

Nutritional Studies of Different Cultivars of *Dolichos lablab* and *Phaseolus vulgaris*

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Abstract

This article describes the nutrient composition of different varieties of *Dolichos lablab* seeds and *Phaseolus vulgaris* seeds. In this experiment, nine different types of *Dolichos lablab* seeds and eight different types of *Phaseolus vulgaris* seed samples were analyzed for proximate composition, sugar, vitamins, and minerals content. *Dolichos lablab* seeds contained 13.2%-16.1% moisture, 1.7%-3.45% ash, 0.6%- 1.39% total fat, 16.58%-29.04% total protein, 6.85%-8.91% crude fiber, 51.66%-66.16% total carbohydrate, 328.65-340.59 Kcal energy, 0.0172- 0.58% reducing sugars, 51.2-66.15% non-reducing sugars, 0.01-0.78% glucose, and 15.43-18.39% amylose. *Phaseolus vulgaris* seed contains 12.5%-14.9% moisture, 2.98%-5% ash, 0.49%- 14.9% total fat, 11.19%-29.04% total protein, 2.9%-3.6% crude fiber, 53.36%-71.10% total carbohydrate, 328.76-453.29 kcal energy, 0.05-0.51% reducing sugars, 53.174-70.643% non-reducing sugars, 0.01-0.32% glucose, and 6.43-18.47% amylose. Thiamine, niacin, pyridoxine, L-ascorbic acid content for *Dolichos lablab* seeds ranged 1.11-1.24 mg/100g, 1.53-1.67 mg/100g, 0.04-0.21 mg/100g, 5.52-11.06 mg/100g respectively. And for *Phaseolus vulgaris*, thiamine, niacin, pyridoxine, L-ascorbic acid content ranged 0.19-1.6 %, 2.2-2.38%, 0.24-1.7 %, 2.765-5.54 % respectively. Both *Dolichos lablab* and *Phaseolus vulgaris* contained good amount of minerals. *Dolichos lablab* contained phosphorus 374-500 mg, calcium 31.63-130.1 mg, copper 0.878-1.04 mg, iron 5.957-14.182 mg, magnesium 1377.16-2332.16 mg, manganese 0.19125-0.35875 mg, nickel 0.13-1.663 mg, zinc 3.89-6.61 mg, and cadmium 0.0013-0.025 mg. On the other hand, *Phaseolus vulgaris* contained phosphorus 362-584 mg, calcium 41.63-104.1 mg, copper 0.823-1.646 mg, iron 4.845-13.08 mg, magnesium 1462.16-1697.16 mg, manganese 0.1375-0.275 mg, nickel 0.215-5.463 mg, zinc 1.07-12.2 mg, and cadmium 0.0012-0.312 mg in it. Thus nutritional studies on beans could bring about important changes in our food habit in order to prevent many diseases related to nutritional deficiency.

Keywords: Proximate composition, *Dolichos lablab*, *Phaseolus vulgaris*

Introduction

Legumes have been a staple food for thousands of years and have played a vital role in the nutritional health of many cultures from ancient times to the present¹. They are a nearly "perfect" food because of their being rich in protein, folic acid, dietary fiber, complex carbohydrates and being one of the best non-meat sources of iron (provides 23 % to 30 % of daily recommended levels from a single serving)². Beans and grains have a symbiotic relationship in which the amino acids of each complement one another to form an abundant source of protein, which can play a pivotal role in the growth and development in humans. The calorie content of 130 g of cooked rice or 198.45 g baked potato is equal to 130 g of cooked beans yet beans contain higher dietary fiber it also offers many of the same nutrients as meat, but without bad cholesterol³. Beans are the cheapest

source of best protein as we see in Bangladesh. Whereas, beef and mutton price are higher^{4,5}.

Phaseolus vulgaris is mostly used as a vegetable crop in Bangladesh. It is a functional food as it contains several phytochemicals such as polyphenols, carbohydrates, fiber and polysaccharides with potential health benefits⁶. It is sporadically cultivated in some areas of Sylhet, Chittagong, Cox's Bazar and Chittagong Hill tracts and some other parts of the country on limited scale in the winter⁷. In recent times some non-govt. organizations (NGO's) have ventured into commercial production of dry bean and started to export some European countries. Its cultivation is so widespread that it would be almost impossible to find a house in rural areas which lacks a bush of *Dolichos* bean in the winter in Bangladesh. The nutritive value of *Dolichos lablab* and *Phaseolus vulgaris* is not widely known to people and it has, therefore,

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remained underutilized⁸. As part of our efforts to obtain more information about legumes to encourage its wider use, this study was carried out to determine the proximate composition, functional qualities, vitamins and minerals profile of nine cultivars of *Dolichos lablab* and seven cultivars of *Phaseolus vulgaris* seeds collected from different regions of Bangladesh. A comparative analysis of nutritive values of different cultivars of *Dolichos lablab* and *Phaseolus vulgaris* was also done in this study.

Materials and Methods

In this study matured dried seeds were collected from local markets and from different places of Bangladesh. Then it was brought to the laboratory where it was washed and sun-dried and was dehusked followed by grinding into fine powder. Later on it was stored in a desiccator for the further experiments⁹. Moisture of the sample is determined by drying it in vacuum oven to constant weight at 550 and then loss is weighted (AOAC, 2007). The ash content (inorganic residue left after the organic matter has been burnt away at about 5500 C) of the samples were measured following the method described in modified AOAC, 2005. A dried, ground sample was extracted with diethyl ether for three days which dissolved fats, oils, pigments and other fat-soluble substances. Fat content was further estimated following the standard method described in AOAC, 1990. The protein content of food stuff is usually determined by estimating the nitrogen content of the material and multiplying the nitrogen value by specific factors. The estimation of nitrogen is done by the Kjeldahl method¹⁰. Subtracting the sum of the percentage of moisture, fat, protein and ash contents from 100% according to AOAC (AOAC, 2005), the carbohydrate content was calculated rather than direct analysis. Further, by adding the energy from carbohydrate, protein, and fat. The total energy content of the food was obtained¹¹. For quantitative determination of reducing sugars the method Nelson-Somogyi method was used. Sucrose is the most common non reducing sugar. Non reducing

sugar content was measured indirectly by subtracting percent reducing sugar from percent of total sugar. Amylose content was estimated following the method of Williams et al., (1958) which was further modified by Juliano¹². Glucose content was estimated by performing Trinder reaction¹³. The bulk of roughage in food is referred to as the crude fiber. Beans samples were dried, defatted with petroleum ether and then the experiment was carried out using the standard methods described in AOAC manual (AOAC, 2005). Carotenoids content in the vegetable or fruit sample was determined by acetone petroleum ether extraction followed by spectrophotometer measurement¹⁴. β -Carotene estimations was done by HPLC method, where both the β -Carotene standard and samples were prepared following standard protocol¹⁵. Vitamin C was measured by di-nitro phenyl hydrazine method with modification according to¹⁶. Fat-soluble and water-soluble vitamins were determined by HPLC where, both fat-soluble and water soluble vitamins' standard solution were prepared by the method explained in modified Moreno and Salvadó method¹⁷. In case of sample preparation of fat-soluble vitamins, 1g of a sample was taken and 20ml methanol was added to it and shaken vigorously for 60min, then it was centrifuged at 3000 rpm for 10 min. The supernatant was collected and filtered by 0.22 μ m filter with a syringe and dried with nitrogen gas. Later on, it was dissolved with a small amount of methanol and was inserted into the vial. On the other hand sample for water-soluble vitamins were prepared following standard method¹⁸. Inorganic phosphorous were estimated using standard protocols of Pons and Guthrie, 1946 and AOAC, 1990^{19,20}. For the analysis cadmium, calcium, copper, iron, magnesium, manganese, nickel, and zinc, 2 gram of each Bean sample was ached in the furnace at 8000 C for 7 hours. It was then sent to CARS (Centre for Advanced Research in Sciences, University of Dhaka, Bangladesh) for Atomic absorption spectroscopy (AAS-275). Whole ash sample was transferred into the Teflon vessel and was digested

with 10 ml of HNO₃ (65%) at 1800 C in microwave digestion system for 45 min. After digestion, the solution was diluted with 25 ml de-ionized Nano pure water. After receiving the samples these were kept at room temperature for analysis. To analyze the sample calcium (wavelength 422.7 nm), magnesium (wavelength 285.2 nm), manganese (wavelength 279.5 nm), copper (wavelength 324.8 nm), iron (wavelength 248.3 nm), zinc (wavelength 213.9 nm), cadmium (wavelength 228.8 nm) and nickel (wavelength 232 nm) specific hollow cathode lamp was used. The instrument has minimum detection limit of 0.06 mg/L for calcium, 0.01 mg/L for cadmium, 0.03 mg/L for copper, 0.04 mg/L for iron, 0.01 mg/L for magnesium, 0.02 mg/L for manganese, 0.06 mg/L for nickel and 0.01 mg/L for zinc in the flame method. Samples were aspirated through anebulizer and the absorbance was measured with blank as a reference. A calibration curve was obtained using standard samples. The correlation coefficient was found for calcium 0.0998, cadmium 0.998, copper 0.999, iron 0.999, magnesium 0.999, manganese 0.999, nickel 0.998 and zinc 0.999 respectively. The samples had to be diluted to keep the results within analytical range.

Results

Proximate composition of Dolichos lablab and Phaseolus vulgaris cultivars

Proximate analysis was done by the chemical method to analyze components such as moisture, protein, fat, ash, crude fiber, carbohydrate, and energy have been presented in table 1 and 2 for *Dolichos lablab* and *Phaseolus vulgaris* respectively. Fat varied from 0.6% to 1.39%, moisture varied from 13.2%-16.1% and 16.58%-29.04% protein, 1.7%-3.45% ash, 6.85%-8.91% crude fiber, 51.66%-66.16% carbohydrate and 328.65-340.59 kcal energy were found in different varieties of *Dolichos lablab* seed sample. For *Phaseolus vulgaris*, the variation of fat ranged from 0.49% to 14.9%, 12.5%-14.9% moisture, 11.19%-29.04% protein, 2.98%-5% ash, 2.9%-3.6% crude fiber, 53.36%-71.10% carbohydrate and 328.76-453.29 kcal energy were found in samples.

Table 1: Proximate compositions of *Dolichos lablab* cultivars per 100 g

Cultivars	Fat (g)	Moisture (g)	Protein (g)	Ash (g)	Crude fiber (g)	Carbohydrate (g)	Energy (Kcal)
1d	0.6±0.11	15.3±0.2	18.66±0.1	1.74±0.03	7.8±0.15	63.68±0.06	334.79
2d	0.89±0.06	14±0.14	16.59±0.28	3.29±0.08	6.87±0.003	65.21±0.24	335.3
3d	0.7±0.01	16.1±0.18	24.88±0.5	2.6±0.07	8.91±0.015	55.70±0.004	328.65
4d	1.19±0.3	14.3±0.09	20.74±0.11	3.45±0.1	6.86±0.02	60.30±0.001	334.96
5d	0.70±0.16	15.2±0.05	29.04±0.09	3.4±0.006	7.9±0.008	51.66±0.03	329.09
6d	0.69±0.21	13.2±0.18	16.58±0.002	3.34±0.05	6.92±0.03	66.16±0.11	337.28
7d	0.8±0.17	13.8±0.5	16.59±0.4	3.15±0.03	6.85±0.08	65.65±0.031	336.18
8d	1.1±0.31	14.5±0.51	16.59±0.23	3.0±0.05	7.89±0.02	64.80±0.05	335.47
9d	1.39±0.09	14.9±0.4	18.66±0.35	1.7±0.06	6.89±0.01	63.33±0.07	340.59

Data represent the mean value ± standard error of mean (SEM)

Table 2: Proximate composition of *Phaseolus vulgaris* cultivars per 100 g

Cultivars	Fat (g)	Moisture (g)	Protein (g)	Ash (g)	Crude fiber (g)	Carbohydrate (g)	Energy (Kcal)
1p	0.89±0.06	14.9±0.005	20.74±0.12	3.45±0.04	3.6±0.07	60.01±0.01	331.06
2p	1.3±0.13	13±0.003	20.74±0.04	3.39±0.001	3.54±0.043	61.56±0.04	340.9
3p	0.6±0.04	13.8±0.001	11.19±0.02	3.3±0.001	3.51±0.1	71.10±0.003	334.59
4p	0.49±0.003	14±0.005	29.04±0.1	3.1±0.05	3.5±0.1	53.36±0.1	334.09
5p	2.19±0.054	12.5±0.1	18.66±0.08	2.98±0.1	3.21±0.003	63.68±0.4	349.19
6p	0.60±0.1	13±0.08	20.74±0.003	3.29±0.08	3.2±0.04	62.36±0.006	337.8
7p	1.19±0.13	14.3±0.04	16.59±0.01	5±0.1	3.1±0.15	62.91±0.04	328.76
8p	14.9±0.02	14±0.01	21.29±0.005	4.3±0.01	2.9±0.05	58.50±0.005	453.29

Data represent the mean value ± standard error of the mean (SEM)

Estimation of sugars, amylose, glucose of dehusked Dolichos lablab and Phaseolus vulgaris seeds

Reducing sugars, non-reducing sugars, glucose, amylose content ranged from (0.0172- 0.58) %, (51.2-66.15) %, (0.01-0.78) %, (15.43-18.39) %, (142.93-487.07)% respectively for different cultivars of *Dolichos lablab* seeds (Table 3). Reducing sugar content was highest in type 4d and lowest in type 6d, non-reducing sugar content was highest in type 6d and lowest in type 5d, glucose content was highest in type 8d and lowest in type 6d, amylose content was highest in type 3d and lowest in type 7d, total carotenoids

content was highest in type 6d and lowest in type 9d. Very negligible amount of beta-carotene was present in *Dolichos lablab* seed samples. In case of *Phaseolus vulgaris* reducing sugars, non-reducing sugars, glucose, amylose, total carotenoids, β-Carotene content ranged from (0.05-0.51) %, (53.174-70.643) %, (0.01-0.32) %, (6.43-18.47) %, (101.27-1875.96) %, (1.58-2.27)% respectively (Table 4).

Reducing sugar content was highest in type 1p and lowest in type 6p, non-reducing sugar content was highest in type 3p and lowest in type 4p, glucose content was highest in type 6p and lowest in type 3p, amylose content was highest in type 5p and lowest in type 8p.

Table 3: Sugars, amylose, glucose content of *Dolichos lablab* dehusked seeds

Cultivars	Reducing sugars (g/100g)	Non-reducing sugars (g/100g)	Glucose (g/100g)	Amylose (g/100g)
1d	0.24±0.2	63.44±0.2	0.18±0.2	16.1±0.1
2d	0.512±0.3	64.698±0.1	0.15±0.35	15.77±0.1
3d	0.0238±0.25	55.6762±0.1	0.12±0.1	18.39±0.1
4d	0.58±0.5	59.72±0.1	0.08±0.2	15.87±0.7
5d	0.46±0.9	51.2±0.76	0.1±0.2	16.8±0.2
6d	0.0172±0.1	66.1428±0.2	0.01±0.2	15.97±0.2
7d	0.51±0.21	65.14±0.1	0.08±0.1	15.43±0.4
8d	0.49±0.6	64.31±0.12	0.78±0.1	16.11±0.4
9d	0.133±0.1	63.197±0.16	0.03±0.1	18.21±0.7

Data represent the mean value ± standard error of the mean (SEM)

Table 4: Sugars, glucose, amylose, carotenoids and β -Carotene content of *Phaseolus vulgaris* dehusked seed

Cultivar	Reducing sugar (g/100g)	Non reducing sugar (g/100g)	Glucose (g/100g)	Amylose (g/100g)	Carotenoids (g/100g)	β -Carotene (g/100g)
1p	0.51 \pm 0.5	59.49 \pm 0.54	0.11 \pm 0.1	17.8 \pm 0.3	226.65 \pm 0.08	1.6
2p	0.47 \pm 0.4	61.09 \pm 0.1	0.07 \pm 0.6	17.2 \pm 0.2	173.61 \pm 0.01	2.1
3p	0.457 \pm 0.53	70.643 \pm 0.1	0.01 \pm 0.1	17.18 \pm 0.7	130.21 \pm 0.01	1.97
4p	0.186 \pm 0.21	53.174 \pm 0.23	0.16 \pm 0.7	18.39 \pm 0.2	231.48 \pm 0.2	1.58
5p	0.37 \pm 0.7	63.31 \pm 0.1	0.01 \pm 0.7	18.47 \pm 0.1	154.32 \pm 0.05	1.97
6p	0.05 \pm 0.1	62.31 \pm 0.1	0.32 \pm 0.2	17.54 \pm 0.2	101.27 \pm 0.04	2.16
7p	0.183 \pm 0.26	62.717 \pm 0.9	0.09 \pm 0.82	17.42 \pm 0.2	294.17 \pm 0.1	2.27
8p	0.28 \pm 0.8	58.22 \pm 0.16	0.1 \pm 0.34	6.43 \pm 0.71	1875.96 \pm 0.06	2.3

Data represent the mean value \pm standard error of the mean (SEM)

Vitamins content in dehusked Dolichos lablab and Phaseolus vulgaris seeds

Vitamins are a group of organic compounds which are essential for normal growth and nutrition and are required in small quantities in the diet because they cannot be synthesized by the body. RDA of thiamin, niacin, vitamin B₆, vitamin C is (0.9-1.1) mg/day, (16-20) mg/day, (1.5-1.7) mg/day and 40 mg/day respectively. Both *Dolichos lablab* and *Phaseolus vulgaris* seeds are rich in thiamin, niacin, vitamin B₆ thus by in taking few grams of *Dolichos lablab* and

Phaseolus vulgaris seeds regularly can balance the daily need of vitamins. Table 1.7 and 1.8 represents the water soluble vitamin content of different cultivars of *Dolichos lablab* and *Phaseolus vulgaris*. Thiamine, niacin, pyridoxine and L-ascorbic acid content ranged from (1.11-1.24) %, (1.53-1.67) %, (0.04-0.21) %, (5.52-11.06) % respectively in different cultivars and cultivars of *Dolichos lablab* seeds (Table 5). Depending on different cultivars of *Phaseolus vulgaris* seeds thiamine, niacin, pyridoxine and L-ascorbic acid content ranged from (0.19-1.6) %, (2.2-2.38) %, (0.24-1.7) %, (2.765-5.54) % respectively (Table 6).

Table 5: Vitamins content in different cultivars of *Dolichos lablab* dehusked seeds per 100 g

Cultivar	Thiamine (mg)	Niacin (mg)	Pyridoxine (mg)	L-ascorbic acid (mg)
1d	1.12 \pm 0.5	1.6 \pm 0.2	0.16 \pm 0.1	5.6 \pm 0.1
2d	1.2 \pm 0.2	1.64 \pm 0.2	0.12 \pm 0.1	11.06 \pm 0.1
3d	1.19 \pm 0.1	1.59 \pm 0.2	0.21 \pm 0.24	9.2 \pm 0.1
4d	1.17 \pm 0.1	1.67 \pm 0.4	0.098 \pm 0.2	5.52 \pm 0.1
5d	1.24 \pm 0.1	1.61 \pm 0.21	0.089 \pm 0.2	11.04 \pm 0.14
6d	1.16 \pm 0.4	1.53 \pm 0.11	0.12 \pm 0.2	5.53 \pm 0.12
7d	1.13 \pm 0.43	1.63 \pm 0.14	0.12 \pm 0.12	5.526 \pm 0.17
8d	1.15 \pm 0.2	1.66 \pm 0.1	0.1 \pm 0.17	5.528 \pm 0.11
9d	1.11 \pm 0.2	1.64 \pm 0.1	0.04 \pm 0.13	11.06 \pm 0.1

Data represent the mean value \pm standard error of the mean (SEM)

Table 6: Vitamins content in different cultivars of *Phaseolus vulgaris* dehusked seeds per 100 g

Cultivar	Thiamine (mg)	Niacin (mg)	Pyridoxine (mg)	L-ascorbic acid (mg)
1p	0.24±1.3	2.2±0.2	0.24±0.4	5.122±0.1
2p	0.21±0.5	2.27±0.2	0.48±0.1	4.146±0.1
3p	0.19±0.4	2.38±0.4	0.3±0.1	5.53±0.14
4p	0.27±0.3	2.24±0.12	0.65±0.1	4.148±0.16
5p	0.29±0.5	2.29±0.1	0.63±0.1	5.528±0.1
6p	0.2±0.7	2.21±0.1	0.93±0.24	5.53±0.1
7p	0.22±0.42	2.3±0.47	0.24±0.19	5.54±0.1
8p	1.6±0.11	2.29±0.49	1.7±0.13	2.765±0.12

Data represent the mean value ± standard error of the mean (SEM)

Minerals content of dehusked Dolichos lablab and Phaseolus vulgaris seeds

Phosphorus, calcium, copper, iron, magnesium, manganese, nickel, zinc and cadmium content ranged 374-500 mg, 31.63-130.1 mg, 0.878-1.04 mg, 5.957-14.182 mg, 1377.16-2332.16 mg, 0.19125-0.35875 mg, 0.13-1.663 mg, 3.89-6.61 mg and 0.0013-0.025 mg respectively depending on different cultivars of *Dolichos lablab* seeds (Table 7)

while the phosphorus, calcium, copper, iron, magnesium, manganese, nickel, zinc and cadmium content ranged from 0.362-0.584 g, 41.63-104.1 mg, 0.823-1.646 mg, 4.845-13.08 mg, 1462.16-1697.16 mg, 0.1375-0.275 mg, 0.215-5.463 mg, 1.07-12.2 mg and 0.0012-0.312 mg respectively depending on different cultivars and cultivar of *Phaseolus vulgaris* seeds (Table 8).

Table 7: Minerals content of different cultivars of dehusked *Dolichos lablab* seeds per 100 g

Cultivars	P (g)	Ca (mg)	Cu (mg)	Fe (mg)	Mg (mg)	Mn (mg)	Ni (mg)	Zn (mg)	Cd (mg)
1d	0.4	77.63	1.04	7.8325	1377.16	0.2075	1.06	3.89	0.0037
2d	0.5	58.76	0.906	5.9575	1504.66	0.21125	0.368	4.71	0.0037
3d	0.374	130.1	0.962	6.395	2332.16	0.35875	1.663	5.24	0.025
4d	0.378	63.38	0.986	6.12	1377.16	0.19125	0.13	6.61	0.0013
5d	0.493	50.76	0.953	7.095	1645.91	0.19375	0.666	4.51	0.0025
6d	0.398	88.01	0.953	7.97	1773.41	0.19875	0.247	5.79	0.0237
7d	0.473	31.63	0.973	8.0825	1463.41	0.19375	0.352	5.31	0.015
8d	0.5	52.76	0.878	9.17	1460.91	0.195	0.43	6.24	0.01
9d	0.484	107.1	1.036	14.182	1774.66	0.2975	0.601	5.33	0.0162

Table 8: Minerals content in different cultivars of dehusked *Phaseolus vulgaris* seeds per 100 g

Cultivar	P (g)	Ca (mg)	Cu (mg)	Fe (mg)	Mg (mg)	Mn (mg)	Ni (mg)	Zn (mg)	Cd (mg)
1p	0.495	65.88	1.046	5.9575	1619.66	0.21375	0.271	5.59	0.03
2p	0.487	82.63	1.133	6.245	1523.41	0.20125	3.026	5.07	0.02
3p	0.529	65.63	1.073	4.845	1462.16	0.1675	2.188	1.07	0.0212
4p	0.584	104.1	0.823	7.4825	1474.66	0.1375	1.613	3.74	0.0125
5p	0.429	93.13	1.646	11.982	1697.16	0.275	5.463	12.2	0.0312
6p	0.488	64.26	1.017	13.082	1508.41	0.175	0.215	5.82	0.02
7p	0.476	41.63	0.953	10.332	1580.91	0.24875	0.261	4.62	0.0237
8p	0.362	63.63	1	6.1575	1573.41	0.195	0.307	4.07	0.0012

Phosphorus=P; Calcium=Ca; Copper=Cu; Iron=Fe; Magnesium=Mg; Manganese=Mn; Nickel=Ni; Zinc=Zn and Cadmium=Cd

Table 9: Comparative analysis of the data of *Dolichos lablab* seeds with IFCT and USDA database

Nutrients	Data obtained	IFCT	USDA
Moisture	13.2% -16.1%	9.57%	9.38%
Ash	1.7% -3.45%	2.83%	-
Total fat	0.6% to 1.39%	0.92%	1.69%
Total protein	16.58% -29.04%	19.93%	23.90%
Total dietary fiber	6.85% -8.91%	5.80%	25.60%
Total carbohydrate	51.66% -66.16%	44.46%	60.74%
Energy	328.65 -340.59 kcal	-	344 kcal
Reducing sugars	(0.0172 - 0.58) %	(1.07 -1.15) %,	-
Non -reducing sugars	(51.2 -66.15) %	-	-
Glucose	(0.01 -0.78) %	(0.29 -0.53) %,	-
Amylose	(15.43 -18.39) %	-	-
Total carotenoids	(142.93 -487.07) %	(207 -256) %,	-
Thiamine	(1.11 -1.24) mg/100g	(0.34 -0.37) %,	1.13 mg/100g
Niacin	(1.53 -1.67) mg/100g	(1.88 -1.96) %	1.61 mg/100g
Pyridoxine	(0.04 -0.21) mg/100g	(0.35 -0.38) %	0.155 mg/100g
L -ascorbic acid	(5.52 -11.06) mg/100g	-	-
Phosphorus	(374 -500) mg	(429 -457) mg	372mg
Calcium	(31.63 -130.1) mg	(75.20 -78.16) mg	130mg
Copper	(0.878 -1.04) mg	(0.9 -1.93) mg	
Iron	(5.957 -14.182) mg	(4.5 -5.5) mg	5.10mg
Magnesium	(1377.16 -2332.16) mg	(173 -197) mg	283mg
Manganese	(0.19125 -0.35875) mg	(2.38 -2.41) mg	-
Nickel	(0.13 -1.663) mg	(0.184 -0.28) mg	-
Zinc	(3.89 -6.61) mg	(2.42 -2.8) mg	9.30 mg
Cadmium	(0.0013 -0.025) mg	-	-

Table 10: Comparative analysis of the data of *Phaseolus vulgaris* seeds with IFCT and USDA database

Nutrients	Data obtained	IFCT	USDA
Moisture	12.5% -14.9%	8.69% -9.87%,	11.75%
Ash	2.98% -5%	3.28% -3.35%	-
Total fat	0.49% to 14.9%	1.62% -1.77%,	0.83%
Total protein	11.19% -29.04%	19.01% -19.91%	23.58%
Total dietary fiber	2.9% -3.6%	4.66% -5.95 %,	24.90%
Total carbohydrate	53.36% -71.10%	48.83% -49.59%	60.01%
Energy	328.76 -453.29 kcal	-	333 Kcal
Reducing sugars	(0.05 -0.51) %,	(1.52 -2.27) %	-
Non -reducing sugars	(53.174 -70.643) %,	-	-
Glucose	(0.01 -0.32) %,	(0.18 -0.39) %,	-
Amylose	(6.43 -18.47) %,	-	-
Total carotenoids	(101.27 -1875.96) %,	(86.67 -103) %,	-
β-Carotene content	(1.58 -2.27)%	-	-
Thiamine	(0.19 -1.6) %,	(0.21 -0.3) %,	0.529
Niacin	(2.2 -2.38) %,	(2.37 -2.61) %	2.06
Pyridoxine	(0.24 -1.7) %,	(0.21 -0.23) %	0.397
L -ascorbic acid	(2.765 -5.54) %	-	4.5
Phosphorus	(362 -584) mg	(386 -409) mg	407
Calcium	(41.63 -104.1) mg	(126 -134) mg	143
Copper	(0.823 -1.646) mg	(0.78 -0.87) mg	-
Iron	(4.845 -13.08) mg	(6.13 -6.30) mg	8.2
Magnesium	(1462.16 -1697.16) mg	(160 -173) mg	140
Manganese	(0.1375 -0.275) mg	(1.24 -1.19) mg	-
Nickel	(0.215 -5.463) mg	(0.203 -0.287) mg	
Zinc	(1.07 -12.2) mg	(2.69 -3.08) mg	2.79
Cadmium	(0.0012 -0.312) mg	-	-

Discussion

Comparative analysis of obtained data from this study with Indian food composition table (IFCT) and United States Department of Agriculture (USDA) food database has been presented in the table 9 and table 10. In most of the cases the values were in a good agreement with the reported values. It has been found that the values of most of the nutrients are very similar to the reference values of published data IFCT & USDA, but the slight difference were occurred due to the different kind of variety of seeds, growth and environmental conditions, and different methods of estimations. The moisture content of a seed is a major concern for the storage. Here the moisture content was very low so the seed could be preserved for a long duration. RDA of protein is 1g/kg/day and plant food that provides more than 12% of its calorific value from protein is considered a good source of protein which is provided by both of the seeds²¹. So *Dolichos lablab* and *Phaseolus vulgaris* seeds have a good source of protein. RDA for fiber is 25g/day for adult women and 38g/day for adult men²². It has the capacity to block the amylase action that directly or indirectly contributes to reducing intestinal glucose absorption which ultimately lowers the Glycemic Indexes²³. Since *Dolichos lablab* and *Phaseolus vulgaris* seeds are a good source of fiber, they can be recommended to diabetic patients. Glucose content of *Dolichos lablab* and *Phaseolus vulgaris* seeds were very less and rest of the reducing sugar might contain mainly fructose. The body processes glucose very efficiently (GI of glucose is 100), but cannot be easily metabolize fructose which has a low GI of 23. Again the amount of non-reducing sugar is many folds higher than reducing sugar in both *Dolichos lablab* and *Phaseolus vulgaris* seeds. The glycemic index of non-reducing sugar (mainly sucrose) was 65. The degree of gelatinization was proportional to the amount of amylose. The less amylose there is, the greater the degree of gelatinization and vice-versa. The degree of gelatinization of starches is inversely

proportional to amylose levels, the more the chances of hydrolysis by alpha-amylase, the greater its propensity to become glucose and naturally, the greater its tendency to raise blood sugar levels²⁴. Amylose content for *Dolichos lablab* and *Phaseolus vulgaris* seeds were quite higher than other seeds which helped to maintain low glycemic index²⁵. So, we can reach a conclusion that *Dolichos lablab* and *Phaseolus vulgaris* seeds help to maintain a significantly low glycemic index. Fat soluble vitamins like A, D and E was found in a negligible amount both in *Dolichos lablab* and *Phaseolus vulgaris* seed samples. The value of iron, magnesium, zinc was found to be a slight higher and the value of manganese was found lower than the published reference data than the Indian food composition table (Table 9 and Table 10) which might be due to the cultivars of seed and the place it was grown. Recommended dietary allowance of phosphorus, calcium, copper, iron, magnesium, manganese, nickel and zinc are 1200-1400 mg, 800-1000mg, 2-4 mg, 10-40 mg, 300-400mg, 2-9mg, 0.1-0.2 mg and 13-15mg respectively. So, *Dolichos lablab* and *Phaseolus vulgaris* seeds contain sufficient amount of minerals. Cadmium used in rechargeable nickel-cadmium batteries are rarely recycled, and often dumped together with household waste. The cadmium content in *Dolichos lablab* and *Phaseolus vulgaris* seeds is very negligible. So there is a less chance of the toxic effect of heavy metals when consumed.

Conclusion

Cultivars of *Dolichos lablab* and *Phaseolus vulgaris* seeds have rich nutritional values. It can, therefore, be concluded that if 150 to 200 grams of *Dolichos lablab* or *Phaseolus vulgaris* seeds are taken without seed coat regularly, then most of the RDA of essential nutrients can be covered. The seeds of plants can be used nutritionally in our diet, which would contribute to build up nutritional foods.

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