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# Biochemical screening of antinutritional factors in desi and kabuli chickpea (*Cicer arietinum* L.) germplasm

**Satya Prakash Gautam and RP Singh**

**Abstract**
The present investigation was carried out in thirty distinct (desi and kabuli) chickpea garmplasm namely KWR 108, BG 547, PDG 84-16,Phule G-5, HC 3,BG 362,SBD 377,JAKI 9218, Rajush ICCV 88105, Vijay, IPC 97-72, BG 5058,ICCV 05107,IPC 2004-52,Virat, KAK 2,BG 1003,JGKI,BG 1053,BG 267,L 550, HK 94-134, ICC 3137, GNG 2237, Phule G 0625-9, CSJK 77, NDGK 99-9 NDGK 98-8IPCK 2009-145. All the chickpea germplasms showed wide variability in there antinutrient content regarding phytic acid, tannin and total phenol content which were recorded maximum in desi genotype followed by kabuli germplasm. The phytic acid (mg/g), tannin (mg/g) and total phenol content where noticed between 10.52-12.71, 4.67-4.83 and 71.23-107.40. The phytic acid tannin and total phenol of kabuli germplams where reported from 10.35-11.16 (mg/g), 4.53-4.72 (mg/g) and 95.37-68.23(mg/100g). Minimum phytic acid, tannin, total phenol content observed in Vijay, KWR 108 and KWR 108 in desi gerplasm. The minimum phytic acid tannin and total phenol content where found in BG 1003 followed by CSJK 77.

**Keywords:** Phytic acid, tannin, total phenol

## Introduction
Poor nutritive value of the legume is due to the presence of certain anti nutritional factors such as tannins, phytates and trypsin inhibitors has been also reported by some authors earlier [1]. Trypsin inhibitors and tannins inhibit the digestibility of protein and starch where as essential minerals viz. iron and zinc etc [2]. Phytate has a strong binding capacity to form complexes with divalent minerals. At physiological pH most of the phytate-mineral complexes are insoluble and make the minerals like calcium, zinc, magnesium and iron biologically unavailable. Phytic acid is decreases zinc uptake in animals and humans [3, 4]. Polyphenols are major antioxidants in the human diet and common constituents of foods from plant. Phenolic compound having different biological properties which act as an antioxidant, antiaging, anticarcinogenic, anti-inflammatory activities, cardiovascular protection and improvement of endothelial function. Chickpea also contains a wide range of phenolic compounds, including flavonols, flavones glycosides, oligomeric and polymeric proanthocyanidins [5, 6].

## Materials and Methods
The present investigation on "Biochemical Screening of antinutritional factors in desi and kabuli chickpea (*Cicer arietinum* L.) germplasm" was carried out at Student's Instructional Farm and in the laboratory of Department of Biochemistry during Rabi season 2015-16. After harvesting the seeds were collected and stored in desiccators for the analysis of various antinutritional factors by standard biochemical methods.

### Assay of phytic acid content
Phytic acid content in chickpea seed was determined by the method of [7]. 2g finally grind chickpea seed sample was transferred into conical flask (200 ml capacity). 3% TCA (50 ml) was added in the flask and extracted in the material for 30 minute with mechanical shaking. The whole content was filter and 10 ml filtrate was collected and 4 ml ferric chloride solution was added and the contents were heated in boiling water bath for 45 minutes. After expiry of the period, the whole content was decanted carefully and the precipitate was washed with 20ml 3% TCA. 2-3 times Finally 3 ml 1.5N NaOH was added in the decanted material and total volume was made 30 ml with water. The whole content was heated in boiling water bath for 30 min. and filtrate by whatman filter paper No-1. The residue from the filter paper was dissolve with 40 ml 3.2 N $HNO_3$ into 100 ml volumetric flask. The flask was cooled at room temperature. 5ml aliquot was taken in another volumetric flask dilute 70 ml with water. 1.5 M

Potassium thiocynate (20 ml) was also added and colour absorbance was recorded immediately at 480 nm against blank solution. The µg iron was calculated from standard curve and phytate phosphorus (ml/100g) in sample as Phytate (%) = µg/ weight of sample x15.

**Assay of tannin content**

Tannin content in chickpea seed was determined by the method of Ranganna (1986) [8]. 5 gram chickpea sample was taken and transfer into conical flask by mixing 400 ml water. The whole material was boiled for 30 min. in to water bath. After expiry of the period the content of conical flask was transfered into 500ml volumetric flask and diluted the whole content up to mark with the help of water. The whole content was filtered and filtrate was collected in another conical flask. 10 ml filtrate was taken in 100 ml volumetric flask containing 75 ml water, 5 ml folin-Denis reagent was added and mixes the whole content. Further 10 ml sodium carbohydrate solution was also added and make up the volume up to the mark with water. The whole content of the flask was shaken and intensity of blue colour was measured at 760 nm using blank. and calculation was done by Standard curve with tannic acid.

**Assay of total phenol content**

Total phenol content in chickpea seed was determined by the method of [9]. 1 gm. Oven dried and powdered seed sample was taken and blended with 20 ml 80 % alcohol, the whole content was centrifuged at 10000 rpm for 15 minutes and supernatant was collected in 3 test tubes for blank, standard and biological sample.1 ml supernatant was taken a test tube and mixed with phenol reagent (1 ml) finally 2 ml of sodium carbonate solution was added and made up the volume with 50 ml distilled water. Similarly blank and standard solutions were also prepared by above method taking 1 ml. galic acid solutions .The whole content of all three test- tube was mixed and incubated further at room temperature. An expiry of period the intensity of colour was recorded at 650 nm and total phenol content was calculated in mg/100gm sample on the basis of standard curve prepared from galic acid.

**Results and Discussion**

The findings of the present work is given in table no.1 graphically represented in fig.no.1

**Phytic acid content**

The result of phytic acid content varied significant. Lowest value phytic acid was recorded in desi chickpea Vijay, (10.52 mg/g) followed by BG5058,(10.76 mg/g) and ICCV05107, (11.05 mg/g) and kabuli chickpea germplasm CSJK 77, (10.35 mg/g), followed by Virat, (10.37 mg/g) and NDGK 98-8, (10.48 mg/g). Highest phytic acid was noticed in desi chickpea HC 3, (12.71 mg/g), followed by KWR-108, (12.68 mg/g) and BG 547, (12.53 mg/g) and kabuli chickpea germplasm BG 1003, (11.16 mg/g) followed by KAK 2, (11.10 mg/g) and HK 94-134, (11.08 mg/g) .The result was very much supported by [10]. Phytic acid is an storage form is phosphorous but its phosphate group carries negative charges which binds with calcium iron and zinc ions which reduces the availability of these minerals.

**Tannin content**

The result of tannin content varied significant. Minimum tannin content was recorded in desi chickpea BG 5058, (4.66 mg/g) followed by Vijay, (4.67 mg/g) and ICCV 0510, (4.68 mg/g) and kabuli chickpea germplasm Virat, (4.53 mg/g) followed by CSJK 77, (4.55 mg/g) and NDGK 98-8, (4.56 mg/g). Maximum tannin content was noticed in desi chickpea KWR 108, (4.83 mg/g) followed by HC 3, (4.81 mg/g), BG 547, (4.80 mg/g) and kabuli chickpea germplasm BG 1003, (4.72 mg/g) followed by KAK 2, (4.70 mg/g) and HK95-134, (4.69mg/g).The similar work was done by [11]. The tannin content helps in the formation of hydrophobic association with seed protein an enzymes are chickpea and reduces its bioavability.

**Total phenol content**

Total phenol content varied significant. Maximum value of desi chickpea KWR 108, (107.40 mg/100g) followed by HC 3,(105.40 mg/100g) and BG 547, **(**103.40 mg/g) and kabuli chickpea BG 1003, (95.37 mg/100g) followed by KAK 2,(93.21 mg/100g) and HK 94-134, (90.37 mg/100g) .Minimum value desi chickpea, Vijay, (71.23 mg/100g) followed by BG 5058, (73.52 mg/100g) and ICCV 05107, (75.31 mg/100g) and kabuli chickpea germplasm CSJK 77, (68.23 mg/100g) followed by Virat, (69.53 mg/g) and IPCK 2009-145, (70.86 mg/100g). The results indicate close correlation with [12]. The total phenol content in chickpea involve in the biosynthesis of secondary plant metabolism such as flavonides, lignin's, flavones, isoflavone and phytoelxin.

**Table 1:** Phytic acid (mg/g), Tannin (mg/g) and Total phenol (mg/100g) in chickpea seeds

| Germplasm | Phytic acid (mg/g) | Tannin (mg/g) | Total phenol (mg/100/g) |
|---|---|---|---|
| KWR 108 | 12.68 | 4.83 | 107.40 |
| BG 547 | 12.53 | 4.80 | 103.40 |
| PDG 84-16 | 11.87 | 4.75 | 98.76 |
| Phule G-5 | 11.69 | 4.74 | 97.53 |
| HC 3 | 12.71 | 4.81 | 105.40 |
| BG 362 | 11.42 | 4.69 | 78.63 |
| SBD 377 | 11.37 | 4.68 | 80.53 |
| JAKI 9218 | 12.38 | 4.76 | 100.40 |
| Rajush | 11.57 | 4.72 | 95.72 |
| ICCV 88105 | 11.53 | 4.71 | 92.39 |
| Vijay | 10.52 | 4.67 | 71.23 |
| IPC 97-72 | 11.47 | 4.70 | 86.57 |
| BG 5058 | 10.76 | 4.66 | 73.52 |
| ICCV 05107 | 11.05 | 4.68 | 75.31 |
| IPC 2004-52 | 12.47 | 4.78 | 101.50 |
| Virat | 10.37 | 4.53 | 69.53 |
| KAK 2 | 11.10 | 4.70 | 93.21 |
| BG 1003 | 11.16 | 4.72 | 95.37 |

| | | | |
|---|---|---|---|
| JGKI | 10.87 | 4.66 | 79.53 |
| BG 1053 | 10.75 | 4.63 | 76.47 |
| BG 267 | 10.93 | 4.66 | 81.47 |
| L 550 | 11.06 | 4.68 | 88.57 |
| HK 94-134 | 11.08 | 4.69 | 90.37 |
| ICC 3137 | 11.02 | 4.67 | 85.63 |
| GNG 2237 | 10.83 | 4.65 | 78.23 |
| Phule G 0625-9 | 10.99 | 4.67 | 83.37 |
| CSJK 77 | 10.35 | 4.55 | 68.23 |
| NDGK 99-9 | 10.57 | 4.60 | 75.43 |
| NDGK 98-8 | 10.48 | 4.56 | 73.58 |
| IPCK 2009-145 | 10.63 | 4.58 | 70.86 |
| SEm± | 0.028 | 0.015 | 0.119 |
| CD at 5 % | 0.080 | 0.044 | 107.40 |

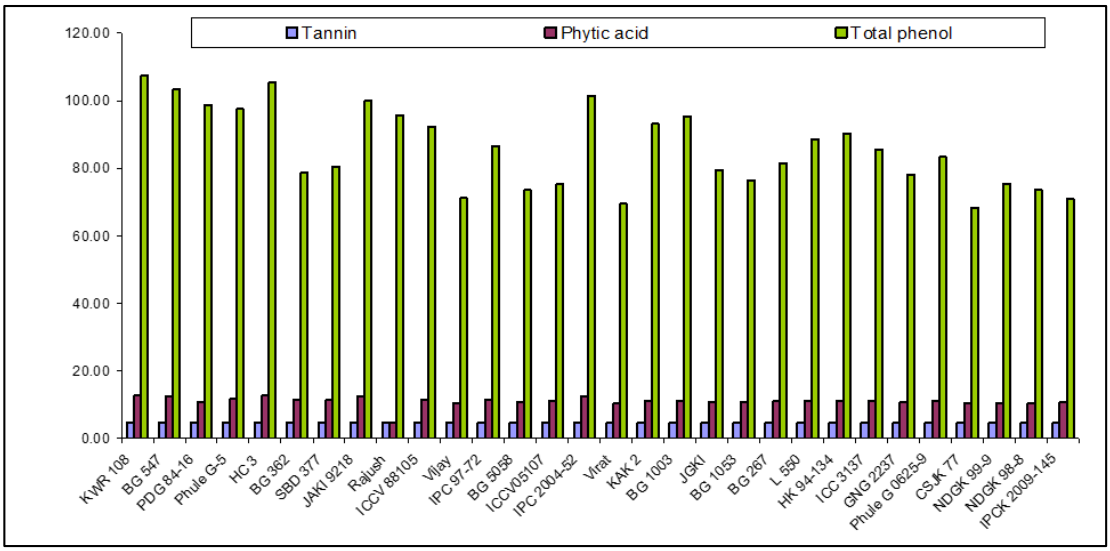


**Fig 1:** Tannin content, phytic acid and total phenol content in various gemplasm

## Conclusions

The variability in antinutrional factors of desi and kabuli chickpea have been reported in the present investigation indicates that desi chickpea germplasm have highest content of phytic acid, tannin and total phenol in compression to kabuli germplasm phenolic compounds in chickpea where also found as most important group of secondary plant products which played major role in creating disease resistance against pathogen and act in defense mechanism. On the basis of overall observation it can be concluded that minimum antinutrional factors were found in KWR 108, HC, BG 547 and IPC 2004-52 in desi verities while BG 1003, KAK 2, L 550, HK 94-134 and ICC 3337 in kabuli varieties.

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