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## Total mineral content present (calcium, magnesium, potassium, phosphorus, iron, zinc, manganese, copper, and boron and nickel) In leaves of *Desi* and *Kabuli* chickpea varieties (On dry matter basis)

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### Abstract

In this experiment all the minerals were found higher at 45 days after sowing in leaves of both varieties of chickpea. The leaves of C-235 collected at 45 days after sowing had the highest amounts of calcium (2802.67 mg/100 g), magnesium (137 mg/100g) and phosphorus (387.67 mg/100 g), calcium content of HC-1 variety at 30 days after sowing was almost similar to that of C-235 varieties leaves collected at 60 days. Copper content of leaves of HC-1 collected at 30, 45 and 60 days were almost similar to those in leaves of C-235 variety. The highest calcium content was *kabuli*, HK-1 (2675.67 mg/100 g) followed by HK-2 (2624.33 mg/100 g) at 45 days. Magnesium content was higher in the leaves of HK-1 (139.67 mg/100 g) and least was in HK-2 (128.00 mg/100 g) at 30 days, potassium content was higher in the leaves of HK-1 (965.33 mg/100 g) at 45 days, than in the leaves of HK-2 at 30, 45 and 60 days after sowing. Phosphorus content was maximum in the leaves of HK-1 and HK-2 (386.67 and 377.00 mg/100 g) at 45 days after than at 30 and 60 days. Iron content was higher in the leaves of *kabuli* variety HK-1 at 45 days (360.00 mg / 100 g) than in the leaves of HK-2 at 30 and 60 days after sowing. Total zinc content was found highest in the leaves of *kabuli* chickpea variety HK-1 (6.57 mg /100 g) and HK-2 (6.37 mg /100 g) at 45 days after sowing. Manganese content was found in the leaves of HK-2 (1.42 mg/100 g) and HK-1 (1.39 mg/100 g) at 45 days after sowing. Copper content was almost same in the leaves of HK-1 and HK-2 at 30, 45 and 60 days and ranged from 1.20 to 1.36 mg /100 g. Highest boron content (1.20 mg /100 g) was found in the leaves of HK-1 and HK-2 at 60 days followed by HK-1 at 45 days (1.07 mg/100 g). Nickel content was found higher in the leaves of HK-1 and HK-2 at 45 and 60 days.

**Keywords:** Minerals, calcium, magnesium, phosphorus

### Introduction

Chickpea seed is a good source of mineral content is iron (6.2 mg), zinc (3.4 mg), calcium (105 mg), magnesium (11.5 mg), potassium (875 mg), sulphur (24 mg) and selenium (8.2 mg) per 100 g. Not only chickpea grain but its leaves are reported to be rich in various nutrients. So, in the present scenario, it is important to use chickpea as a source of protein from grain as well as micronutrients from its leaves which have been underutilized and ignored in India for a long time. For chickpea leaves data on leaf mineral concentrations are limited, however, available reports on iron, zinc and copper suggest that this food could be a good source of these minerals. More information is needed on the concentrations of all the human essential minerals in chickpea leaves, and whether certain types and/or cultivars of chickpea might be more nutritious than others (Ibrikei *et al.*, 2003) <sup>[1]</sup>.

Chickpea included in the Indian vegetarian diets have a great role to prevent and control not only Protein Energy Malnutrition in India, but consumption of their leaves can combat micronutrient deficiency which is also very common. Multiple micronutrient deficiencies are more common than single deficiencies in developing countries like India and the cause for their high prevalence is low dietary intake by populations and poor bioavailability of micronutrients. Iron deficiency is the most common nutritional problem worldwide, and contributes to maternal deaths in pregnancy and parturition. The principle manifestation of iron deficiency is anaemia; iron deficiency also compromises the immune system and is associated with limited cognitive development in children. Among preschool aged children worldwide, 23 per cent suffer from iron deficiency anaemia (Gegios *et al.*, 2010) <sup>[2]</sup>.

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In developing countries these nutritional problems are more severe; however, people in developed countries also suffer from different forms of these nutritional problems. In India, 79 per cent of children between 6 to 35 months and women between 15 to 49 years of age are anaemic (Krishnaswamy, 2009)<sup>[3]</sup>.

### Material and Methods

The present investigation was carried out in the Department of Foods and Nutrition, College of Home Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar.

### Minerals

Minerals were estimated by atomic absorption spectrophotometer by the method of Lindsey and Norwell, (1969).

### Total minerals (Ca, Mg, K, P, Fe, Zn, Mn, Cu, B and Ni)

#### Acid digestion:

To one gram ground sample in a 150 ml conical flask, 25-30 ml of diacid mixture (HNO<sub>3</sub>: HClO<sub>4</sub>: 5:1, v/v) was added and kept overnight. The contents were digested by heating until clear white precipitates settled down at the bottom. The volume was made to 50 ml with double distilled water. The crystals were filtered through Whatman #42 filter paper and used for the determination of total calcium, magnesium, iron, zinc, potassium, phosphorus, manganese, copper, boron and nickel.

#### Estimation of calcium, iron, potassium, zinc, magnesium, phosphorus, manganese, copper, boron and nickel by Lindsey and Norwell (1969) method

Calcium, magnesium, potassium, iron, zinc, phosphorus, manganese, copper, boron and nickel in acid digested samples were determined by Atomic Absorption Spectrophotometer according to the method of Lindsey and Norwell (1969).

$$\text{Minerals (mg/100 g)} = \frac{\text{Reading (conc. } \mu\text{g/ml)} \times \text{volume made}}{\text{Weight of sample (g)} \times 1000} \times 100$$

### Results

#### Minerals

#### Total minerals

The data pertaining to total mineral present in the leaves at different intervals after sowing is presented in Tables 1 and 2. All the minerals like calcium, magnesium, potassium, phosphorus, iron, zinc, manganese, copper, and boron and nickel contents were found to be significantly ( $p \leq 0.05$ ) higher at 45 days after sowing in leaves of both *desi* and *kabuli* chickpea varieties. The leaves of C-235 *desi* variety had significantly ( $p \leq 0.05$ ) higher iron content at 30, 45 and 60 days after sowing when compared to that of HC-1 variety. The leaves of C-235 collected at 45 days after sowing had the highest amounts of calcium (2802.67 mg/100 g), magnesium (137 mg/100g) and phosphorus (387.67 mg/100 g). The calcium content of leaves of HC-1 variety at 30 days after sowing was almost similar to that of C-235 varieties leaves collected at 60 days after sowing. Copper content of leaves of HC-1 collected at 30, 45 and 60 days after sowing were almost similar to those in leaves of C-235 variety at all days of growth.

The highest calcium content was found in the leaves of *kabuli* variety HK-1 (2675.67 mg/100 g) followed by HK-2 (2624.33 mg/100 g) at 45 days after sowing. Magnesium content was significantly higher in the leaves of HK-1 (139.67 mg/100 g) and least was in HK-2 (128.00 mg/100 g) at 30 days after sowing. Similarly, potassium content was significantly higher in the leaves of HK-1 (965.33 mg/100 g) at 45 days after sowing than in the leaves of HK-2 at 30, 45 and 60 days after sowing. Phosphorus content was found maximum in the leaves of HK-1 and HK-2 (386.67 and 377.00 mg/100 g) at 45 days after sowing than at 30 and 60 days after sowing. Iron content was again significantly higher in the leaves of *kabuli* variety HK-1 at 45 days after sowing (360.00 mg / 100 g) than in the leaves of HK-2 at 30 and 60 days after sowing.

Total zinc content was found highest in the leaves of *kabuli* chickpea variety HK-1 (6.57 mg /100 g) and HK-2 (6.37 mg /100 g) at 45 days after sowing. Manganese content was found in the leaves of HK-2 (1.42 mg/100 g) and HK-1 (1.39 mg/100 g) at 45 days after sowing. Copper content was almost same in the leaves of HK-1 and HK-2 at 30, 45 and 60 days after sowing and ranged from 1.20 to 1.36 mg /100 g. Highest boron content (1.20 mg /100 g) was found in the leaves of HK-1 and HK-2 at 60 days after sowing followed by HK-1 at 45 days after sowing (1.07 mg/100 g). Nickel content was found higher in the leaves of HK-1 and HK-2 at 45 and 60 days after sowing (Table 2)

**Table 1:** Total mineral content (mg/100 g) in leaves of *desi* chickpea varieties (on dry matter basis)

Total Minerals	HC-1 variety			C-235 variety		
	Days after sowing (DAS)					
	30	45	60	30	45	60
Calcium	2633.00 <sup>c</sup> ± 11.85	2716.67 <sup>b</sup> ± 9.26	2513.33 <sup>d</sup> ± 7.06	2706.67 <sup>b</sup> ± 4.91	2802.67 <sup>a</sup> ± 5.81	2622.33 <sup>c</sup> ± 10.90
Magnesium	126.33 <sup>c</sup> ± 0.88	133.00 <sup>b</sup> ± 0.58	131.00 <sup>c</sup> ± 0.58	128.67 <sup>d</sup> ± 0.33	137.00 <sup>a</sup> ± 0.58	134.00 <sup>b</sup> ± 0.58
Potassium	947.00 <sup>b</sup> ± 0.58	951.67 <sup>a</sup> ± 1.20	942.33 <sup>c</sup> ± 0.88	945.00 <sup>bc</sup> ± 0.58	953.33 <sup>a</sup> ± 1.45	935.33 <sup>d</sup> ± 1.76
Phosphorus	355.67 <sup>de</sup> ± 3.18	372.00 <sup>b</sup> ± 3.06	348.00 <sup>e</sup> ± 2.08	367.33 <sup>bc</sup> ± 3.93	387.67 <sup>a</sup> ± 2.33	359.33 <sup>cd</sup> ± 4.33
Iron	507.67 <sup>bc</sup> ± 2.33	518.33 <sup>b</sup> ± 2.03	505.33 <sup>c</sup> ± 2.03	545.33 <sup>a</sup> ± 4.10	555.33 <sup>a</sup> ± 5.54	546.33 <sup>a</sup> ± 4.26
Zinc	6.00 <sup>d</sup> ± 0.06	6.40 <sup>ab</sup> ± 0.06	6.10 <sup>cd</sup> ± 0.06	6.10 <sup>sd</sup> ± 0.06	6.53 <sup>a</sup> ± 0.07	6.27 <sup>bc</sup> ± 0.07
Manganese	1.20 <sup>ab</sup> ± 0.06	1.30 <sup>a</sup> ± 0.06	1.10 <sup>b</sup> ± 0.06	1.22 <sup>ab</sup> ± 0.06	1.32 <sup>a</sup> ± 0.06	1.15 <sup>ab</sup> ± .05
Copper	1.10 <sup>a</sup> ± 0.06	1.20 <sup>a</sup> ± 0.06	1.20 <sup>a</sup> ± 0.06	1.16 <sup>a</sup> ± 0.04	1.24 <sup>a</sup> ± 0.05	1.28 <sup>a</sup> ± 0.06
Boron	0.70 <sup>c</sup> ± 0.06	0.90 <sup>bc</sup> ± 0.06	1.10 <sup>ab</sup> ± 0.06	0.70 <sup>c</sup> ± 0.06	0.90 <sup>bc</sup> ± 0.01	1.17 <sup>a</sup> ± 0.09
Nickel	0.97 <sup>b</sup> ± 0.01	1.03 <sup>a</sup> ± 0.02	1.03 <sup>a</sup> ± 0.02	0.98 <sup>b</sup> ± 0.07	1.05 <sup>a</sup> ± 0.02	1.04 <sup>a</sup> ± 0.07

Values are mean ± SE of three independent determinations

The mean values in same row with different superscripts differ significantly ( $p \leq 0.05$ ).

**Table 2:** Total mineral content (mg/100 g) in leaves of *kabuli* chickpea varieties (on dry matter basis)

Total minerals	HK-1 variety			HK-2 variety		
	Days after sowing (DAS)					
	30	45	60	30	45	60
Calcium	2554.33 <sup>c</sup> ± 19.36	2675.67 <sup>a</sup> ± 11.32	2452.33 <sup>e</sup> ± 8.21	2514.33 <sup>d</sup> ± 2.91	2624.33 <sup>b</sup> ± 15.82	2418.33 <sup>e</sup> ± 3.75
Magnesium	132.00 <sup>c</sup> ± 1.15	139.67 <sup>a</sup> ± 1.20	135.67 <sup>b</sup> ± 1.45	128.00 <sup>d</sup> ± .58	132.00 <sup>c</sup> ± 1.16	129.33 <sup>cd</sup> ± 0.88
Potassium	956.33 <sup>b</sup> ± .88	965.33 <sup>a</sup> ± 2.03	947.00 <sup>c</sup> ± 1.53	943.67 <sup>c</sup> ± 0.88	946.33 <sup>c</sup> ± 1.20	937.00 <sup>d</sup> ± 1.53
Phosphorus	353.67 <sup>b</sup> ± 3.84	386.67 <sup>a</sup> ± 2.91	355.33 <sup>b</sup> ± 5.21	349.00 <sup>b</sup> ± 3.61	377.00 <sup>a</sup> ± 3.22	347.00 <sup>b</sup> ± 4.58
Iron	520.67 <sup>bc</sup> ± 8.82	560.00 <sup>a</sup> ± 8.72	524.00 <sup>b</sup> ± 7.57	494.33 <sup>d</sup> ± 3.53	515.33 <sup>bc</sup> ± 3.53	502.33 <sup>cd</sup> ± 2.40
Zinc	6.27 <sup>b</sup> ± 0.90	6.57 <sup>a</sup> ± .15	6.10 <sup>bc</sup> ± 0.60	5.90 <sup>c</sup> ± 0.06	6.37 <sup>ab</sup> ± 0.98	6.10 <sup>bc</sup> ± 0.06
Manganese	1.29 <sup>b</sup> ± 0.01	1.39 <sup>a</sup> ± 0.01	1.19 <sup>d</sup> ± 0.01	1.32 <sup>b</sup> ± 0.01	1.42 <sup>a</sup> ± 0.01	1.23 <sup>c</sup> ± 0.02
Copper	1.22 <sup>a</sup> ± 0.06	1.36 <sup>a</sup> ± 0.06	1.34 <sup>a</sup> ± 0.08	1.20 <sup>a</sup> ± 0.06	1.30 <sup>a</sup> ± 0.06	1.30 <sup>a</sup> ± 0.06
Boron	0.87 <sup>c</sup> ± 0.03	1.07 <sup>b</sup> ± 0.03	1.20 <sup>a</sup> ± 0.00	0.83 <sup>c</sup> ± 0.03	1.03 <sup>b</sup> ± 0.04	1.20 <sup>a</sup> ± 0.06
Nickel	0.97 <sup>b</sup> ± 0.00	1.03 <sup>a</sup> ± 0.02	1.03 <sup>a</sup> ± 0.02	0.97 <sup>b</sup> ± 0.01	1.04 <sup>a</sup> ± 0.02	1.05 <sup>a</sup> ± 0.02

Values are mean ± SE of three independent determinations

The mean values in same row with different superscripts differ significantly ( $p \leq 0.05$ )

## Discussion

Total minerals like boron, calcium, copper, iron, magnesium, nickel and zinc in the chickpea leaves were found to increase with the crop growth and found to maximum at maturity. Total calcium content ranged from 2418.33 to 2802.67 mg / 100 g. The total magnesium content was found maximum in the leaves of chickpea variety HK-1 (139.67 mg /100 g) at 45 days after sowing. Highest potassium content (965.33 mg/100 g) in leaves of chickpea variety HK-1 was observed at 45 days after sowing. Singh and Saxena (1972) reported that different stages of maturity did not affect the potassium contents of the leaves. Giri *et al.* (1984) reported that potassium decreased with the age of the *Chekurmeni* plant. Sodium and potassium are important intercellular and extracellular cations, respectively. The importance of Na/K ratio in the body in controlling high blood pressure cannot be over emphasized (Yusuf *et al.*, 2007). Phosphorus content was found maximum in the middle stage of the growth of chickpea and it reduced with growth and lowest at maturity. Copper content was found maximum in variety HK-1 (1.36 and 1.34 mg / 100 g) at 45 and 60 days after sowing. Total boron content (mg / 100 g) was found maximum in the leaves of HK-1(1.20) and HK-2 (1.20), C-235 (1.17) and HC-1 (1.10) at 60 days after sowing. Manganese content is also increased in the initial phase of growth (30 DAS) and reached the maximum in the middle phase (45 DAS) and then decreased with maturity (60 DAS).

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