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Comparative studies on biochemical components in mung bean [Vigna radiata (L.) Wilczek] varieties cultivars in rainfed area

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Abstract

The field experiment to determine Biochemical, Molecular and Morphological Characterization of Mung bean [*Vigna radiata* (L.) Wilczek] Cultivars in Rainfed Area" in Vindhyan Plateau of Madhya Pradesh" during kharif and jayad season in the year 2020-21 to 2021-22 was conducted at the Agricultural Research Center, Ravindranath Tagore University, Raisen, Madhya Pradesh. The nutritional composition of Vigna radiata were estimated in terms of carbohydrate, free amino acid, protein, crude protein, methionine, fat content and nutrient content such as Fe, Cu and Zz biochemical changes in seeds. The significantly maximum (63.56%) carbohydrate in the variety of RMG-62 but maximum total soluble sugar content (6.11%) and minimum nutrient value noticed in Pant M-2. These results suggest that the nutritional content and quality of Vigna radiata significantly differ according to cultivars.

Introduction

In India, pulses find an important place in human diet due to vegetarian food habits. According to FAO estimate, 70 per cent of human food comprises cereals and legumes and the remaining 30 per cent comes from animal. The area under pulses in India is around 24.38 million hectares with a production of 14.52 million tones (Sathyamoorthi et al., 2017). Nearly 8 per cent of this area is occupied by mungbean, which is the third most important pulse crop of India, next to gram and pigeonpea. In Punjab, mungbean occupied 12.3 thousand hectares with a production of 10.7 thousand tonnes and with average productivity of 873 kg per hectare (Anonymous, 2018). Pulses are generally deficient in sulfur containing amino acids such as methionine and cysteine but rich in lysine and tryptophan (Khan et al., 2019), which are the limiting amino acids in cereals. Mungbean seeds contain 22-25% protein, 1.21% lysine, 0.006% iron and other essential elements. The seeds are used as whole as well as split dal, which is easy to cook. Nutrients, hormones and environmental factors such as temperature, relative humidity may alter biochemical components affecting seed quality and quantity. A lot of work on growth parameters such as short stature, short duration, synchronous maturity, shining green bold seeds, resistance to shattering of pods, high grain yield and tolerance to Mungbean Yellow Mosaic Virus (MYMV) has been reported (Sekhon et al., 2004). Mungbean is considered the hardiest of all pulse crops since it is grown extensively under varying climatic conditions. It has greater capacity to grow at high temperature up to 45°C. Therefore, presence of hard seeds affects the grain quality and yield. Work on mungbean biochemical components, storage protein, their characterization, electrophoretically and immunologically for subunit composition and changes during seed development has been reported (Sital et al., 2009). Protein quality improvement in mungbean as influenced by sulfur nutrition and Rhizobium inoculation has also been studied. Schroeder(2016) compared some characters pertaining to protein quality parameters viz; crude protein, extractable protein, globulins, albumins, total seed and protein sulfur, carbon: nitrogen and nitrogen: sulfur ratios in the genus Pisum, but information in comparison to climatic conditions affecting seed biochemical components of mungbean was lacking. Therefore, the present investigation was carried out to omparative studies on biochemical components in mung bean [Vigna radiata (L.) Wilczek] varieties cultivars in rainfed area during Kharif and Jayad seasons in Bhopal region.

Materials and Methods

The current study was carried out at an agricultural farm of the Faculty of Agriculture, Rabindranath Tagore University Raisan during the Kharif of 2020–21 and 2021–22 M.P. (India). The area is characterised by a dry sub-humid climate. A set of twelve cultivars of mungbean [*Vigna radiata* (L.) Wilczek] (BPMR-145, HUM-2, MUM-2, PAIRY MUNG, PANT M-2, PANT M-4, PKV AKM-4, PUSA-0672, RMG-62, RMG-268 and SAMRAT were taken as experimental materials in the present study. Three replications of each cultivar were used in the experiment's Randomized Block Design (RBD) layout during the Kharif seasons of 2020–21 and 2021–22. The field tests took place between July and September of 2020–21 and 2021–22. Each genotype was planted on an area of 3.0 m by 2.25 m and having five rows. The plant-to-plant spacing was kept at 10 cm by thinning, and the row-to-row spacing was 45 cm. A sample of mungbean seeds weighing 0.1 g was extracted twice using 5 ml of hot, 80% ethanol. The reducing sugar was dissolved in 10ml of distilled water after the supernatant was collected and evaporated on a water bath at 800C. Then, after adding 3 ml of the dinitrosalicylic acid (DNS) reagent to a 1 ml aliquot, the mixture was heated on a water bath for 5 minutes. 1 ml of 40% Sodium - Potassium tartarate was added while the tube's contents were still heated and then cooled to room temperature. At 510 nm, a spectrophotometer (Systronics 169) was used to measure the intensity of the red colour in comparison to a reagent blank. On the basis of a standard curve created with known concentrations of glucose, the total amount of reducing sugar was estimated. The estimation was carried out three times, and the mean of the results was expressed as a percentage of reducing sugar in the moisture-free sample. The data were statistically analyzed using factorial complete random design and mean values of different parameters were compared using critical difference at 5%.

Results and Discussion

The largest figure for moisture percent was found in HUM-2 (10.67%) in the pooled data, along with Pant M-2 (9.43%) and RMG-268 (9.23%), and the least value was discovered in Samrat (7.83%). The outcomes were consistent with those of Blessing and Gregory (2010) and Mubarak (2005), who estimated that raw, unprocessed mungbean flour had a moisture content of 10.25% and 9.75%, respectively. The moisture content of mungbean flour is 8.78% in Afzal (1978) and 8.25% in Bhatty et al. (2000), respectively. The variations in moisture content may be influenced by geographical and varietal factors. The majority of nutritional calories consumed by humans and other animals come from carbohydrates. The combined data also showed that MUM-2 (62.47%) had the highest carbohydrate content, followed by Samrat (62.09 %) and Pusa-9072(62.05%), while HUM-2 (59.67%) had the lowest value. The findings of this study corroborate those of Mubarak (2005), Agugo and Onimawo (2008), Paul et al. (2011), who determined that the carbohydrate content was 62.9%, 61.47%, and 60.35 percent, respectively. According to Adel et al. (1980), the percentage of carbohydrate in mungbean seeds ranged from 64.15 to 66.32%. Mungbean seeds have a total carbohydrate content of 54.9–58.9% of their weight, according to Habbibullah et al. (2007). Savage and Deo and Muller (1988) and Savage and Deo and Muller (2000) both noted significantly reduced carbohydrate content (between 35 and 40 percent). Different chemical synthesis due to environmental and genetic variables may be the source of the variation in total carbohydrate content. The combined data also showed that Samrat (4.47%) had the highest total soluble sugar content, while RMG-62 (3.97 %) had the lowest. HUM-2 (3.97%) and Pant M-4 (2.19%) were the next-highest in this list. In contrast to the most recent findings, Naivikul and D'appolonia (1976) showed that sugar content was higher in mungbean genotypes and was 7.22 percent higher. According to Anonymous (2012), soluble sugar concentrations differed among mungbean genotypes (between 7.1% and 8.9%). According to Mondal et al. (2013), the soluble sugar concentration of freshly harvested seeds from six different mungbean kinds ranged from 5.01 to 9.30%. The combined data also showed that BPMR-145 (3.96%) had the highest non-reducing sugar value, followed by Pusa-9072 (3.17%) and Samrat (2.98%), while Pant M-2 (2.17%) had the lowest value. in the both the years. Non-reducing sugar in mungbean, broadbean, and kidneybean varied from 5% to 7%, according to Tanusi et al. in 1972. On the other hand, a substantially lower range, 7.10–7.11 mg/100 g mungbean flour, has been observed by (Kakati et al. 2010). The combined results also showed that the cultivar HUM-2 had the highest reducing sugar content (0.92%), followed by the cultivars Pant M-2 (0.80%) and Samrat (0.80%), while cultivar Pusa-0672 had the lowest (0.39%). These findings are in line with those of Chakraborty (1993) and Kakati et al. (2010), who discovered that the decreasing sugar levels in mungbean flour varied from 641.61 to 794.50 mg/100g and from 724.97 to 729.23 mg/100g, respectively, on a dry weight basis. Tanusi et al. measured decreasing sugar levels in mungbean, broadbean, and kidneybean in 1972; these levels ranged from 0.06 to 0.10 g per 100g on a dry weight basis. Mubarak (2005) found an unusually high result (4.85 g/100g) for reducing sugar in raw mungbean seed during his investigation of the effects of different domestic and traditional methods on the nutritional composition of mungbean seeds. The combined data also showed that HUM-2 (25.16%), BPMR-145 (23.98%), and Pusa-0672 (24.97%) had the highest and lowest values of crude protein, Soluble Protein Content, Methionine Content, Crude Fat Content, Calorific Value, Total Phenol Content, Ash Content respectively. Samrat (23.00%) had the lowest value. In 1998, Saleem et al. showed that the crude protein content of mungbean seed ranged from 22.88 to 24.65 percent. The percentages of protein in mungbean seed flour reported by Agugo and Onimawo (2008), Blessing and Gregory (2010), Butt and Batool (2010), and Gregory and Gregory (2008) are 25.09%, 24.08%, 25.90%, and 25.00%, respectively. (2000) Bhatty et al. The variations in protein levels are assumed to be caused by the genetic makeup of mungbean cultivars, cultural practices, as well as some environmental factors.

The cultivar BPMR-145 (14.89 mg/100g) had the highest quantity of iron, followed by Pusa-9072 (14.28 mg/100g) and PKV AKM-4 (14.12 mg/100g), while Pusa-0672(10.32 mg/100g) had the lowest amount. The combined results showed that Pusa-9072 had the highest copper and zinc concentration, followed by RMG-62, and HUM-2 , while Samrat had the lowest value (1.55 mg/100g). Habibullah et al. (2007) found that two kinds of mungbean had zinc concentrations that were much lower (1.54-1.88 mg/100 g flour).

Table: 1 Values of Moisture (%), Total Carbohydrate (%), Total Soluble Sugar (%),Non Reducing Sugar (%) in 12 Mung bean Cultivars

S. N.	Cultivar/Variety	Moisture (%)	Total Carbohydrate (%)	Total Soluble Sugar (%)	Non Reducing Sugar (%)
1	BPMR-145	8.2	61.54	2.99	3.96
2	HUM-2	10.67	59.67	3.97	2.49
3	MUM-2	8.6	62.47	6.11	2.94
4	Pairy Mung	8.65	60.17	2.99	5.07
5	Pant M-2	9.43	61.25	3.67	2.17
6	Pant M-4	8.8	61.75	2.19	2.95
7	PKV AKM-4	8.21	61.83	2.82	2.49
8	Pusa-0672	9.17	61.31	2.98	2.95
9	Pusa-9072	8.81	62.05	2.9	3.17
10	RMG-62	8.53	63.56	3.97	2.48
11	RMG-268	9.23	61.99	3.43	2.94
12	Samrat	7.83	62.09	4.47	2.98
	SEm±	0.11	0.1	0.02	0.02
	CD at 5%	0.33	0.3	0.06	0.06

Table: 2 Values of Reducing Sugar (%), Crude Protein (%), Soluble Protein (%), Methionine (g/16g N) in 12 Mung bean Cultivars

S. N.	Cultivar/Variety	Reducing Sugar (%)	Crude Protein (%)	Soluble Protein (%)	Methionine (g/16g N)
1	BPMR-145	0.67	23.98	18.83	1
2	HUM-2	0.92	25.16	15.48	1
3	MUM-2	0.66	24.79	20.62	1.95
4	Pairy Mung	0.61	24.81	16.8	0.79
5	Pant M-2	0.8	24.51	17.26	1.22
6	Pant M-4	0.66	23.95	18.07	0.91
7	PKV AKM-4	0.64	23.8	18.34	0.99
8	Pusa-0672	0.39	24.97	15.44	1.18

9	Pusa-9072	0.61	24.81	17.33	1.14
10	RMG-62	0.74	24.16	15.77	0.64
11	RMG-268	0.77	24.31	18.84	0.94
12	Samrat	0.8	23	16.49	0.98
	SEm±	0	0.23	0.04	0.03
	CD at 5%	0.01	0.66	0.13	0.08

Table: 3 Values of Crude Fat Content (%), Calorific Value (kcal/100g), Total Phenol (mg/100g), Ash (%) in 12 Mung bean Cultivars

S. N.	Cultivar/Variety	Crude Fat Content (%)	Calorific Value (kcal/100g)	Total Phenol (mg/100g)	Ash (%)
1	BPMR-145	1.15	354.86	67.34	3.74
2	HUM-2	1.16	351.17	89.33	3.68
3	MUM-2	0.95	360.52	75.46	3.63
4	Pairy Mung	1.22	351.16	72.63	3.5
5	Pant M-2	1.03	355.26	71.77	4.05
6	Pant M-4	1.02	351.59	73.98	3.41
7	PKV AKM-4	1.12	358.15	62.31	3.62
8	Pusa-0672	1.27	356.09	60.18	3.58
9	Pusa-9072	1.51	351.59	74.83	3.95
10	RMG-62	1.04	356.59	65.46	3.61
11	RMG-268	1.01	356.08	71.33	3.45
12	Samrat	1.28	349.14	80.16	3.65
	SEm±	0.04	1	0.1	0.06
	CD at 5%	0.13	2.93	0.29	0.17

Table: 4 Values of Fe Content (mg/100g), Cu Content (mg/100g), Zn Content(mg/100g), in 12 Mung bean Cultivars

S. N.	Cultivar/Variety	Fe Content (mg/100g)	Cu Content(mg/100g)	Zn Content(mg/100g)
1	BPMR-145	14.89	1.69	3.56
2	HUM-2	11.49	2.12	3.25
3	MUM-2	12.19	1.72	3.11
4	Pairy Mung	13.81	1.71	3.32
5	Pant M-2	11.39	1.87	3.27
6	Pant M-4	13.71	1.9	3.38
7	PKV AKM-4	14.12	2.05	3.4

8	**Pusa-0672**	10.32	1.63	2.55
9	**Pusa-9072**	14.28	3.28	3.49
10	**RMG-62**	12.43	3	2.78
11	**RMG-268**	11.27	1.64	3.43
12	**Samrat**	10.45	1.55	2.78
	SEm±	0.17	0.04	0.06
	CD at 5%	0.5	0.11	0.18

Conclusion

Thus, it may be suggested that mung bean seedlings is involved in changes in the nutritive contents, biochemical composition, growth parameters and photosynthetic pigments. There was a dramatic increase in proteins and amino acids involving de novo synthesis of new proteins and accumulation of certain existing proteins compared to the dry mung bean seeds. Improved nutritional values of legumes through such techniques have immense importance in alleviation of food crisis. Thus, it is encouraged to increase the consumption of germinated mung beans for enhanced nutrition uptake and disease prevention.

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