

Proximate Composition of Seed of Improved Varieties of *Cicer arietinum*

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Seeds of promising *Cicer arietinum* variety, viz., JGG-1, JG-218, JG-322, SAKI-93130, and JG-11 were analysed for their proximate composition, such as moisture, total ash (and its analysis), crude protein, lipids, total carbohydrates, reducing sugar and non-reducing sugar, calcium, phosphorus and crude fibre content.

Key words: Composition, *Cicer arietinum*, seed.

INTRODUCTION

The world's protein requirement has to be met through plant proteins because of scarcity and high cost of animal proteins. Nearly 8% of the protein and 15–30% of protein calories consumed in the world are derived from pulses, of which *Cicer arietinum* contributes an appreciable portion¹. Although Bengal gram (*Cicer arietinum*) is an important legume of the diet and has varied uses, due to low productivity Bengal gram suffered adverse consequences of the green revolution resulting in shrinkage of acreage².

Grain legumes supply a major part of the dietary proteins in the vegetarian diets of Indian subcontinent and African population³. Legumes contain 2–3 times more protein than cereals⁴ and are also good sources of dietary carbohydrates⁵.

The seeds under investigation were procured from Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur.

EXPERIMENTAL

In the present investigation, all the seeds were analysed for moisture, total ash and its analysis (acid soluble and acid insoluble ash, water soluble and water insoluble ash and alkalinity), crude protein, total lipids, total carbohydrates, reducing sugar and non-reducing sugar, phosphorus, calcium and crude fibre content.

Moisture, ash (and its analysis) and calcium content were determined by the method as described by Pearson⁶. Crude fibre content was determined by the method recommended in the fertilizers and feeding stuffs regulation⁷. Phosphorus was determined according to the procedure of Sumner⁸. Total lipids were determined by the method of Colowick and Kaplan⁹. Carbohydrates, reducing and non-reducing sugar were estimated by the method of Nelson¹⁰. Crude protein was estimated by "Micro Kjeldhal" method (Nx 6.25)

The data collected were statistically analysed according to "Analysis of Variance" method for one way classified data¹¹.

RESULTS AND DISCUSSION

The results of chemical analysis are shown in Tables 1 and 2, while Tables 3 and 4 represent the statistical analysis.

Moisture contents of *Cicer arietinum* varieties JGG-1, JG-218, JG-322, SAKI-93130 and JG-11 were found to be 6.95, 8.17, 7.04, 6.70 and 5.62%, respectively. Variety JG-218 has maximum (8.17%) moisture content, whereas variety JG-11 has lowest (5.62%) moisture content (Table-1).

TABLE-1
PROXIMATE PRINCIPLES OF AIR DRIED SEEDS OF *Cicer arietinum* (g/100 g)

Seeds	Moisture	Crude fibre	Total lipid	Crude protein	Total carbohydrate	Reducing sugar	Non-reducing sugar
<i>Cicer arietinum</i> JGG-1	6.95	0.26	4.92	22.75	49.2	30.0	19.2
<i>Cicer arietinum</i> JG-218	8.17	0.99	4.18	19.68	37.2	32.0	5.2
<i>Cicer arietinum</i> JG-322	7.04	1.43	4.20	20.56	40.8	24.0	16.8
<i>Cicer arietinum</i> SAKI-93130	6.70	0.90	4.61	21.43	45.6	28.0	17.6
<i>Cicer arietinum</i> JG-11	5.62	0.96	4.89	21.87	50.4	26.0	24.4

TABLE-2
MINERAL AND ASH CONTENT OF AIR DRIED SEEDS OF *Cicer arietinum* (g/100 g)

Seeds	Total ash	Water insoluble ash	Water soluble ash	Acid insoluble ash	Acid soluble ash	Alkalinity of water soluble ash in m.eqv.	Ca	P
<i>Cicer arietinum</i> JGG-1	3.06	1.48	1.58	0.16	2.90	8.8	0.148	0.50
<i>Cicer arietinum</i> JG-218	3.15	1.16	1.99	0.20	2.95	9.6	0.140	0.37
<i>Cicer arietinum</i> JG-322	3.10	0.98	2.12	0.34	2.76	9.0	0.149	0.62
<i>Cicer arietinum</i> SAKI-93130	2.96	0.87	2.09	0.86	2.10	8.0	0.068	0.31
<i>Cicer arietinum</i> JG-11	2.50	0.54	1.96	0.60	1.90	9.2	0.080	0.56

Statistically, the *Cicer arietinum* variety JG-218 and variety JG-11 were found to be significantly different with each other and also from all the other varieties of *Cicer arietinum* under study, while varieties JGG-1, JG-322 and SAKI-93130 have non-significant differences with each other (Table-3).

The crude fibre contents of *Cicer arietinum* varieties JGG-1, JG-218, JG322,

TABLE-3
STATISTICAL ANALYSIS OF PROXIMATE PRINCIPLES OF AIR DRIED SEEDS OF *Cicer arietinum* (g/100 g)

Seeds	Moisture	Crude fibre	Total lipid	Crude protein	Total carbohydrate	Reducing sugar	Non-reducing sugar
<i>Cicer arietinum</i> JGG-1	6.95 (15.28769) b	0.26 (2.92279) e	4.92 (12.80388) a	22.75 (28.48994) a	49.2 (44.54152) a	30.0 (33.07991) a	19.2 (25.54178) a
<i>Cicer arietinum</i> JG-218	8.17 (16.61175) a	0.99 (5.71025) b	4.18 (11.79251) a	19.68 (26.33160) d	37.2 (37.55842) c	32.0 (34.42261) a	5.2 (13.15620) b
<i>Cicer arietinum</i> JG-322	7.04 (15.38648) b	1.43 (6.87604) a	4.20 (11.82104) a	20.56 (26.96641) c, d	40.8 (39.69430) b, c	24.0 (29.12064) a	16.8 (23.42885) a
<i>Cicer arietinum</i> SAKI-93130	6.70 (14.99813) b	0.90 (5.44351) d	4.61 (12.40045) a	21.43 (27.57527) b, c	45.6 (42.47375) a, b	28.0 (31.93875) a	17.6 (24.69357) a
<i>Cicer arietinum</i> JG-11	5.62 (13.70236) c	0.96 (5.62263) c	4.89 (12.76318) a	21.87 (27.87921) a, b	50.4 (45.22922) a	26.0 (30.64640) a	24.4 (29.56961) a
Mean	6.89 (15.19728)	0.90 (5.31504)	4.56 (12.31621)	21.25 (27.44848)	44.6 (41.89944)	28.0 (31.84166)	16.6 (23.27800)
S.E. (m)	0.00230 (0.27536)	0.0000165 (0.02329)	0.00331 (0.32979)	0.00174 (0.23949)	0.02627 (0.92875)	0.13075 (2.07229)	0.27421 (3.00170)
S.E. (d)	0.00461 (0.38943)	0.0000330 (0.03294)	0.00662 (0.46640)	0.00349 (0.33869)	0.05254 (1.31345)	0.26140 (2.93066)	0.54793 (4.24505)
C.D. at 5%	0.02456 (0.89802)	0.000175 (0.07595)	0.03523 (1.07551)	0.01857 (0.78101)	0.27918 (3.02881)	1.38480 (6.75810)	2.89075 (9.78908)

Figures in parentheses denote angular (arc sine) transformation. Values having the same "Alphabets" as suffix are non-significant ($p < 0.05$).

TABLE-4
STATISTICAL ANALYSIS OF MINERAL AND ASH CONTENT OF AIR DRIED SEEDS OF *Cicer arietinum* (g/100 g)

Seeds	Total ash	Water insoluble ash	Water soluble ash	Acid insoluble ash	Acid soluble ash	Alkalinity of water soluble ash in m.eqv.	Ca	P
<i>Cicer arietinum</i> JGG-1	3.06 (10.07905) a	1.48 (6.99553) a	1.58 (7.22106) e	0.16 (2.29244) e	2.90 (9.81058) b	8.8 (17.25638) d	0.148 (2.20723) b	0.50 (4.06827) c
<i>Cicer arietinum</i> JG-218	3.15 (10.22846) a	1.16 (6.18289) b	1.99 (8.11644) d	0.20 (2.58431) d	2.95 (9.89554) a	9.6 (18.08184) a	0.140 (2.14686) c	0.37 (3.50293) d
<i>Cicer arietinum</i> JG-322	3.10 (10.15148) a	0.98 (5.68129) c	2.12 (8.37877) a	0.34 (3.35906) c	2.76 (9.56884) c	9.0 (17.49088) c	0.149 (2.21466) a	0.62 (4.52826) a
<i>Cicer arietinum</i> SAKI-93130	2.96 (9.91712) a	0.87 (5.36222) d	2.09 (8.31226) b	0.86 (5.33134) a	2.10 (8.33228) d	8.0 (16.42994) e	0.068 (1.49791) e	0.31 (3.19174) e
<i>Cicer arietinum</i> JG-11	2.50 (9.03207) a	0.54 (4.21416) e	1.96 (8.04782) c	0.60 (4.44256) b	1.90 (7.92290) e	9.2 (17.68977) b	0.080 (1.62078) d	0.56 (4.30437) b
Mean	2.95 (9.88163)	1.00 (5.68721)	1.94 (8.01527)	0.43 (3.60194)	2.52 (9.10602)	8.9 (17.38976)	0.117 (1.93748)	0.47 (3.91911)
S.E. (m)	0.00425 (0.37381)	0.00000241 (0.00890)	0.00000214 (0.00840)	0.00000492 (0.01271)	0.000000558 (0.00428)	0.0000196 (0.02542)	0.000000131 (0.00208)	0.00000442 (0.01205)
S.E. (d)	0.00851 (0.52865)	0.00000482 (0.01259)	0.00000430 (0.01188)	0.00000984 (0.01798)	0.00000111 (0.00605)	0.0000393 (0.03595)	0.000000263 (0.00294)	0.00000884 (0.01704)
C.D. at 5%	0.04526 (1.21906)	0.0000256 (0.02903)	0.0000228 (0.02739)	0.0000523 (0.04146)	0.00000592 (0.01395)	0.000209 (0.08290)	0.00000139 (0.00677)	0.0000470 (0.03929)

Figures in parentheses denote angular (arc sine) transformation. Values having the same "Alphabets" as suffix are non-significant ($p < 0.05$).

SAKI-93130 and JG-11 were found to be 0.26, 0.99, 1.43, 0.90 and 0.96%, respectively. Variety JG-322 has highest (1.43%) crude fibre content and variety JGG-1 has lowest (0.26%) content. All these values of crude fibre content are lower than the value 6.03% reported by Saxena *et al.*¹², but in resemblance with the value 0.2% reported by Harsha *et al.*¹³. However, the crude fibre contents of these varieties were found in close accordance with other legumes¹³⁻¹⁷. However, these varieties of *Cicer arietinum* under study were found to be statistically significant for their crude fibre content (Table-3).

The total lipids contents of *Cicer arietinum* variety JGG-1 (4.92%), JG-218 (4.18%), JG-322 (4.20%), SAKI-93130 (4.61%) and JG-11 (4.89%) were found to be in close proximity with each other and also with other legumes¹²⁻¹⁹. Statistically, these varieties of *Cicer arietinum* were found to be non-significant for their total lipid content (Table-3).

The crude protein content was estimated to be 22.75, 19.68, 20.56, 21.43 and 21.87% in *Cicer arietinum* varieties JGG-1, JG-218, JG-322, SAKI-93130 and JG-11 respectively, which are in close proximity with other varieties of *Cicer arietinum* and also with other legumes¹²⁻¹⁶. Variety JGG-1 has highest (22.75%) crude protein content, which was statistically non-significant with variety JG-11 (21.87%). The lowest (19.68%) crude protein content was found in variety JG-218; it was also statistically non-significant with variety JG-322 (Table-3).

Cicer arietinum varieties JGG-1, JG-218, JG-322, SAKI-93130 and JG-11 have 49.2, 37.2, 40.8, 45.6 and 50.4% of total carbohydrates content respectively. However these seeds exhibit general agreement with other varieties of *Cicer arietinum* and also with other legumes¹²⁻¹⁶. Among all the varieties of *Cicer arietinum*, the variety JG-11 has highest (50.4%) of total carbohydrates content, which was statistically non-significant with variety JGG-1 (49.2%) and SAKI-93130 (45.6%). The lowest (37.2%) total carbohydrates content was in variety JG-218, which was also statistically non-significant with variety JG-322 (40.8%) (Table-3).

The major portion of carbohydrates of seeds under study were present in non-reducing form. Non-reducing sugar content was found to be the highest (24.4%) in variety JG-11 and lowest (5.2%) in variety JG-218.

Statistically, the *Cicer arietinum* varieties JGG-1, JG-322, SAKI-93130 and JG-11 were found to be non-significant for their non-reducing sugar content, but variety JG-218 has significant difference from all the other varieties of *Cicer arietinum* under study.

Reducing sugar content of *Cicer arietinum* varieties JGG- 1, JG-218, JG-322, SAKI-93130 and JG-11 is found to be statistically non-significant with each other (Table-3).

The seeds of *Cicer arietinum* varieties JGG-1, JG-218, JG-322, SAKI-93130 and JG-11 have 3.06, 3.15, 3.10, 2.96 and 2.50% ash content respectively, which closely resemble with each other and also with other legumes¹²⁻¹⁶. The highest (3.15%) ash content was found to be in variety JG-218 and lowest (2.50%) in variety JG-11. However, these varieties were found to be statistically non-significant for their total ash content (Table-4).

Cicer arietinum varieties JGG-1, JG-218, JG-322, SAKI-93130 and JG-11

were found to be statistically significant for their water insoluble ash, water soluble ash, acid insoluble ash, acid soluble ash and alkalinity of ash content.

Ash content of seeds of *Cicer arietinum* variety JG-322 and variety JG-218 was found to be more soluble in water (2.12%) and in acid (2.95%) respectively. Alkalinity of water soluble ash was found to be maximum (9.6%) in variety JG-218 (Table-4).

Calcium content of *Cicer arietinum* variety JGG-1 (0.148%), JG-218 (0.140%) JG-322 (0.149%), SAKI-93130 (0.068%) and JG-11 (0.080%) is in general agreement with other legumes^{12-17, 20}, whereas variety JG-322 has higher (0.149%) calcium content. However, these varieties of *Cicer arietinum* under study were found to be statistically significant with each other (Table-4).

Phosphorus contents of seeds of *Cicer arietinum* varieties JGG-1 (0.50%), JG-218 (0.37%), JG-322 (0.62%), SAKI-93130 (0.31%) and JG-11 (0.56%) is in general accordance with other varieties of *Cicer arietinum*¹³⁻¹⁶. But higher than the value 0.425% reported by Saxena *et al.*¹². All these varieties of *Cicer arietinum* have statistically significant differences for their phosphorus content (Table-4).

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