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Proximate composition and estimation of mineral content from different mungbean (*Vigna radiata* (L).Wliczek) genotypes

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Abstract
Sixteen mungbean genotypes studied to analyze the proximate composition and mineral contents, Mungbean is a rich source of protein, carbohydrate, Ca, Mg, Zn, Fe, P, and K. The result showed that in Green gram protein ranges from 15.8 to 24.59 %, carbohydrate 11.97 to 41.88 %, ash 3.1 to 4 %, moisture 5.26 to 10 %, phosphorus 89 to 350 mg/100g, potassium 878 to 1685 mg/100g, zing 0.85 to 2.73 mg/100g, iron 4.02 to 11.20 mg/100g, calcium 85.52 to 134.80 mg/100g and magnesium 121.22 to 168.9 mg/100g. The stated genotypes AKM-8802, PKV-AKM-4 and PKV-Green Gold showed highest % of protein and carbohydrate. Among sixteen genotypes PKV-AKM-4, BM-4, Uttkarsha and PKV Green Gold had highest amount of calcium, magnesium, Iron, and Zinc contain.

Keywords: proximate composition, mineral contents, mungbean and protein

Introduction
Mungbean (*Vigna radiata* (L.) *Wilczek*) is one of the lesser known legume which originated from South East Asia (India) has been mostly grown in Asian countries like Thailand, Burma, Indonesia and Philippines. It is now widely cultivated in Africa, South America, Australia and the United states. The seed colour usually dark olive green, bright green skin or yellow and the beans are small, cylindrical or ovoid, globular or oblong in shape, but some cultivar produced brow or speckled blak seed**.** Green gram is an excellent source of protein (25%), high in dietary fibre, rich source of vitamin, minerals and its essential amino acid. They are the rich source of Ca, Mg, Fe, P and K. Green gram is a valuable addition to a crop rotation both from its nutritional benefits as a grain as a vegetable, and its compatibility with other crops. It can fix up to 110 Kg N/ha of nitrogen crops after meeting its own requirement. Therefore the present study conducted to determine the proximate composition and mineral content of green gram for the best possible utilization for the poor people of India.

Materials and Methods
Seed of 16 mungbean genotype *viz.*,Kopergaon,PKV-AKM-4,AKM-8802, PKV Green gold,BM-2003-2, BM-2002-1, AKM-10-12,Vaibhav, Utkarsha, BM-4, AKM-12-17,AKM-12-07, BM-2011-3, BPMR-145,AKM-10-10, Phule M-504-20-27 were obtained from Pulses Research Unit Dr. P.D.K.V, Akola were used for the experiment which was conducted at the field of Agricultural Botany Dr. P.D.K.V, Akola, Maharashtra, during the Kharif 2015. The material was planted in Randomized Block Design (RBD) with three replication and data was recorded on five randomly selected plant at harvesting stage of pod. After harvesting of plant seeds of were powdered using pestle and mortar finely and finally kept in an airtight glass container, all the chemicals used in the experiment were analytical grade.

Proximate analysis
Protein content (%)
The nitrogen content of grain of each genotype was determined by Kjeldahl method.
The nitrogen percentage was multiplied by 6.25 factors for to estimate protein content.

Moisture content
Moisture content was determined by oven dry method

Ash content
Ash contain was determine by Muffle furnace maintaining temperature between 500-600 ^{0}c.

Carbohydrate content
Carbohydrate (starch) content of seeds from pods harvested at maturity was determined using Anthrone reagent.

Mineral Analysis
Calcium: Calcium was analysed by titration with EDTA-Ethylene Di-amine Tetra acetic acid using Sodium hydroxide buffer and Calcon indicator.

Magnesium: Magnesium was analysed by titration with EDTA- Ethylene Di-amine Tetra acetic acid using ammonium buffer and Eric indicator.

Micronutrients
Iron and zinc, present in the seeds grain stage were measured using the Atomic Absorption spectrophotometer (AAS).

Potassium: Potassium in mungbean seeds was determined by flame photometer method.

Phosphorus: Phosphorous in mungbean seeds was determined by spectrophotometer.

Result and Discussion
The analysis of variance revealed significant differences among the genotypes for all the traits studied
The present study aimed at assessing the nutritional composition of sixteen mungbean genotypes for proximate and mineral composition of mungbean genotypes at mature seed stage. The results of proximate and mineral composition are mentioned in the Tables 1.

A) Proximate composition
Moisture content (%)
Moisture content ranged from 5.26 to 10.90%. Highest moisture was observed in PKV-Green gold (10.90 %) while Kopergaon and AKM-12-07 showed lowest moisture content (5.26%). Average mean of all genotypes for moisture content was 7.05%.
However, other researchers had earlier reported that raw mungbean had 8.25 to 10% moisture content, Butt and Batool (2010) [2].

Ash content (%)
Ash is the inorganic residue remaining after water and organic matter have been removed by heating in the presence of oxidizing agent, which provides a measure of the total amount of minerals within a seed. Ash content in mungbean genotypes ranged from 3.1 to 4% with average mean of 3.66 %, PKV-green gold (4 %) has highest ash contain (4 %) and minimum ash content was reported in AKM-12-07 (3.1%). Similar findings were observed by Tapash *et al* (2011) [7].

Protein content (%)
Proteins are building blocks of human body needed for growth, development and body repair cells.The recommended dietary allowance for protein is 45 g/day to 55 g/day (National academies).

Table 1: Mean performance of proximate and minerals composition in mungbean genotypes

Name of varieties	Protein (%)	Carbohydrate (%)	Ash (%)	Moisture (%)	Phosphorus (mg/100g)	Potassium (mg/100g)	Zinc (mg/100g)	Iron (mg/100)	Calcium (mg/100g)	Magnesium (mg/100g)
Kopergaon	24.55	32.14	3.90	5.26	104.00	1120.00	1.98	9.58	120.20	131.60
PKV-AKM-4	24.59	24.83	3.40	7.14	110.00	985.00	0.85	7.09	134.50	146.80
AKM-8802	21.85	41.88	3.60	10.00	312.00	1018.00	1.58	6.90	121.06	165.02
PKV Green gold	23.90	40.24	4.00	10.90	120.00	1685.00	1.79	6.37	122.80	129.90
BM-2003-2	20.22	25.8	3.40	8.50	108.00	1630.00	1.26	11.20	125.08	135.66
BM-2002-1	18.26	25.8	3.20	7.24	113.00	1150.00	1.98	6.64	120.90	130.08
AKM-10-12	22.30	25.32	3.50	5.76	382.00	878.00	1.85	10.90	132.50	145.00
Vaibhav	17.90	27.75	3.90	5.88	354.00	1490.00	1.77	7.86	126.20	121.22
Uttkarsha	15.80	25.32	3.90	5.43	142.00	1095.00	1.25	4.15	134.80	160.08
BM-4	19.60	11.97	3.85	7.69	153.00	1485.00	2.73	8.82	133.02	133.00
AKM-12-17	20.10	37.25	3.60	6.20	123.00	980.00	2.43	7.65	108.65	131.99
AKM-12-07	18.90	23.86	3.10	5.26	89.00	1320.00	1.99	6.58	98.66	129.30
BM-2011-3	20.40	18.5	4.00	8.00	232.00	1245.00	1.98	4.02	121.66	135.09
BPMR-145	22.25	22.86	3.70	8.50	98.00	1070.00	2.18	10.98	95.89	128.99
AKM10-10	23.40	18.5	3.90	5.55	115.00	1045.00	1.85	8.29	120.82	130.08
Phule M-504-20-27	23.20	17.67	3.60	5.54	350.00	950.00	1.29	5.65	85.52	168.90
Range	15.8 -24.59	11.97-41.88	3.1-4	5.26-10.90	89-382	878-1685	0.85-2.73	4.02-11.20	85.52-134.08	121.22-168.9
Mean	21.08	26.23	3.66	7.05	181.56	1196.63	1.80	7.67	118.89	138.92
SE (mean)	0.97	1.21	0.18	0.35	12.55	64.48	0.10	0.40	6.40	6.82
CD @ 1%	3.73	4.67	0.71	1.37	48.25	247.87	0.37	1.55	24.63	26.21
F-Test	S	S	N.S	S	S	S	S	S	S	S

Protein percentage varied from 15.8 to 24.59 % with average mean 21.08 % shown in table 1. Among the genotype Utkarsha (15.80 %) had minimum protein percentage while genotype PKV-AKM-4 (24.59 %) recorded highest protein percentage. Similar findings were observed by li *et al* (2010) [6].

Carbohydrate (%)
Carbohydrates are the primary energy sources for the human body. Starch and sugars are the major forms of energy sources for the body. The recommended dietary allowance of carbohydrate is 46 g to 56 g per day. The tolerable upper intake level is 25 % of the energy intake (National academies). In mungbean, carbohydrate ranged from 11.97 to 41.88% with average mean of 26.23%. AKM-8802 (41.88%) had maximum carbohydrate while, genotype BM-4 (11.97%) had minimum percentage of carbohydrate, and similar findings were recorded by Habibullah (2007) [5].

B) Minerals composition

Phosphorus (mg/100g)

Phosphorus use for growth and repair of body cells and tissue. All the body cells contain phosphorus with 85% found in bone and teeth. Phosphorus together with calcium provide structure and strength.

Phosphorus content ranged from 89 - 382 mg/ 100 g with average mean 181.56 mg/100g. it was recorded highest in genotype AKM-10-12 (382 mg/100g).

Potassium (mg/100g)

Potassium is a very significant body mineral, important to both cellular and electrical function. It is one of the main blood minerals called "electrolytes".

In present study Potassium ranged from 878 – 1685 mg/100g with average mean 1196.63 mg/100g. Genotype PKV-green gold (1685 mg/100g) recorded highest potassium content while AKM-10-12 (878 mg/100g) recorded lowest potassium content in studied mungbean seed.

Zinc (mg/100g)

Zinc is an important trace mineral needed for the body's immune system, cell division, wound healing and sense of smell and taste.

Zinc ranged from 0.85 to 2.73 mg/100 g with average mean of 1.80 mg/100g. BM-4 (2.73 mg/100g) recorded highest zinc content.

Iron (mg/100g)

Iron is an essential mineral as it is needed for haemoglobin synthesis and its deficiency causes iron-deficiency anaemia which is a common problem in women and children (U.S. National Library of General Medicine).

In studied mungbean genotypes Iron ranged from 4.02-11.20 mg/100 g with average mean of 7.67 mg/100g. Genotype BM-2003-2 (11.20) recorded highest Iron content.

Calcium (mg/100 g)

Calcium is the most important plentiful mineral found in the human body which helps in maintaining strong bones and teeth, blood clotting, neuro-transmission, muscular movements, hormonal activities and maintaining a normal heart beat (U.S. National Library of General Medicine).

The recommended dietary allowance for calcium is 1000-1200 mg/day. The tolerable upper intake level is 2500 mg/day (ConsumerLab.com).

In present investigation, calcium ranges from 85.52 – 134.80 mg/100 g with average mean of 118.89 mg/100 g. Genotype Uttkarsha (134.80mg/100 g) recorded highest calcium content.

Magnesium (mg/100 g)

Magnesium ranged from 121.22-168.9 mg/100g with average mean 138.92 mg/100 g. Genotype Phule –M-504-20-27 (168.9 mg/100g) recorded highest magnesium content.

Similar findings were reported by Anwar *et al* (2007) and Tapash *et al*. (2011) [7].

Conclusion

In present investigation, analysis of nutritional and mineral composition was done in sixteen mungbean genotypes and found that mungbean is a rich source of protein, carbohydrate, Ca, Mg, Zn, Fe, P, and K.

In genotypes PKV-green gold and AKM-8802 the protein percent was found to be 23.90 and 21.85 percentage respectively and carbohydrate percentage was found to be 40.24 and 41.88 percentage respectively.

PKV- green gold and AKM-8802 can satisfy needs of protein and carbohydrate. These genotypes can be further used for bio fortification.

Among sixteen genotypes PKV-AKM-4, BM-4, Utkarsha and PKV-green gold had highest amount of calcium, magnesium, Iron and Zinc content.

PKV-AKM-4, BM-4, Utkarsha and PKV-green gold can satisfy the micro-nutritional needs of the growing population, hence these genotype can be further used for bio fortification.

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