rangee Urahi	51·5	5·95	385	282	73·2
Kajala Urahi	47·8	6·65	483	380	78·9
Marrar Urahi	50·3	6·85	393	366	93·3
SED±	0·62	0·08	11·4	0·24	0·39
'*F*' test	248·68**	50·63**	24·70**	50 787·75**	906·78**

Figures are the mean of four independent determinations.
SED± is the standard error of difference of two means.
** Significant at 1% level of probability.

TABLE 4
Level of Antinutritional Factors of *Dolichos lablab* Seed (on Oven-Dry Basis)

Cultivars	*Phytic acid (mg/100 g)*	*Trypsin inhibitor activity (TIU/g)*	*Tannins (mg/100 g)*
Kala Urahi	1275	2900	2000
Boga Urahi	1175	2400	2040
Rangee Urahi	1000	2700	2125
Kajala Urahi	1350	3200	2205
Mattar Urahi	1300	2500	2045
SED±	28·86	89·46	84·17
'*F*' test	46·05**	25·63**	NS

Figures are the mean of four independent determinations.
SED± is the standard error of difference of two means.
** Significant at 1% level of probability.
NS indicates non-significant.

Dolichos bean had a fairly high content of phytic acid and the concentration among cultivars varied significantly ($P \leq 0{\cdot}01$) from 1000 to 1350 mg/100 g. The phytate phosphorus ranged significantly from 282 to 380 mg/100 g (Table 3) which constituted 73·2–93·3% of total phosphorus in the seeds. These values are much higher than those reported by Reddy *et al.* (1982) for grain legumes. This indicated that phytate in the dolichos bean was the main form of storage of phosphorus. The high content of phytate is of nutritional significance as not only is the phytate phosphorus unavailable to humans but it also lowers the availability of many other essential minerals (Reddy *et al.*, 1982). The phytate could, however, be substantially eliminated by processing methods such as soaking and cooking (Reddy *et al.*, 1982).

Tannins have been claimed to adversely affect protein digestibility (Sathe & Salunkhe, 1984). Dolichos bean was found to contain 2000–2205 mg/100 g tannins; they showed non-significant variation among cultivars, but all the tannins were found to be located in the seed-coat with only traces in the cotyledons. Since the seed-coats are usually removed by soaking prior to consumption, the tannins in dolichos beans can be considered to be of little significance from the nutritional point of view.

CONCLUSION

The analytical data suggest that *Dolichos lablab* L. seed can be useful as a food source and that the bean merits wider use in India and other parts of the tropics. Although the antinutritional factors studied in the present investigation showed high concentrations in all the cultivars, this should not

pose a problem in human consumption if the beans are properly processed. However, the presence of antinutritional factors like hemagglutinins and other toxic substances in dolichos bean requires proper assessment from the nutritional point of view. This study also indicates that there is a wide range of variability in the nutrient composition and antinutritional factors of the beans. This merits the attention of plant breeders for the production of good quality food.

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