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Nutrition Composition and Antinutritional Factors of Green Gram Varieties

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Abstract Twelve green gram varieties including both elite entries and released varieties procured and they were analyzed for proximate composition, minerals, sugar and starch content. DGG-3 had highest crude protein content, BGS-9 had highest fat, carbohydrate and starch content, Pusa Baisaki had highest moisture content, Selection-04 had highest crude fiber and calcium content, DGG-1 had highest ash, zinc and copper content, DGG-8 and DGG-7 had highest iron and manganese content respectively. The total, reducing and non-reducing sugars ranged from 11.50–11.70 mg/100 g, 4.62–4.84 g/100 g and 6.75–7.16 mg/100g respectively. DGG-7 recorded highest (532.3 CE/100g) and DGG-1 (456.0 CE/100 g) had lowest tannin content. Trypsin inhibitor and phytic acid ranged from 206.6–267.2 TIU/g and 7.27–9.40 mg/g respectively. The results of the present study revealed that elite entries are on par with released varieties with regard to nutrient composition.

Keywords Proximate composition, Elite entries, Trypsin inhibitor.

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Introduction

Legumes are widely grown throughout the world and their dietary and economic importance is well established. They are rich in protein and essential amino acid like lysine, which perform significant role in human nutrition. Legumes not only add variety to human diet but also serve as an economical source of supplementary proteins (20—30% of protein) for a large population in developing countries like India, where majority of the population is vegetarian [1]. plant proteins are cheaper than animal proteins therefore; people consume legume seeds worldwide as major source of protein and especially in developing countries. Hence, legumes are considered as a "poor man's meat". There is great need to increase the production and utilization of pulses. In this regard, breeders have a great responsibility to release high yielding varieties with high nutritional value, good cooking quality characteristics and acceptable varieties [2].

One of the important legumes like green gram which is short season, summer growing crop grows widely throughout tropics and subtropics of the

Table 1. Proximate composition of green gram varieties (g/100 g). Values are mean of three replication, SEm: Standard Error of Mean, CD: Critical Difference. *Significant @ 5%.

Varieties	Moisture	Fat	Crude protein	Cured fiber	Ash	Carbohydrate
			Released varieties			
DGGV-02	10.30 ± 0.08	1.25 ± 0.02	27.71 ± 1.97	5.91 ± 0.01	3.59 ± 0.01	51.21 ± 1.91
BGS-9	10.21 ±0.11	1.53 ± 0.01	25.58 ± 0.30	4.61 ± 0.02	3.62 ± 0.03	54.43 ± 0.43
Selection-04	10.01 ± 0.02	1.31 ± 0.01	27.65 ± 1.26	6.95 ± 0.05	3.46 ± 0.06	50.60 ± 1.30
Chinamoong	10.32 ± 0.17	1.46 ± 0.06	28.23 ± 0.40	6.52 ± 0.03	3.70 ± 0.04	49.75 ± 0.26
IPM-02-14	10.03 ± 0.05	1.30 ± 0.01	26.48 ± 0.40	5.52 ± 0.06	3.63 ± 0.02	53.02 ± 0.51
PusaBaisaki	10.46 ± 0.06	1.26 ± 0.02	25.78 ± 0.20	5.36 ± 0.08	3.63 ± 0.00	53.49 ± 0.14
			Elite entries			
DGG-1	10.43 ± 0.16	0.81 ±0.02	27.18 ± 0.20	5.79 ± 0.01	3.70 ± 0.00	52.08 ± 0.38
DGG-3	10.39 ± 0.06	0.69 ± 0.01	28.70 ± 0.00	5.53 ± 0.01	3.62 ± 0.07	51.06 ± 0.07
DGG-5	10.35 ± 0.09	1.29 ± 0.02	26.48 ± 0.40	6.10 ± 0.02	3.67 ± 0.04	52.10 ± 0.38
DGG-6	10.20 ± 0.19	1.04 ± 0.01	27.30 ± 0.00	5.49 ±0.08	3.71 ± 0.05	52.24 ± 0.30
DGG-7	10.43 ± 0.23	1.26 ± 0.02	25.78 ± 0.20	4.88 ± 0.04	3.67 ± 0.06	53.96 ± 0.08
DGG-8	10.40 ± 0.38	0.87 ± 0.01	27.41 ± 0.20	5.17 ± 0.03	3.46 ± 0.01	52.67 ± 0.54
Mean±SD	10.30 ± 0.13	1.18 ± 0.02	27.03 ± 0.46	5.66 ± 0.03	3.62 ± 0.03	52.22 ± 0.52
Sem±	0.09	0.01	0.41	0.02	0.02	0.44
CD	0.29*	0.04*	1.28*	0.08*	0.07*	1.34*
F-value	2.62	430.8	5.87	721.0	13.1	10.6

world. It is also known as green gram, moong and golden gram. Green gram is the third most important legume crop in India. This plant is a native of India and since ancient time it has been in cultivation but its production is now common throughout Asia and other tropical countries. It is widely grown in Asia, particularly in Thailand, India and Pakistan. Major states growing green gram in India are Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Orissa, Bihar and Tamil Nadu. Green gram is an excellent source of protein, low in fat and contains good amount of minerals and vitamins. It is free from heaviness and tendency to flatulence, which is associated with other legumes [3]. The present investigation was undertaken to study the nutrient composition of selected elite entries and released green gram varieties.

Materials and Methods

Twelve different varieties were procured from the AICRP on MULLaRP (Mungbean, Urdbean, Lentil, Lathyrus, Rajmah and Peas), Main Agriculture Research Station University of Agricultural Sciences Dharwad, Karnataka state in India. Among the twelve varieties six varieties are elite entries (DGG-1, DGG-03, DGG-05, DGG-06, DGG-07 and DGG-08) and six are released varieties (DGGV-02, IPM-04-14, Selection-04, Chinamoong, BGS-9 and Pusa Baisaki). Proximate composition of green gram was determined using standard method [4]. Minerals (iron, zinc, manganese and copper) were analyzed by atomic absorption spectrophotometer. Calcium was estimated by titrimetric method [5]. Sugars were estimated by Nelson Somogyi's method and starch content was determined by Anthrone method, according to the procedure given by. Sadasivam and Manickam [6]. The results were statistically analyzed by one way ANOVA followed by paired *t*-test, using SPSS software.

Results and Discussion

Proximate composition

The impact of genotypes on all the proximate composition was statistically significant ($p \leq 0.05$) (Table 1). Moisture content ranged between 10.01–10.46 g/100 g. Pusa Baisaki had highest moisture content i.e. 10.46 g/100 g and Selection-04 recorded least moisture content (10.01 g/100 g). The moisture content observed in the present investigation (10.30 g/100 g) was in

Table 2. Mineral contents of green gram varieties (mg/100 g). Values are mean of three replications. SEm: Standard Error of Mean, CD: Critical Difference. *Significant @ 5%.

Varieties	Ca	Fe	Zn	Mn	Cu
			Released varieties		
DGGV-02	80.16 ± 0.01	5.00 ± 0.10	2.83 ± 0.06	2.46 ± 0.00	0.38 ± 0.01
BGS-9	80.59 ± 0.40	4.86 ± 0.06	2.96 ± 0.06	2.48 ± 0.01	0.38 ± 0.01
Selection-04	120.5 ± 0.10	4.40 ± 0.00	3.03 ± 0.06	2.48 ± 0.01	0.37 ± 0.01
Chinamoong	100.4 ± 0.37	4.53 ± 0.06	2.66 ± 0.06	2.48 ± 0.01	0.36 ± 0.00
IPM-02-14	100.3 ± 0.25	4.73 ± 0.06	2.70 ± 0.00	2.46 ±0.00	0.37 ± 0.00
PusaBaisaki	100.6 ± 0.36	4.56 ± 0.06	3.03 ± 0.06	2.45 ± 0.00	0.38 ± 0.01
			Elite entries		
DGG-1	100.3 ± 0.21	4.46 ± 0.06	3.06 ± 0.06	2.46 ± 0.01	0.39 ± 0.00
DGG-3	80.17 ± 0.02	4.53 ± 0.06	2.70 ± 0.00	2.49 ± 0.01	0.37 ± 0.01
DGG-5	120.2 ± 0.03	4.76 ± 0.06	2.96 ± 0.06	2.48 ± 0.00	0.36 ± 0.00
DGG-6	100.4 ± 0.25	4.73 ± 0.06	2.93 ± 0.06	2.46 ± 0.01	0.37 ± 0.01
DGG-7	100.3 ± 0.18	5.03 ± 0.06	2.83 ± 0.06	2.50 ± 0.00	0.36 ± 0.01
DGG-8	100.3 ± 0.11	5.06 ± 0.06	2.80 ± 0.00	2.47 ± 0.01	0.38 ± 0.01
Mean±SD	98.53 ± 0.19	4.72 ± 0.06	2.87 ± 0.04	2.47 ± 0.00	0.37 ± 0.00
Sem±	7.74	0.03	0.03	0.00	0.00
CD	23.84*	0.11*	0.09*	0.01*	0.01*
F-value	2.83	43.82	24.08	37.50	15.36

agreement with those reported in two varieties of green gram by Habibullah Abbas and Shah [3]. The fat content varied from 0.69–1.53 g/100 g. BGS-9 had highest fat content (1.53 g/100g) and DGG-3 had least fat content (0.69 g/100 g). The fat content ranged from 0.69–1.53 g/100 g in green gram is comparable with values reported by Paul et al. [7] (i.e. 1.53 g/100 g).

Protein content ranged from 25.58–28.70 g/100 g. DGG-3 had highest protein content (28.70 g/100 g). BGS-9 had least protein content (25.58 g/100 g). Green gram contains appreciable amount of protein (27.03 g/100 g) which was comparable with the values reported by Tresina et al. [8]. The crude fiber content varied from 4.61–6.95 g/100 g. Highest was observed in Selection -04 (6.95 g/100 g), BGS-9 had recorded least crude fiber content (4.61 g/100 g). The ash content varied from 3.46–3.70 g/100 g. Highest was found in DGG-1 and Chinamoong (3.70g/100g) and DGG-8 and Selection-04 recorded least ash content (3.46 g/100 g). Similarly Habibullah Abbas and Shah [3] reported that fiber and ash contents varied from 6.8–7.1% and 3.9–3.0% respectively.

The carbohydrate is an important fuel nutrient which was ranged from 49.75–54.43 g/100 g. The present study reveals that carbohydrate content of green gram is 52.22g/100 g, which was comparable with the values reported by Habibullah Abbas and Shah [3].

Mineral content

Table 2 depicts the mineral content of green gram varieties. Significant difference was observed among the varieties ($p \leq 0.05$), whereas calcium content ranged from 80.16–120.5 mg/100 g. Selection-04 had highest calcium content (120.5 mg/100 g) and least was found in DGGV-02 (80.16 mg/100g). The iron content varied from 4.40–5.06 mg/100 g. DGG-8 had highest iron content, whereas Selection-04 had least iron content i.e. 4.40 mg/100 g. Zinc content in green gram varied from 2.66–3.06 mg/100 g. Highest was found in DGG-1 (3.06 mg/100 g). Chinamoong had least zinc content i.e. 2.66 mg/100 g. The manganese content ranged from 2.46–2.50 mg/100 g. Highest manganese content was found in DGG-7. Copper content of green gram ranged from 0.36–0.39 mg/100 g. DGG-1 recorded highest copper content (0.39 mg/100 g) whereas lowest was found in DGG-5 and Chinamoong (0.36 mg/100 g). Habibullah Abbas and Shah [3] reported that M1 had relatively higher concentration of Ca (216 mg/100 g), Fe (11.34 mg/100 g) and Zn (1.88 mg/100 g), whereas

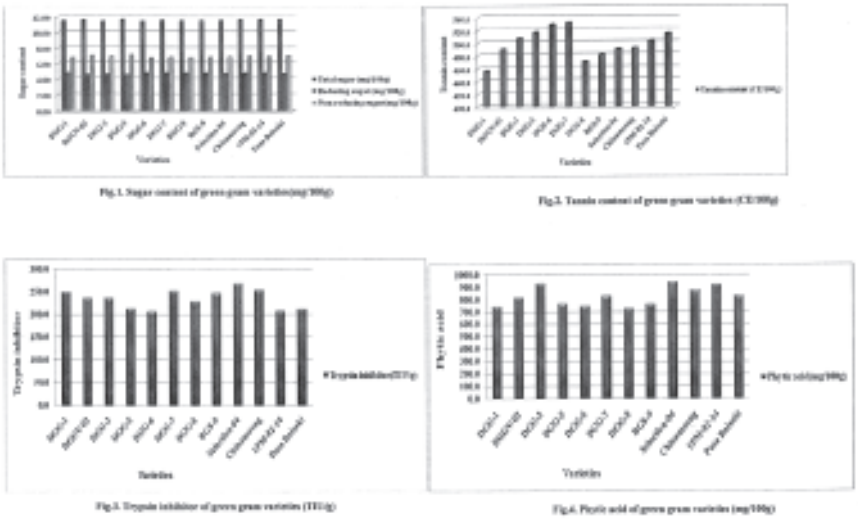

Fig. 1. Sugar content of green gram varieties (mg/100g). **Fig. 2.** Tannin content of green gram varieties (CE/100g). **Fig. 3.** Trypsin inhibitor of green gram varieties (TIU/g). **Fig. 4.** Phytic acid of green gram varieties (mg/100 g).

NM-92 had higher values of Cu (1.92 mg/100 g) and Mn (1.49 mg/100 g). Similar results were also reported by Tresina et al. [1]. and Paul et al. [7]. Dahiya et al. [9] where the significant difference in the mineral content was found among the varieties, this may be attributed to ability of the root to absorb mineral from the soil.

Sugar and total starch content

Starch content, total, reducing and non-reducing sugars of green gram varieties are presented in Figure 1. There was significant difference found in all the above contents ($p \leq 0.05$). The starch content varied from 52.94–59.84 g/100 g. BGS-9 had highest starch content (59.84 g/100 g) and lowest was found in Selection-04 (52.94 g/100 g). The total sugar ranged from 11.50–11.70 mg/100 g. IPM-02-14 and DGG-5 had higher value of total sugar i.e. 11.70 mg/100 g and least was found in DGG-3 (11.50 mg/100g). Reducing and non-reducing sugar ranged from 4.62–4.84 g/100 g and 6.75–7.16 mg/100 g respectively. DGG-8 had higher amount (4.86 g/100 g) and DGGV-02 had lowest (4.62 g/100 g) reducing sugar whereas DGG-5 (7.16 mg/100 g) recorded highest and DGG-6 (6.75 mg/100 g) had lowest non-reducing sugar. Kakati et al. [10] reported that starch, reducing sugar and non-reducing sugar contents ranged from 56.87–57.23%, 724.97–729.23 mg/100 g and 7.10–7.11 mg/100 g respectively.

Antinutritional factors

There was significant ($p \leq 0.05$) difference in antinutritional factors of green gram varieties. The tannin content ranged from 456.0–532.3 CE/100 g, whereas DGG-7 recorded highest (532.3 CE/100 g) and DGG-1 (456.0 CE/100 g) had lowest tannin content (Fig. 2). Trypsin inhibitor ranged from 206.6–267.2 TIU/g, whereas highest was found in Selection-04 (267.2 TIU/g) and least in DGG-6 (206.6 TIU/g) (Fig. 3). The phytic acid content varied from 7.27–9.40 mg/g. Selection-04 recorded highest (9.40 mg/g) followed by DGG-3 (9.26 mg/g) and IPM-02-14 (9.20 mg/g). DGG-8 had least phytic acid content (7.27 mg/g) (Fig. 4). Kakati et al. [10] reported that significant difference was found in antinutritional factors. Similar results were also reported by Tresina et al. [8].Tajoddin et al. [11] reported that phytic acid content varies depend-

ing upon the cultivars, climatic conditions, location, irrigation condition, type of soil and year during which they are grown. Therefore, from the present study it can be concluded that elite entries are on par with released varieties with regard to nutrient composition.

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