



IMPORTANT MACRO AND MICROELEMENTS IN CHICKPEA AND LENTIL

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Important macro and microelements in different genotypes of chickpea and lentil were determined. Maximum concentrations (mg/100g) of Na, K, Ca, Mg, P, Fe, Zn, Mn and Cu were observed in chickpea genotypes C-727 (24.23), Pb-91 (1686.9), CM-98 (87.02), Pb-91 (228.29), Pb-91 (181.13), Paidar-91 (6.78), CM-89 (3.34), Paidar-91 (1.60) and CM-72 (1.29) and lentil genotypes TCL-85-1 (34.43), 46-3-3-1 (1250.3), 583-2 (85.0), 46-3-3-1 (200.59), Precoz (329.1), 583-2 (6.95), TCL-85-1 (4.40), 46-3-3-1 (1.37) and 79-1 (0.73). K, Mg, Mn and Cu were higher in chickpea, Na and P contents were higher in lentil whereas Ca, Fe and Zn contents were comparable in both the pulses. Coefficient of variability (CV) in different elements varied from 4.76% (Mn) to 15.09 % (Na) in chickpea and 7.66% (Na) to 21.39% (P) in lentil. Correlations between protein content and different minerals in chickpea and lentil were not significant. Field fortification of staples for minerals versus post-harvest addition is discussed.

Keywords: Chickpea, Lentil, Macro and Microelements Protein, Field fortification.

1. Introduction

Different elements are needed in small amounts compared to macro growth factors (carbohydrates, fats and proteins), but they are essential for human health. The essential major elements are required to maintain osmolarity of biological fluids, for the structural and functional integrity of cell wall, the conduction of nerve impulses across cell membranes and for muscle contraction [1]. The essential trace elements function mainly as activators of the enzyme-metal-substrate complexes or as integral constituents of metalloenzymes [1,2]. Cereals and pulses are major sources of human food and animal feed in Pakistan and are considered as a significant source of carbohydrates and proteins. However, their contribution of minerals is usually overlooked. In order to determine the status of our diet with respect to minerals, the recent systematic data on elements (especially trace elements) is need of the day. Data pertaining to important macro- and micro- elements of prevalent varieties and new genotypes of wheat and rice have been reported recently [3]. Results on the important minerals of potential genotypes of chickpea and lentil are reported in this paper.

2. Materials and Methods

Samples of chickpea (Noor-91, CM-89, C-727, CM-99, Paidar-91, CM-72, Bittle-98, CM-98, C-44, Pb-91) and lentil (TCL-85-1, 259-1, 79-1, Masoor-93, 609-3, 791-1, PL-406, 46-3-1, Precoz, Masoor-85, PL-603-4, 583-2, 46-3-3-1) genotypes were collected from Mutation Breeding Division, NIAB, Faisalabad. Both chickpea and lentil genotypes were grown under similar agroclimatic conditions. The grains were cleaned and stored in polyethylene bags at room temperature. Whole meal chickpea and lentil flour was used for analysis. Moisture and protein contents were determined by AACC Methods [4]. Flour of chickpea and lentil grains was digested in diacid mixture of nitric acid and perchloric acid (1:1) and was analyzed on an atomic absorption spectrophotometer (Varian 1475) for Fe, Mn, Zn, Cu and Mg. Flame photometer (Janway PFP-7) was used for the determination of Na, K and Ca. Total phosphorus was analysed calorimetrically using the vandate molybdate method [5]. Mean (X), standard deviation (SD) and coefficient of variability (CV%) of protein content and different minerals were calculated. Coefficient of correlation (r) between different, macro- and micro- elements and protein content of different chickpea and lentil were computed.

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Table 1. Important macro-elements in different chickpea genotypes (mg/100g).

Genotypes	Na	K	Ca	Mg	P
Noor-91	19.44	1397.13	72.02	194.22	142.46
CM-89	17.28	1511.55	73.00	218.56	179.97
C-727	24.23	1378.58	84.00	199.00	113.97
CM-99	14.21	1455.86	87.00	204.41	129.60
Paidar-91	18.41	1269.08	68.29	225.74	154.96
CM-72	22.73	1445.81	58.59	205.36	141.65
Bittle-98	16.64	1201.62	66.55	214.44	158.89
CM-98	20.19	1387.08	87.02	199.31	143.45
C-44	19.16	1657.54	78.90	201.06	161.61
Pb-91	18.51	1686.91	59.29	228.29	181.13
Mean	19.08	1439.12	73.46	209.04	150.77
SD	2.88	152.07	10.04	11.94	21.04
CV(%)	15.09	10.57	13.67	5.71	13.96

Table 2. Important micro-elements in different of chickpea genotypes (mg/100g).

Genotypes	Fe	Zn	Mn	Cu	Protein(%)
Noor-91	5.18	3.26	1.40	0.94	22.50
CM-89	5.16	3.34	1.36	1.08	22.51
C-727	6.32	3.08	1.47	0.93	22.56
CM-99	6.57	2.96	1.58	1.11	21.46
Paidar-91	6.78	2.97	1.60	1.28	22.00
CM-72	6.21	2.99	1.49	1.29	23.40
Bittle-98	6.07	2.99	1.47	1.10	21.95
CM-98	5.59	2.88	1.42	0.90	21.95
C-44	5.19	2.83	1.47	1.01	20.00
Pb-91	6.47	2.72	1.41	1.05	22.85
Mean	5.95	3.00	1.47	1.07	22.12
SD	0.59	0.18	0.07	0.14	0.92
CV(%)	9.92	6.00	4.76	13.08	4.16

3. Results and Discussion

Data on the macro- and micro- elements of different chickpea genotypes are reported in Tables 1 and 2, respectively. Highest amounts (mg/100g) of Na, K, Ca, Mg and P were found in C-727 (24.23), Pb-91 (1686.91), CM-98 (87.02), Pb-91 (228.29) and Pb-91 (181.13) genotypes of chickpea respectively. In case of micro-elements maximum concentrations (mg/100g) of Fe (6.78),

Zn (3.34), Mn (1.60) and Cu (1.29) were observed in Paidar-91, CM-89, Paidar-91 and CM-72 genotypes, respectively. Protein content in different chickpea samples ranged from 20.0% in C-44 to 23.4% in CM-72 (Table 2). Coefficient of variability (%) ranged from 5.71 (Mg) to 15.09 (Na) in macro- and from 6.0 (Zn) to 13.08 (Cu) in micro- elements in different chickpea samples. Correlations between different minerals and protein content were not significant.

Table 3. Important macro-elements in different lentil genotypes (mg/100g).

Genotypes	Na	K	Ca	Mg	P
TCL-85-1	34.43	1028.53	76.50	177.95	328.67
259-1	31.28	1000.71	67.50	170.21	209.23
79-1	33.64	911.84	78.00	183.08	202.16
Masoor-93	32.29	1040.12	77.50	167.63	216.83
609-3	31.07	972.87	84.00	169.22	193.32
791-1	31.91	970.11	70.00	150.92	171.13
PL-406	29.68	1023.89	65.00	141.20	203.09
46-3-1	28.65	1084.86	66.00	149.00	203.80
Precoz	32.23	1095.75	45.00	141.20	329.10
Masoor-85	26.25	1195.04	76.00	168.75	205.28
PL-603-4	30.34	1195.04	80.00	177.62	268.93
583-2	27.76	1238.71	85.00	196.93	246.95
46-3-3-1	32.96	1250.30	84.00	200.59	245.24
Mean	30.96	1077.52	73.42	168.79	232.59
SD	2.37	110.44	10.93	19.16	49.76
CV(%)	7.66	10.25	14.89	11.35	21.39

Table 4. Important micro-elements in different lentil genotypes (mg/100g).

Genotypes	Fe	Zn	Mn	Cu	Protein(%)
TCL-85-1	6.46	4.40	1.11	0.48	25.63
259-1	5.13	2.91	1.01	0.50	24.76
79-1	5.44	2.89	1.41	0.73	24.99
Masoor-93	5.75	3.16	1.21	0.49	25.41
609-3	6.26	3.04	1.18	0.51	24.10
791-1	6.16	2.73	1.34	0.48	24.46
PL-406	6.10	2.82	1.34	0.68	23.85
46-3-1	6.13	3.20	1.24	0.50	21.48
Precoz	6.45	3.16	1.48	0.66	24.65
Masoor-85	6.48	3.01	1.41	0.56	24.26
PL-603-4	6.17	3.00	1.21	0.57	23.79
583-2	6.95	3.55	1.22	0.61	24.61
46-3-3-1	5.90	2.87	1.37	0.61	21.74
Mean	6.11	3.13	1.25	0.57	24.13
SD	0.47	0.43	0.13	0.08	1.24
CV(%)	7.69	13.74	10.40	14.04	5.14

Different genotypes of lentil were analysed for macro- and micro- elements and proteins content (Tables 3 and 4). Na, K, Ca, Mg and P contents (mg/100g) in different genotypes ranged from 26.25 (M-85) to 34.43 (TCL-85-1), from 911.84 (79-1) to 1250.3 (46-3-3-1), from 45.0 (Precoz) to 85.0 (583-2), from 141.20 (Preoz, PL-406) to 200.59 (46-3-3-1) and from 171.13 (791-1) to 329.10 (Precoz), respectively. Highest amounts (mg/100g) of Fe, Zn, Mn and Cu were recorded in 583-2 (6.95), TCL-85-1 (4.40), 46-3-3-1 (1.37) and 79-1 (0.73) respectively. Coefficient of variability (%) in different macro- and micro- elements of lentil varied from 7.66 (Na) to 21.39 (P) and from 7.69 (Fe) to 14.04 (Cu) respectively. Protein contents in lentil varied from 21.48% in 46-3-1 to 25.63 % in TCL-85-1. As in case of chickpea, correlation between different elements and proteins content was not significant. In case of protein content, coefficient of variability (%) was almost comparable in different chickpea and lentil samples.

Concentration of elements in chickpea and lentil mentioned in this paper mostly agreed to those reported earlier [6-9]. Disagreement found in some elements could be due to genetic background [10] and agroclimatic conditions in which the pulses were grown [11]. Analytical techniques employed could also be one of the factors for discrepancy [9]. Potassium, Mg, Mn and Cu contents were higher in chickpea, Na and P contents were higher in lentil whereas Ca, Fe and Zn elements were comparable in both the pulses.

Inorganic elements are essential for human health and their deficiency may lead to stunted growth, loss of appetite, anaemia, infertility, skeleton defects and nervous/ muscular disorders [12,13]. According to rough estimates, about 2 billion people mostly in developing countries are suffering from multiple micronutrient malnutrition [14,15]. As recommended earlier [3] the potential of staple foods (especially cereals and pulses) to provide more than energy and protein should be exploited. The proportion of staples in the diet of malnourished population is high. Food based approach to overcome micronutrient malnutrition is economical [16]. Population living in developing countries should rely more on staples for most of their nutritional needs instead of postharvest additions/amendments. Initially the strategy should be to enhance absolute content of micronutrients in staples; afterwards bioavailable micronutrients should be elevated [17].

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