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RESEARCH ARTICLE

MINERAL COMPOSITION AND SUGARS CONTENT IN CHICKPEA (*CICER ARIETINUM* L.) VARIETIES*

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ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the most important grain- legumes crops in the world. Chickpeas are rich sources of nutritional composition and there health benefits of consuming legumes could be effective for the expansion of their food uses. Ten prominent varieties of *desi* and *kabuli* chickpea procured from AICRP on voluntary center, Dharwad. And variety BGD-111- 01 was obtained from IARI Regional research center, Dharwad. Among these six varieties are released and while remaining five varieties are elite genotypes which were under advanced trials. Standard methods used to analyze mineral composition and sugars estimation. Calcium content was more in DIBG-201 variety whereas BG-1105 showed least amount of calcium. DIBG-201 had highest iron content, BGD-111-01 variety had higher amount of copper (1.86 mg/100g), and BGD-111-01 variety had higher amount of copper (1.86 mg/100g), zinc (6.67 mg/100g) and manganese (2.24 mg/100g) as compared with other varieties. The total sugar content varied from 11.50mg/100g-4.50mg/100g Variety DIBG-201 (1.58mg/100g) variety had highest reducing sugars and non-reducing sugars are more in MNK-1(10.19 mg/100g).Starch content was ranged from 34.49 to 50.24 g/100g. The results of the present study revealed that elite entries are on par with released varieties with regard to mineral composition, sugars and starch levels.

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INTRODUCTION

Legumes are the most commonly used plant food materials in our country. Legumes comprise a large group of foods. The term pulses, bean and legume are commonly used to designate the decorticated or whole seeds of leguminous plants. They are the primary source of dietary proteins and other nutrients. But the legumes have the limitation that they have to be cooked for a prolonged period to make them digestible and palatable. Chickpea (*Cicer arietinum* L.) is the most important pulse crop India from production and consumption point of view. Chickpea is an important source of protein in several developing countries. Among the world's grain legumes, chickpea is second to dry bean in cultivated area and third in production to dry beans and dry peas. Chickpea s are of two basic types: *kabuli* and *desi*. *Kabuli* seeds are generally grown mainly in the Mediterranean countries whereas the *desi* types predominant in the Indian sub continent (Singh *et al*., 1991) in fact India accounts for over 70 per cent of the world's total production and consumption of chickpea. Chickpea is widely grown across the country and serves as a multi-purpose crop (Shiferaw and Hailemariam, 2007). First, it fixes atmospheric nitrogen in soils and thus improves soil fertility and saves fertilizer costs in subsequent crops. Secondly, it improves more intensive and productive use of land, particularly in areas where land is scarce and the crop can be grown as a second crop using residual moisture. Thirdly, it reduces malnutrition and improves human health especially for the poor who cannot afford livestock products. It is an excellent source of protein, fiber, complex carbohydrates, vitamins, and minerals. So the present investigation was under taken to study the mineral composition and sugars content of selected elite entries and released varieties of chickpea.

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MATERIALS AND METHODS

Ten prominent varieties of *desi* and *kabuli* types were procured from AICRP on Chickpea Voluntary Center Dharwad and one variety BGD111-01 was obtained from IARI, Regional

Research Center, Dharwad. Among these six varieties are released and while remaining five varieties were elite genotypes which were under advanced trials. Among the these six varieties are released (JG-11, JAKI-9218, Annigeri-1, Annigeri, BG-1105, MNK-1) and five varieties are elite entries (DIBG-201, DIBG-202, BGD-111-01, GBM-2, DBGV-165). Calcium was estimated by titrimetric method (Anonymous, 2005). The trace elements viz., iron, zinc, copper and manganese were estimated using Atomic Absorption Spectrophotometer. Sugars were estimated by Nelson Somogyi's method and starch content was determined by Anthrone method, according to the procedure given by Sadashivam and Manickam (Sadashivam and Manickam, 2008). The results were statistically analysed by one way ANOVA followed by paired t- test, using SPSS software.

RESULTS AND DISCUSSION

Table 1 depicts the mineral composition of chickpea varieties. Significant differences for the all above mineral contents were observed among the varieties ($p \leq 0.05$). Whereas calcium content is ranged from 170.34 to 196.27 mg/100g, DIBG-201 variety showed highest of calcium content as compared with other varieties, whereas BG-1105 showed least amount of calcium. Iron content of chickpea differed significantly ($p \geq 0.05$) in all the varieties, and it ranged from 4.14 to 7.06 mg/100g. DIBG-201 had highest iron content followed by BGD-103 (6.05 mg/100g), DIBG-202 (6.02 mg /100g) and less in GBM - 2 (4.14mg /100g) variety. Similar results were observed by Agrawal and Singh 2003 (Agrawal and Singh, 2003) where calcium content ranged from 203.18to 222.59mg/100g and Iron content in chickpea varied from 4.14

Table 1. Mineral contents of chickpea varieties (mg/100g)

Varieties	Calcium	Iron	Copper	Zinc	Manganese
Released varieties					
JG-11	192.47±0.16	5.25±0.03	1.06±0.00	4.35±0.03	1.27±0.01
JAKI – 9218	193.31±0.18	4.65±0.04	1.15±0.03	5.03±0.01	1.95±0.04
Annigeri-1	178.23±0.20	4.58±0.03	1.21±0.01	5.70±0.01	2.04±0.04
BGD -103	190.25±0.22	6.05±0.04	1.19±0.03	4.97±0.01	1.87±0.03
BG-1105(K)	170.34±0.00	4.68±0.01	1.05±0.02	4.34±0.02	0.75±0.03
MNK-1(K)	176.23±0.20	4.57±0.02	1.07±0.02	3.05±0.02	0.87±0.02
Elite entries					
DIBG-201	196.27±0.23	7.06±0.03	1.58±0.01	6.03±0.02	1.67±0.02
DIBG-202	194.36±0.15	6.02±0.01	1.67±0.02	5.92±0.06	2.30±0.01
BGD-111-01	192.38±0.00	5.58±0.01	1.86±0.03	6.67±0.02	2.24±0.02
GBM – 2	188.37±0.00	4.14±0.01	1.57±0.03	4.86±0.01	1.54±0.03
DBGV – 165(K)	174.34±0.00	5.09±0.05	1.08±0.01	3.01±0.06	0.96±0.02
Mean±SD	186.05±0.01	5.24±0.01	1.32±0.01	4.90±0.0.3	1.59±0.01
SEm ±	0.91	0.02	0.01	0.02	0.01
C.D	3.22*	0.05*	0.04*	0.06*	0.05*

Note: Values are mean of three replications, SEm : Standard Error of Mean, CD: Critical Difference. *Significant @ 5%

Table 2. Mineral contents of released and elite entries of chickpea varieties (mg/100g)

Chickpea varieties	Ca	Fe	Zn	Mn	Cu
Released varieties	183±0.75	4.96± 0.59	4.57± 0.90	1.45 ± 0.57	1.12± 0.07
Elite entries	189±0.77	5.57 ± 1.08	5.29 ± 1.43	1.74 ± 0.55	1.55 ± 0.28
t-value	1.00*	1.20 NS	1.02 NS	0.83NS	3.56 **

Note: Values are mean of three replications, SEm: Standard Error of Mean, CD: Critical Difference. *Significant @ 5%, ** Significant @ 1%

Table 3. Starch and sugar contents of chickpea varieties

Varieties	Total sugar (mg/100g)	Reducing sugar (mg/100g)	Non-reducing sugar (mg/100g)	Starch (g/100g)
Released varieties				
JG-11	5.8±0.08	0.92±0.04	4.92±0.09	36.25±0.03
JAKI – 9218	6.08±0.05	0.82±0.05	5.29±0.05	36.09±0.02
Annigeri-1	7.02±0.05	1.08±0.05	6.00±0.09	38.23±0.03
BGD -103	5.88±0.11	1.23±0.05	4.72±0.13	39.46±0.02
BG-1105(K)	9.93±0.06	0.87±0.01	9.10±0.05	48.58±0.05
MNK-1(K)	10.93±0.05	0.76±0.03	10.19±0.03	50.24±0.02
Elite entries				
DIBG-201	6.75±0.03	1.58±0.01	5.24±0.04	42.24±0.02
DIBG-202	7.48±0.05	1.54±0.02	6.01±0.05	40.21±0.01
BGD-111-01	5.27±0.04	1.24±0.25	4.09±0.23	43.39±0.05
GBM – 2	4.50±0.02	0.86±0.03	3.68±0.04	34.49±0.03
DBGV – 165 (K)	11.10±0.03	0.95±0.02	10.20±0.04	51.18±0.05
Mean±SD	7.34±0.02	1.08±0.07	6.32±0.06	41.85±0.01
SEm ±	0.03	0.05	0.05	0.02
C.D	0.11*	0.16*	0.19*	0.06*

Note: Values are mean of three replications, SEm: Standard Error of Mean, CD: Critical Difference. *Significant @ 5%

Table 4. Starch and sugar contents of released and elite entries of chickpea varieties

Varieties	Total sugar (mg/100g)	Reducing sugar (mg/100g)	Non-reducing sugar(mg/100)	Starch (g/100g)
Released varieties	7.60 ±2.25	1.23 ±0.32	6.70 ±2.34	41.47±6.29
Elite entries	7.02 ±2.56	0.95 ±0.17	5.85 ±2.59	42.30±6.02
t-value	0.40 NS	1.83 NS	0.57 NS	0.22 NS

Note: Values are mean of three replications, SEm: Standard Error of Mean, CD: Critical Difference. *Significant @ 5%, ** Significant @ 1%

to 7.06 mg/100g. Iron content in the varieties ranged from 6.5 to 9.2mg/100g. BGD-111-01 variety had higher amount of copper (1.86 mg/100g), zinc (6.67 mg/100g) and manganese (2.24 mg/100g) as compared with other varieties Whereas, BG-1105 (1.05 mg/100g) had less content of copper, DBGV-165(3.01 mg/100g) exhibited less content of zinc and BG-1105 (0.75 mg/100g) showed the less amount of manganese as compared with other varieties. The present investigation is in conformity with earlier reports (Singh *et al.,* 1981; Christine *et al*., 1976; Ghavidel and Prakash 2008; Mulanga *et al.,* 2012) reported that mineral composition content in chickpea varied greatly with cultivars, further it was observed that *desi* varieties had higher mineral density compared to *kabuli* cultivars. No statistical differences were observed between released varieties and elite entries except calcium and copper content of chickpea. The elite entries had higher values compared to released varieties (Table 2). Significant differences in the mineral content of the chickpea varieties might be attributed to absorbance capacity of mineral content from soil and regional and climatic changes and ability of the root to absorb mineral from soil.

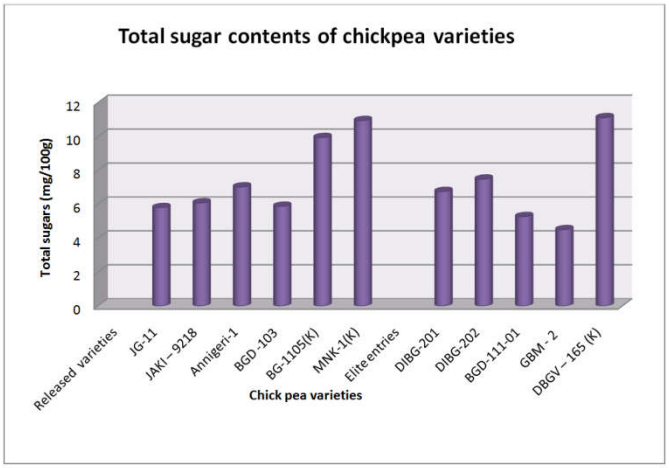

Fig. 1. Total sugars contents of chickpea varieties

The results of the Total sugars, reducing sugars, non-reducing sugars and starch in chickpea varieties presented in Table 3. There was no significant difference in starch, total, reducing, non-reducing contents between released varieties and elite entries. The total sugars content varied from 4.50 mg/100g to 11.10 mg/100g, whereas *kabuli* genotypes exhibited higher amount of total sugars as compared with *desi* genotypes. The total sugar content is more in DBGV – 165 (11.50mg/100g) followed by MNK-1(10.93 mg/100g), BG-1105(9.93 mg/100g) and less in GBM-2 (4.50mg/100g) (Fig 1). Variety DIBG-201 (1.58mg/100g) variety exhibited higher amount of reducing sugars as compare with JAKI - 9218 (0.82mg/100g). The non-reducing sugars are more in MNK-1(10.19 mg/100g) and less in GBM-2 (3.68 mg/100g) variety. According to Sanchez-Mata *et al.,* 1999 the total soluble sugar content in chickpea varieties ranged from 5.89 to 8.21g/100g. Total soluble sugars content was 9.33g/100g in chickpea reported by Goni *et al*., 1996. The non-reducing sugars are more in MNK-1variety and less in GBM -1variety in the present study. Non reducing sugars content ranged from 1.61 to 7.95 g/100g as reported earlier by several workers (Agrawal and Singh, 2003; Gupta *et al*., 2006). Starch content was ranged from 34.49 to 50.24 g/100g, which is highest in DBGV – 165 (51.18 g/100g), MNK-1 (50.24 g/100g) whereas least in GBM-2 (34.49 g/100g) variety. Similar values of reducing sugar content have been reported by Gupta *et al.,* 2006 and reported higher values for reducing sugar content (2.26 to 2.93 g/100g) in chickpea varieties. Kakati *et al*., 2010 reported that starch, reducing sugar and non-reducing sugar contents ranged from 56.87 to 57.23 per cent, 724.97 to 729.23mg/100g and 7.10 to 7.11mg/100g respectively. The non-reducing sugars are more in MNK-1variety and less in GBM -1variety in the present study. Non reducing sugars content ranged from 1.61 to 7.95 g/100g as reported earlier by several workers (Agrawal and Singh, 2003; Gupta *et al*., 2006). The similar result with regard to starch content was observed in other studies. Gupta *et al*. 2006; Wang *et al.,* 2008. There was not statistically significant difference in total sugars, reducing sugars, non-reducing sugars and starch contents. The released varieties had higher content of total sugars, reducing sugars and non-reducing sugars whereas elite entries had lower amount of starch. Therefore, from present study it can be concluded that elite entries are on par with released varieties with regard to mineral composition, sugars and starch content.

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