

## Nutrient composition of different chickpea varieties as affected by processing methods

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World wide legumes are mainly grown on large area for their edible seeds and thus are called grain legumes. In present investigation five varieties of chickpea were studied for changes in the nutritional composition after soaking, dehulling and pressure cooking. The results revealed that the moisture content of all five chickpea varieties varied from 7.13 to 8.93, protein 20.24 to 22.60, fiber 2.57 to 5.33, ash 3.09 to 3.35 and fat 2.63 to 4.58 per cent. While studying the effect of soaking, it was observed that moisture, protein, fiber, ash and fat ranged from 34.28 to 38.91, 18.08 to 21.92, 2.36 to 4.80, 2.81 to 3.08 and 2.10 to 4.67 per cent, respectively. Significant ( $P=0.05$ ) increase in moisture content was observed whereas protein, fiber, ash and fat content reduced significantly ( $P=0.05$ ) after soaking in all varieties. The value of moisture, protein, fiber, ash and fat ranged from 29.87 to 34.66, 21.85 to 24.71, 1.92 to 4.19, 2.51 to 3.08 and 2.82 to 5.5 per cent in dehulled chickpea respectively. Significant increase in moisture, protein and fat whereas significant reduction in fiber and ash content was observed after dehulling in chickpea. In pressure cooked chickpea varieties the moisture, protein, fiber, ash and fat content ranged from 57.47 to 62.23, 18.96 to 21.58, 2.98 to 5.64, 2.03 to 3.11 and 2.42 to 4.98 per cent, respectively. While studying the effect of pressure cooking, it was observed that moisture, and fiber, content increased significantly ( $P=0.05$ ) whereas protein, ash and fat content decreased significantly ( $P=0.05$ ) by this process. Highest content of moisture, protein, fiber, ash and fat was observed in H07-3, HC-1, C-235, H-208 and HC-5 varieties, respectively. All the processing techniques especially pressure cooking is recommended for use.

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### INTRODUCTION

Legumes are cultivated throughout the world and contribute a good source of several important nutrients. Dry legumes constitute one of the richest and least expensive sources of supplementary protein for a major section of human population, especially in under developed and developing nations. Legume proteins are rich source of essential amino acids, which are deficient in cereals. Chickpea (*Cicer arietinum*) is a legume and a native of Mediterranean region. The name 'Cicer' is derived from Greek word 'kikus' that means

force or strength. Chickpea is a good source of carbohydrate, protein minerals and trace elements and its protein quality is similar to or better than other legumes such as pigeonpea, black gram and green gram (Williams and Singh, 1987). The present study was undertaken to study the varietal differences in chickpea when different processing treatments *viz.*, soaking, dehulling and pressure cooking were applied to them. Soaking could be one of the process to improve nutritional absorption, as anti-nutritional factors are eliminated with the discarded soaking solution. Cooking generally inactivates heat sensitive factors such as trypsin and chymotrypsin inhibitors and volatile compounds.

### METHODOLOGY

Five varieties of chickpea, namely HC-1, HC-5, H07-3, H-208 and C-235, were procured in a single lot from the Pulse section, Department of Plant Breeding, College of Agriculture, CCS Haryana Agricultural University, Hisar in September 2010.

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The seeds were cleaned and made free of dust, dirt and foreign materials prior to processing.

### Sample preparation:

#### Soaking:

The cleaned chickpea seeds were soaked in distilled water (1:4 w/v) for 12 hours at room temperature, and then washed and rinsed with distilled water.

#### Dehulling:

After soaking the seeds overnight (12 hours), hulls were removed manually.

#### Pressure cooking:

The cleaned chickpea seeds were soaked overnight and then cooked for 45 minutes in pressure cooker using seed to water ratio as 1:4.

Nutrients like moisture, protein, fat, ash and fibre in the samples was calculated by employing the standard methods of analysis (AOAC, 2000).

### Statistical analysis :

The obtained data were statistically analysed using completely randomized design and correlation coefficients according to the standard method (Panse and Sukhatme, 1961).

## OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as well as relevant discussion have been presented under following heads :

### Proximate composition:

Moisture content of selected chickpea varieties ranged from 7.13 to 8.93 per cent (Table 1). Highest moisture (8.93%) content was observed in H07-3 and lowest (7.13%) in HC-1. Rincon *et al.* (1998) reported almost similar moisture content in chickpea varieties. Crude protein content in chickpea varieties ranged from 20.24 to 22.60 per cent. Non-significant (P=0.05) differences in protein content were observed among all chickpea varieties except HC-1, in which protein content was found to be significantly (P=0.05) higher than all other chickpea varieties.

Protein content of 16.85 to 26.10 per cent in chickpea was reported by various workers (Alajaji and El-Adawy, 2006; Bibi *et al.*, 2007; Shad *et al.*, 2009). Crude fiber content of chickpea varieties ranged from 2.57 to 5.33 per cent. Significantly (P=0.05) higher content of crude fiber was observed in C-235 and lowest in HC-5. The results are in agreement with those of the earlier workers Singh, 1997 and Agarwal and Singh, 2003.

Ash content of chickpea varieties ranged from 3.09 to 3.35 per cent. Highest (3.35%) ash content was observed in H-208. Ash content of chickpea in the range of 3.03 to 3.41 per cent has been reported by Agarwal and Singh (2003) and Shad *et al.* (2009). Fat content of five chickpea varieties ranged from 2.63 to 4.58 per cent. Fat content in HC-1 and H07-3 was almost similar and showed non-significant differences, whereas significant (P=0.05) differences in fat content were observed in all other varieties. Highest fat content was observed in C-235, followed by HC-5, HC-1, H07-3 and H-208. Almost similar results were reported by Agarwal and Singh (2003), whereas slightly higher values for fat content in chickpea were reported by Alajaji and El-Adawy (2006) and Mamta (2009).

### Effect of processing on nutrient composition:

#### Moisture:

The moisture content of soaked seeds ranged from 34.28 to 38.91 g/100g (Table 2). Significant (P=0.05) increase in moisture content was observed after soaking and per cent increase ranged from 75.51 to 79.75. Dehulling increased moisture content significantly (P=0.05) in all the chickpea varieties. In dehulled chickpea varieties per cent increase ranged from 72.49 to 76.54. In pressure cooked chickpea moisture content ranged from 57.47 to 62.23 g/100g. The per cent increase in moisture content in pressure cooked chickpea ranged from 85.65 to 87.90. The reason for increase in moisture content during all the processing treatments might be due to the absorption of water by the seeds. The same increasing trend in moisture content after various processing treatments was observed in various food legumes by Garg (2001), Saharan *et al.* (2002) and Sood *et al.* (2002).

#### Protein:

In soaked chickpea protein content ranged from 18.08 to 21.92 g/100g (Table 3). Soaking caused significant (P=0.05)

**Table 1.** Proximate composition of different chickpea varieties (g/100 g, on dry weight basis)

Variety	Moisture	Crude protein	Crude fiber	Ash	Fat
HC-1	7.13±0.18	22.60±0.15	5.13±0.07	3.19±0.03	3.90±0.03
HC-5	8.27±0.07	20.37±0.41	2.57±0.09	3.28±0.03	4.17±0.03
H-208	8.33±0.29	20.27±0.15	3.20±0.10	3.35±0.01	2.63±0.07
C-235	7.47±0.24	21.05±0.30	5.33±0.14	3.09±0.04	4.58±0.03
H07-3	8.93±0.18	20.24±0.32	4.47±0.07	3.25±0.01	3.80±0.03
C.D. (P≤0.05)	0.65	0.91	0.31	0.09	0.14

reduction in protein content of all chickpea varieties. This may be due to leaching of water soluble proteins into soak water. The results are also in agreement with those of the earlier studies by Saxena *et al.* (2003) and Kakati *et al.* (2010). The protein content ranged from 21.85 to 24.71 g/100g in dehulled chickpea and per cent increase in protein content ranged from 7.23 to 11.61 per cent in dehulled chickpea. Since seed coats contain little protein, it is opined that dehulled seeds would proportionately contain more protein. Significant (P=0.05) reduction in protein content was observed after pressure cooking. Per cent reduction in pressure cooked chickpea ranged from 2.62 to 6.32. The results are in agreement with Rani and Hira (1998). The reduction might be due to some metabolic

changes but evidences for the same are not well established. Similar results were reported by Garg (2001) and Sood *et al.* (2002).

**Crude fiber:**

The fiber content in soaked chickpea ranged from 2.36 to 4.80 g/100g (Table 4). A significant (P=0.05) reduction in fiber content was observed in all varieties of chickpea after soaking. Per cent decrease in fiber content after soaking ranged from 7.99 to 11.86. Fiber content decreased significantly (P=0.05) and per cent reduction ranged from 21.39 to 29.37. The present results are in accordance with Sinha *et al.* (2007). This may be due to the fact that most of the fiber is bound in testa which

**Table 2.** Effect of domestic processing on moisture content of chickpea varieties (g/100 g, on dry weight basis)

Treatments	Variety					Mean
	HC -1	HC-5	H-208	C-235	H07-3	
Control (raw)	7.13±0.18	8.27±0.07	8.33±0.29	7.47±0.24	8.93±0.17	8.23±0.23
Soaked (12 h)	35.21±0.18 (+79.75)	37.48±0.11 (+77.93)	38.91±0.18 (+78.59)	34.28±0.13 (+78.20)	36.46±0.13 (+75.51)	36.47±0.14
Dehulled	30.40±0.07 (+76.54)	32.28±0.11 (+74.38)	34.66±0.17 (+75.96)	29.87±0.18 (+74.99)	32.47±0.18 (+72.49)	31.94±0.19
Pressure cooked	58.93±0.11 (+87.90)	60.08±0.07 (+86.23)	61.53±0.07 (+86.46)	57.47±0.07 (+87.00)	62.23±0.13 (+85.65)	60.05±0.12
C.D. (P<0.05)	Variety :0.15		Treatment : 0.17		Interaction : 0.39	

**Table 3.** Effect of domestic processing on protein content of chickpea varieties (g/100 g, on dry weight basis)

Treatments	Variety					Mean
	HC -1	HC-5	H-208	C-235	H07-3	
Control (Raw)	22.60±0.15	20.37±0.41	20.27±0.15	21.05±0.30	20.24±0.32	20.91±0.26
Soaked (12 h)	21.92±0.39 (-3.01)	19.10±0.15 (-6.23)	18.08±0.15 (-10.80)	18.96±0.15 (-9.92)	18.52±0.15 (-8.49)	19.33±0.38
Dehulled	24.71±0.15 (+8.53)	22.14±0.14 (+7.49)	21.85±0.15 (+7.23)	23.16±0.15 (+9.11)	22.90±0.14 (+11.61)	22.95±0.14
Pressure cooked	21.58±0.11 (-4.51)	19.95±0.17 (-2.62)	19.10±0.15 (-5.77)	19.92±0.32 (-5.37)	18.96±0.15 (-6.32)	19.48±0.13
C.D. (P<0.05)	Variety : 0.21		Treatment : 0.25		Interaction : 0.55	

**Table 4.** Effect of domestic processing on crude fiber content of chickpea varieties (g/100 g, on dry weight basis)

Treatments	Variety					Mean
	HC -1	HC-5	H-208	C-235	H07-3	
Control (Raw)	5.13±0.07	2.57±0.09	3.20±0.10	5.33±0.14	4.47±0.07	4.14±0.29
Soaked (12 h)	4.72±0.03 (-7.99)	2.36±0.07 (-8.17)	2.87±0.14 (-10.31)	4.80±0.09 (-9.94)	3.94±0.12 (-11.86)	3.54±0.27
Dehulled	3.96±0.06 (-22.80)	1.92±0.10 (-25.29)	2.26±0.00 (-29.37)	4.19±0.08 (-21.39)	3.22±0.14 (-27.96)	3.01±0.21
Pressure cooked	5.51±0.10 (+6.89)	2.98±0.00 (+13.75)	3.43±0.07 (+6.70)	5.64±0.07 (+5.49)	4.87±0.03 (+8.29)	4.49±0.29
C.D. (P<0.05)	Variety : 0.09		Treatment : 0.10		Interaction : 0.23	

**Table 5.** Effect of domestic processing on ash content of chickpea varieties (g/100 g, on dry weight basis)

Treatment	Variety					Mean
	HC -1	HC-5	H-208	C-235	H07-3	
Control (raw)	3.19±0.03	3.28±0.03	3.35±0.01	3.09±0.04	3.25±0.01	3.23±0.03
Soaked (12 h)	2.81±0.01 (-11.91)	2.91±0.01 (-11.28)	3.03±0.01 (-9.55)	2.85±0.01 (-7.76)	3.08±0.02 (-5.23)	2.98±0.04
Dehulled	2.67±0.01 (-16.30)	2.95±0.01 (-10.06)	3.08±0.01 (-8.05)	2.51±0.01 (-16.18)	2.89±0.01 (-11.07)	2.76±0.07
Pressure cooked	2.03±0.02 (-17.55)	3.11±0.01 (-17.37)	2.65±0.01 (-20.89)	2.60±0.01 (-15.85)	2.48±0.01 (-23.69)	2.72±0.09
C.D. (P≤0.05)	Variety :0.02		Treatment : 0.02		Interaction : 0.05	

**Table 6.** Effect of domestic processing on fat content of chickpea varieties (g/100 g, on dry weight basis)

Treatments	Variety					Mean
	HC -1	HC-5	H-208	C-235	H07-3	
Control (raw)	3.90±0.08	5.17±0.03	2.63±0.03	4.58±0.03	3.80±0.03	4.02±0.23
Soaked (12 h)	3.40±0.08 (-12.82)	4.67±0.06 (-9.67)	2.10±0.08 (-8.74)	4.18±0.04 (-8.73)	3.35±0.03 (-11.84)	3.54±0.21
Dehulled	4.12±0.04 (+5.34)	5.35±0.06 (+3.36)	2.82±0.02 (+6.73)	4.83±0.04 (+5.17)	3.99±0.03 (+4.76)	4.16 ±0.21
Pressure cooked	3.65±0.02 (-6.41)	4.98±0.03 (-3.67)	2.42±0.03 (-7.98)	4.37±0.02 (-4.58)	3.61±0.03 (-5.00)	3.82 ±0.22
C.D. (P≤0.05)	Variety :0.04		Treatment : 0.04		Interaction : 0.10	

was removed during the process of soaking and dehulling. Fiber content increased significantly (P=0.05) by pressure cooking. Per cent increase in fiber content varied from 5.49 to 13.75 in pressure cooked chickpea. Rani and Hira (1998) also reported similar results in mash bean. This increase in fiber content after pressure cooking might be due to the increase in volume of seed and also due to water soluble minerals.

#### Ash:

Ash content in soaked chickpea ranged from 2.81 to 3.08 g/100g (Table 5). Soaking resulted in 5.23 to 11.91 per cent reduction in ash content in chickpea varieties. Ash content in dehulled chickpea varieties ranged from 2.51 to 3.08 g/100g. Dehulling resulted in significant (P=0.05) reduction in ash content. Per cent reduction in ash content in dehulled chickpea ranged from 8.05 to 16.30. Reduction in ash content is due to removal of hull, which have some amount of minerals. Similar results were also reported earlier by Ghavidel and Prakash (2007). Significant (P=0.05) decrease in ash content of chickpea was observed after pressure cooking. Similar results of decrease in ash content were observed in chickpea by Garg (2001) and Sood *et al.* (2002).

#### Fat:

Fat content in soaked chickpea ranged from 2.10 to 4.67

g/100g (Table 6). A significant (P=0.05) reduction in fat content was observed after soaking. Per cent reduction in fat content ranged from 8.73 to 12.84 in soaked chickpea. Comparable results were also reported by Kakati *et al.* (2010). After dehulling a significant increment of 3.36 to 6.73 per cent in fat content was observed in chickpea varieties. Removal of hulls, which contain relatively less amount of fat results in increment of fat content. These results are in agreement with those reported earlier by several workers (Ghavidel and Prakash, 2007; Sinha *et al.*, 2007). Significant (P=0.05) reduction in fat content was observed in chickpea varieties after pressure cooking. Per cent reduction in fat content of chickpea ranged from 3.67 to 7.98. Similar results were reported in chickpea by (Garg, 2001 and Sood *et al.*, 2002).

#### Conclusion:

It may be inferred from the present study that all the five varieties contained good amount of protein and fiber. Among the five varieties, highest content of moisture, protein, fiber, ash and fat was observed in H07-3, HC-1, C-235, H-208 and HC-5, respectively. All the processing techniques like soaking, dehulling and pressure cooking can be adopted at household level with special recommendation for pressure cooked whole chickpea as these contained more fiber in addition to all other nutrients.

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