

Nutritional and Anti-nutritional Profiling of Different Kabuli Chick Pea (*Cicer arietinum* L.) Genotypes

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ABSTRACT

Genotype NGK-1707 had highest amount of Protein (25.58%), Ca (6.20 gm/Kg), K (10.25 gm/Kg). PVK-4 contains highest amount of methionine (0.94 g/16g N) in protein and Mo (3.70 mg/kg). NGK-1702 had lowest amount of anti-nutrient like phenol (1.54 mg/100gm), NGK-1706 tannin (0.26mg/100gm) while NG-477 has another lowest anti-nutrient like trypsin inhibitor activity (6.78 TIU/gm). NGK-1710 has highest amount of Mn (11.33 mg/kg) and B (27.03 mg/kg). NG-195 and JGK-1 jointly has highest amount of Phosphorous (0.34%) and NG-195 solely contained highest amount of Co (6.14mg/kg). JGK-1 contained highest amount of Zn (15.60 mg/kg). KRIPA contained the highest amount of Mg (3.46 gm/Kg), Fe (63.07 mg/kg) where as VIRAT contained the highest amount of Cu (6.20 mg/kg).

Key words : Chickpea, Protein rich and mineral rich genotype, Phenol, Tanin, Trysin inhibitor.

Introduction

Chickpea (*Cicer arietinum* L.) is one of the oldest and most widely consumed (second most consumed legume crop) grain legume in the world (Koul *et al.*, 2022) due to relatively high protein content and wide adaptability, it is used as a food grain. It is the second most widely grown legume in the world. Chickpeas are good source of protein and carbohydrate. In fact its protein quality is better than other legumes such as pigeon pea, black gram and green gram. However, poor nutritive value of this legume is found due to the presence of certain antinutritional factors such as tannins, polyphenols and trypsin inhibitor. In view of the overall nutrient composition and the presence of anti-nutritional factors

will be identified in this experiment which can improve overall nutritional status of kabuli chickpea genotypes. The aim of the present work is to study the protein composition, amino acid, mineral profile, anti-nutritional compounds in kabuli chickpea genotypes.

The present experiment was carried out to ensure with the objective to identify the protein rich and mineral rich genotype(s) of chickpea.

Materials and methods:

The protein content was determined by Micro-Kjeldahl method (A.O.A.C., 1990). The organic nitrogen content of the sample was calculated using the following formula.

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$$\text{Total \% of nitrogen} = \frac{(T - B) \times 1.4 \times N}{W}$$

This amino acid was estimated by the method described by McCarthy and Paille (1959). Mineral content estimation (Jackson, 1973). The phenol content in the dry tissue extract was measured by the Folin-Ciocalteu reagent using catechol as standard (Vinson *et al.* 1998). Tannin content was estimated by the method of Mickael Eskin *et al.* (1978) and Vadodariya *et al.* (2022). Trypsin inhibitor assay was performed as per the method of Erlanger *et al.* (1961).

Results and discussion

For total 20 varieties of kabuli chickpea, NGK-1707 showed highest protein content (25.583 %) at par with the genotype JGK-1 (24.993%). In case of methionine content PVK-4 (Check) revealed the best result containing 0.940 16 N⁻¹ at par with NGK-1708 genotype. Calcium content varied significantly among different 20 germplasms. NGK-1707 (6.2gm/kg) contained the highest amount of calcium at par with NG-195 (5.55gm/Kg) and the Check variety KRIPA (4.913gm/Kg). Regarding phosphorous content the 20 varieties NG-195 and JGK jointly proved to be containing the highest amount of phosphorous content (0.34%) at par with NGK-1704, NGK-1704 and KRIPA. NGK-1707 contained the highest amount of K (10.246 gm/kg) which was at par with NGK-1702 (9.643 gm/kg), NGK-1705 (10.150 gm / Kg), NGK-1716 (9.493gm/kg), NGK-1722 (9.760 gm/kg), KAK-2 (9.416 gm/kg) and PVK-4 (9.690 gm/kg). The genotype KRIPA contained the highest Mg content was 3.46 gm/kg at par

with NG-195 (3.22 gm/kg) and NGK-1707 (3.15 gm/kg). Among all the 20 different genotypes of Kabuli chick pea the check variety KRIPA showed the highest amount of iron content (Fe) i.e.; 63.0733 mg/kg at par with NGK-1704 (63.053 mg/kg), NGK-1707 (62.76 mg/kg), NGK-1708 (62.05 mg/kg), NGK-1716 (63.023 mg/kg), JGK-1 (62.356 mg/kg) and KAK-2 (62.423 mg/kg). The genotypes varied significantly in relation to Zn content. JGK-1 was richest in Zn content (15.603 mg/kg) was at par with at par with NGK-1701 (14.993mg/kg), NGK-1702 (15.463 mg/kg), NGK-1703 (14.29 mg/kg), NGK-1722 (15.233 mg/kg), KAK-2 (14.926 mg/kg), PVK-4 (14.67 mg/kg), KRIPA (15.29 mg/kg), VIRAT (15.47 mg/kg). Highest Cu content was revealed in VIRAT (6.196 mg/kg) at par with NG-163 (6.156 mg/kg) and NGK-1708 (5.993 mg/kg). Mn content in all different genotypes of Kabuli chick pea varied significantly where NGK-1710 contained the highest amount of the elemental Mn 11.33 mg/kg. The genotype NGK-1710 beard the highest amount of elemental B was 27.026 mg/kg, which is at par with eleven other genotypes like NGK-1701 (26.690 mg/kg), NGK-1702 (26.080 mg/kg), NGK-1703 (26.726 mg/kg), NGK-1707 (25.980 mg/kg), NGK-1708 (26.703 mg/kg), NGK-1716 (26.820 mg/kg), NG-477 (26.670 mg/kg), KAK-2 (25.963 mg/kg), PVK-4 (25.873 mg/kg), KRIPA (26.483 mg/kg) and VIRAT (26.240 mg/kg). The genotype PVK-4 revealed the highest amount of Mo 3.703 mg/kg. For elemental Co, the genotype namely NG-195 showed the highest quantity (6.143 mg/kg).

Phenol content significantly varied over 20 genotypes of chick pea and as an anti nutrient it is desirable to contain the lowest

amount in the genotypes. On the basis of the result, the genotype NGK-1702 contained the lowest amount of phenol (1.536mg/100gm) which is at par with NGK-1706 (1.603 mg/100gm). Tannin content also varied significantly and the genotype NGK-1706 proved to be containing the lowest amount of tannin ie; 0.256mg/100gm. The genotype NG-477 showed the lowest trypsin inhibitor activity (6.773 TIU/gm). From t-test result it is clear that all the nutritional and anti nutritional analysis were done significantly varied in *pd* 0.01.

Conclusion

The genotype PVK-4 revealed the highest amount of Mo and for elemental Co, the genotype namely NG-195 showed the highest quantity. Phenol content significantly varied over 20 genotypes of chick pea and as an anti nutrient it is desirable to contain the lowest amount in the genotypes. On the basis of the result, the genotype NGK-1702 and NGK-1706 contained the lowest amount of phenol. NGK-1706 genotype proved to be containing the lowest amount of tannin and NG-477 showed the lowest trypsin inhibitor activity as well. Hence these varieties can be used further in breeding programme.

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Table 1 : Total protein, Calcium (Ca), Phosphorous (P), Potassium (K) and Magnesium (Mg) content of 20 different genotypes of Kabuli chickpea

GENOTYPES	Nutrient content					
	Total Protein (%)	Methionine g/16g N	Ca (gm/Kg)	Phosphorous (%)	K (gm/Kg)	Mg (gm/Kg)
NGK-1701	23.08 de	0.86 de	3.02 def	0.32 b	8.60 efgh	1.61 f
NGK-1702	23.73 cd	0.83 efg	4.64 bcd	0.27 c	9.64 abc	2.55 cde
NGK-1703	21.95fghi	0.90 bc	2.76 ef	0.27 c	8.52 fgh	1.51 f
NGK-1704	21.49 ij	0.84 defg	2.67 ef	0.33 ab	8.41 gh	1.61 f
NGK-1705	21.81 hi	0.85 defh	3.42 cdef	0.24 ef	10.15 a	2.74 bc
NGK-1706	22.84 e	0.75 h	2.64 ef	0.33 ab	8.73 defgh	1.42 f
NGK-1707	25.58 a	0.83 efg	6.20 a	0.23 fg	10.25 a	3.15 ab
NGK-1708	21.89 ghi	0.92 ab	3.03 def	0.22 g	9.29 bcdef	2.40 cde
NGK-1710	21.41 ij	0.74 h	2.36 f	0.25 e	8.59 efgh	1.13 f
NGK-1716	20.78 j	0.85 def	3.46 cdef	0.24 ef	9.49 abcd	2.15 e
NGK-1722	21.42 ij	0.87 cd	2.73 ef	0.24 ef	9.76 ab	1.28 f
NG-163	22.69 ef	0.85 def	2.84 ef	0.24 ef	8.87 cdefgh	1.44 f
NG-195	22.56 efgh	0.81 g	5.55 ab	0.34 a	8.26 h	3.22 a
NG-413	24.28 bc	0.82 fg	4.01 bcdef	0.23 fg	8.36 gh	1.57 f
NG-477	22.48 efgh	0.82 fg	3.59 cdef	0.25 de	8.04 h	2.29 cde
JGK-1	24.99 ab	0.73 h	4.28 bcde	0.34 a	8.79 defgh	2.50 cde
KAK-2	23.70 cd	0.82 efg	4.16 bcde	0.25 e	9.42 abcde	2.72 bc
PVK-4	22.58 efg	0.94 a	4.29 bcde	0.26 cd	9.69 abc	2.23 de
KRIPA	23.71 cd	0.85def	4.91 abc	0.33 ab	9.18 bcdefg	3.46 a
VIRAT	24.76 b	0.88 cd	3.93 cdef	0.27 c	8.38 gh	2.66 cd
Mean	22.89	0.84	3.73	0.27	9.02	2.18
CD@5%	0.68	0.03	1.39	0.01	0.74	0.34
CV%	1.79	2.44	2.77	2.42	4.99	9.49

Table 2 : Iron (Fe), Zinc (Zn) and Copper (Cu) content of 20 different genotypes of Kabuli chickpea

GENOTYPES	Nutrient content		
	Fe (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
NGK-1701	60.37 d	14.99 abc	4.24 f
NGK-1702	57.37 e	15.46 ab	4.80 def
NGK-1703	55.09 f	14.29 abcd	4.98 cde
NGK-1704	63.05 a	11.94 g	3.66 g
NGK-1705	60.69 d	12.11 fg	3.62 g
NGK-1706	61.44 bcd	13.77 bcdef	5.42 bc
NGK-1707	62.76 a	13.73 cdef	4.53 ef
NGK-1708	62.06abc	12.29 fg	5.99 ab
NGK-1710	51.70 g	13.09 defg	5.48 bc
NGK-1716	63.02 a	12.34 fg	4.59 ef
NGK-1722	55.71 f	15.23 abc	5.13 cde
NG-163	61.09 cd	12.96 efg	6.16 a
NG-195	60.78 d	12.27 fg	5.48 bc
NG-413	61.39 bcd	12.94 efg	4.78 def
NG-477	61.36 bcd	13.03 defg	3.47 g
JGK-1	62.36 ab	15.60 a	4.57 ef
KAK-2	62.42 ab	14.93 abc	4.75 ef
PVK-4	61.45 bcd	14.67 abcd	5.39 bcd
KRIPA	63.07 a	15.29 abc	4.51 ef
VIRAT	56.08 f	15.47 ab	6.20 a
Mean	60.16	13.82	4.89
CD@5%	1.11	1.47	0.55
CV%	1.11	6.44	6.83

Table 3 : Manganese (Mn), Boron (B), Molybdenum (Mo), and Cobalt (Co) content of 20 different genotypes of Kabuli chickpea

Variety	Nutrient content			
	Mn (mg/kg)	B (mg/kg)	Mo (mg/kg)	Co (mg/kg)
NGK-1701	8.53 de	26.69 abc	1.98 f	4.05 cd
NGK-1702	8.95 cde	26.08 abcd	1.66 g	2.74 e
NGK-1703	9.59 bc	26.73 abc	1.62 g	3.38 de
NGK-1704	8.47 de	22.84 e	0.00 i	5.01 b
NGK-1705	9.24 cd	25.39 d	2.44 cde	2.47 e
NGK-1706	10.20 b	25.70 cd	1.48 g	2.81 e
NGK-1707	8.06 ef	25.98 abcd	0.95h	3.23 de
NGK-1708	9.55 bc	26.70 abc	2.50 cde	3.26 de
NGK-1710	11.33 a	27.03 a	2.68 cde	5.06 b
NGK-1716	8.45 de	26.82 ab	3.20 b	3.33 de
NGK-1722	7.62 f	25.36 d	0.85 h	2.58 e
NG-163	8.55 de	21.67 f	2.56 cde	2.79 e
NG-195	9.22 cd	25.41 d	1.62 g	6.14 a
NG-413	8.52 de	25.93 bcd	0.00 i	4.52 bc
NG-477	9.167 cd	26.67 abc	2.73 cd	3.31 de
JGK-1	8.52 de	25.65 cd	2.40 de	2.76 e
KAK-2	8.86 cde	25.96 abcd	2.33 e	2.36 e
PVK-4	8.69 cde	25.87 abc	3.70 a	3.12 de
KRIPA	9.05 cd	26.48 abc	2.77 c	3.16 de
VIRAT	8.86 cde	26.24 abcd	2.48 cde	3.16 de
Mean	8.97	25.76	2.00	3.46
CD@5%	0.78	0.91	0.31	0.89
CV%	5.25	2.13	9.38	15.53

Table 4 : Phenol, Tanin and Trypsin inhibitor content of 20 different genotypes of Kabuli chickpea

GENOTYPES	Nutrient content		
	Phenol (mg/100gm)	Tannin (mg/100gm)	Trypsin inhibitor activity(TIU/gm)
NGK-1701	2.12 f	0.85 a	7.42 cde
NGK-1702	1.54 g	0.45 h	7.72 c
NGK-1703	2.65 bc	0.71 bc	8.32 b
NGK-1704	2.76 b	0.64 de	9.13 a
NGK-1705	2.24 fe	0.45 h	7.54 cde
NGK-1706	1.60 g	0.26 j	7.34 cde
NGK-1707	2.36 de	0.85 a	7.62 cde
NGK-1708	2.63 bc	0.66 de	8.41 b
NGK-1710	2.28 fe	0.73 b	7.47 cde
NGK-1716	2.75 b	0.87 a	7.64 cd
NGK-1722	2.66 bc	0.49 gh	7.43 cde
NG-163	2.60 bc	0.58 f	7.53 cde
NG-195	2.36 de	0.67 cd	7.38 cde
NG-413	2.97 a	0.60 ef	7.25 de
NG-477	2.78 b	0.53 g	6.78 f
JGK-1	2.32 de	0.47 gh	7.35 cde
KAK-2	2.39 de	0.38 i	7.31 de
PVK-4	2.24 fe	0.49 gh	7.32 de
KRIPA	2.49 cd	0.62 ef	7.24 e
VIRAT	2.69 b	0.76 b	7.60 cde
Mean	2.42	0.60	7.59
CD@5%	0.16	0.05	0.33
CV%	4.09	5.33	2.60