RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume 40 Issue 1: 123-126 (March 2021)

Evaluation of the Nutritional Quality and Health Benefits of Chickpea (*Cicer arietinum* L.) by using New Technology in Agriculture (Near Infra-red spectroscopy-2500)

Mamta Rathore, H.G. Prakash, Shashi Bala

10.18805/ajdfr.DR-1582

ABSTRACT

Background: Among the pulse crop world chick pea known as important pulse crop which is grown and utilized in the world. This crop nutritionally rich in the carbohydrates, protein which has superior quality protein than the other pulse crop. This pea consists of lots of essential amino acids except the sulphur containing amino acids. So that it is a good combination of diet with the cereals. In the plants mostly carbohydrates stored in the starch form but also followed by oligosaccharides and reducing and non-reducing sugars. In this crop lots of nutritionally rich substances but it has low amount of fats and large amount of unsaturated fatty acid which is very beneficial to the heart patient. The minerals which are present in chick pea are Calcium, magnesium, phosphorus and especially potassium. The vitamins which are present in this pulse such as riboflavin, niacin, thiamin, folate and the vitamin A precursor, β-carotene. The pulses also have anti-nutritional factors which can be minimized by the using of lots of cooking methods.

Methods: Through NIRS-2500 evaluated twenty samples of chick pea. It is an instrument through which Near Infrared (NIR) analysis a spectroscopic technique that makes use of the naturally occurring electromagnetic spectrum. This works in the region of the spectrum defined by wavelengths between 700nm and 2500nm. All the cultivars were found to cluster in major four groups on the basis of principal component analysis. The result showed the diversity between nutritional and antinutritional factors in the cultivars that could be further used by plant breeders to develop superior genotypes. The chick pea has lots of advantages which cure the several diseases such as cardiovascular disease, type 2 diabetes, digestive diseases and some cancers.

Result: Here we study twenty samples of chick pea in which the biochemical composition of this crop consists of protein was varied from 22.12% to 24.42%, sulphur containg amino acids ranged from 0.15 to 1.25% and Tryptophan was ranged from 0.63 to 1.38% which was analyzed by NIRS-2500.

Key words: Anti-nutritional factors, Diet, Digestibility, Essential amino acids, Nutrition.

INTRODUCTION

In the human beings proteins are required for the building of the tissue in the growing human child. Commonly it is known as poor man's meat or in the rich people it is known as rich man vegetables. Now a day India become independent in the area of pulse production, productivity and consumption and also import. India occupies approximately 29% world area and 19% pulse production on the world bases. So that India looks a large producer, consumer of this crop. Mostly India also becomes a large importer and processor in the pulse field. In the pulse production data it varies from 14-15 MT to become 22-23 M ha. since 1990-91 (Aguilera, 2009). In the state wise pulse production varies from Madhya Pradesh (20.3%), Maharashtra (13.8%), Rajasthan (16.4), Uttar Pradesh (9.5%), Karnataka (9.3%) Andhra Pradesh (7.9%), Chhattisgarh (3.8%), Bihar (2.6%) and Tamil Nadu 2.9%). Pulse productivity which was 923 kg/ha in 2019-20. Chickpea (*Cicer arietinum* L.), commonly known as garbanzo bean, Bengal gram, it is found in old world pulse and among the seven Neolithic founder crops which is in the fetile cresent of the near east. Now a days this crop can be grown around fifty countries which was acrossed Indian subcontinent, North Africa, Middle East, southern Europe (Alessio,2011).

Department of Agriculture Biochemistry, C.S. Azad University of Agriculture and Technology, Kanpur-208 002, Uttar Pradesh, India.

Corresponding Author: Mamta Rathore, Department of Agriculture Biochemistry, C.S. Azad University of Agriculture and Technology, Kanpur-208 002, Uttar Pradesh, India.
Email: mamtacsa@gmail.com

How to cite this article: Rathore, M., Prakash, H.G. and Bala, S. (2021). Evaluation of the Nutritional Quality and Health Benefits of Chickpea (*Cicer arietinum* L.) by using New Technology in Agriculture (Near Infra-red spectroscopy-2500). Asian Journal of Dairy and Food Research. 40(1): 123-126. DOI: 10.18805/ajdfr.DR-1582.

Submitted: 26-09-2020 **Accepted:** 19-02-2021 **Online:** 09-03-2021

Global scenario of chick pea

On the basis of globally point of view this pulse crop possess third position in the area of production followed by dry beans, field pea. In India production of pulses was minimized and varied from 14-18 MT. However, from 2016-17, the production crossed 23 MT. In 2016-17, the production of pulses was 23.13 MT, in 2017-18, it was 25.42 MT and in 2018-19 is around 23.22 MT. (Bernable, 1993)

The country which produces chick pea such as includes Pakistan, Turkey, Australia, Myanmar, Ethiopia, Iran, Mexico,

Canada and USA. Most of the cultivated variety known as *Desi* and *Kabuli*. *Desi* (microsperma) looks pink in color with anthocyanin purple color provider to the thick seed coat. The *kabuli* (macrosperma) looks white color flower it shows disappear the anthocyanin pigment. The seed weight was varied from 0.1 to 0.3 g and 0.2 to 0.6g in the *desi* and *kabuli*. It is also known as cool season food legume (Chibbar, 2010).

Nutritional importance of chick pea

The importance of pulse in the form of protein and carbohydrate are identified before long time ago. Among the pulse crop chick pea was identified as staple food crop among the vegetarian people. This is a good source of starch, protein, minerals, fiber, vitamins and also most of the phytochemicals. On the bases of nutrition rich amino acid pulses are rich in essential amino acid such as lysine but in cereals it is deficient (Du,1999). So that Indian food gets complete with cereals and pulse it means dal chaval. It is a very good combination for the supply of nutrition to human beings. In chick pea macromolecules such as carbohydrates ranges from 51-65% in *desi* variety and 54-71% in *kabuli* variety. Most of the carbohydrates are present in seed of chick pea. In chick pea starch are mostly present by weight 30-57%. In the *desi* variety of chick pea consists of 20-42% amylase and 21.0-46.5% in *kabuli* variety. In the chick pea stored form of carbohydrates are not easily digestible because huge amount amylase. The best amount of stach are present in roasted chickpea and green bananas (Frimpong. A, 2009). Due to this property it is consumed in large amount. This crop is a self-pollinating crop it has 2n chromosome number. There are forty-four chick pea variety present. Such as *C. echinospermum* and *C. reticulatum* form the primary gene pool with the cultivated *C. arietinum* L. However, *C. bijugum, C. judaicum* and *C. pinnatifidum* form the secondary gene pool while other Cicer species form the tertiary gene pool (Guillon, 2002).

Chick pea used as food items

This crop is utilized in the different forms in India. Sometime it is used in unripe form or in the snack form, in the form of green vegetables. The leaves of chick pea rich in lots of nutrients such as spinach and cabbage (Ibriki, 2003). Indian and Turkey consists of large per capita and it is also used in diet in form of besan, in dhal *etc.* The mature grain of chickpea used may be in salad, cooked in stews and flour form.

This crop recently plays a provider of nutritious food to the society. This crop is easily adopted according to the environment (Jambunatha, 1980). In the world, each country has this crop that chick pea has nutritionally rich component so that the nutritionist consider its importance to the human beings. It consists of a balanced proportion of carbohydrates, proteins, vitamins and minerals essential to balanced diet in human populations (Javier, 2012). Due to its rich digestibility and rich amount of protein most of the people preferred it. There are very little amount of vitamins are present in the cereals, pulses, vegetables, fruits, meat and dairy products. It is a good source of fat and water soluble vitamins. This crop was consumed another crop it acts as a complementary component with them. This crop is rich in folic acid and easily available with minimum price. Due to maximum amount of good source of folic acid coupled with the advanced amounts of water-soluble vitamins such as riboflavin (B_2), pantothenic acid (B_5) and pyridoxine (B_6) and these levels are similar to or higher than those observed in other pulses. However, niacin concentration in chickpea is lower than that in pigeon pea and lentils (Kozlowska, 2001).

Table 1: Production of pulse in the different states of India.

Name of State	Production
Uttar Pradesh	21.2%
Madhya Pradesh	25%
Rajasthan	25.56%
Maharashtra	8.21%
Orissa	8.23%
Other States	1.437%

Source: www.google.com

Antinutritional factors

In the chick pea the nutritional and human health benefits associated with anti-nutritional factors.Due to this the chick pea consists of its controlled biological value in the form of food.

In the non protein anti nutritional consists of alkaloids, tannins, phytic acid, saponins and phenolics. But the protein anti- nutritional consists of trypsin inhibitors, chymotrypsin inhibitors, lectins and antifungal peptides. In chick pea protease inhibitor are consists of two types such as single chain polypeptide chain about 20kDa with the mostly two bridges (Lev-Yadun, 2000).

An enzyme such as protease inhibitors interact with binding of the trypsin enzyme and chymotrypsin in the human digestive tract. Mostly they are resistant to the digestive enzyme in the stomach environment and its pH.

Pulse used as a fermented food form to promote nutrition and health

Majority of pulse derived from fermentation process from last several years ago. During this process two reaction was occur firstly hydrolyze and then metabolize through which it enhance the nutritional quality and its sensorial features by increase its nutrient content and also its phytochemical bioavailability which favors its bioactive compounds (Madhusudha, 1996). The pulse become very beneficial after fermentation and it is very nutritive after this process which helps in the cardio vascular disease, diabetes and prevention of chronic diseases.

Chick pea has lots of nutritional advantages with full of vitamins and nutrients. It also helps to decrease the harmful disease to human health.

There are lots of advantages of chick pea:

(a) The carbohydrate diminishing effect

In the chick pea stored carbohydrate are digest very slow rate which effect the energy after metabolism for the use of other activities.

(b) To promote satisfaction in the appetite and helps in weight loss

This pulse are consists of rich amount of protein and fiber which helps to reduce the feeling of hunger and food craving so that the people become safe to eat unhealthy food items and helps to minimize the weight gain problem.

(c) To solve the digestion disorder

This crop rich in fiber content approximately 6-7%. In the abroad country it acts as good substitute for the makeup of the deficiency of dietary fiber.

MATERIALS AND METHODS

Sample preparation of chick pea samples from the crops were picked and threshed to remove the peels. The seed samples were kept at a temperature of 25°C and a relative humidity of approximately 85% in an air-conditioned laboratory overnight to attain temperature equilibrium of the seeds before measurement. There are 20 samples of seeds were analyzed for their proximate composition. There are samples named as K-850,K-3256,KPG-59, KGD-1168, Avrodhi, KGD-1170,KGD-2021,KGD-1320,KGD-1122,KGD-1355,KGD-1355-12,KGD-1296,KGD-1288,KGD-1321,KGD-2088,KGD-2035,KGD-1316,KGD-2012,KGD-99-5and KGD-99-9. All the work pertaining to this investigation was done in the laboratories of NIRS in the Directorate of Research, C.S. Azad University of Agriculture and Technology, Kanpur (U.P.). The grain seed of samples were collected from legume section of Azad university of Agriculture and Technology, Kanpur. After cleaning and grading the seed samples were determined using NIRS-2500. For analysis three replication samples are used the average value for the spectrum calibration. For analyses we required 130 gm samples it works from 400-2500nm wave length.

NIRS-2500- An instrument through which Near Infrared (NIR) analysis a spectroscopic technique that makes use of the naturally occurring electromagnetic spectrum. This works in the region of the spectrum defined by wavelengths between 700nm and 2500nm (Moreno,1978).

RESULTS AND DISCUSSION

The results in Table 2 shows the presence of protein and amino acids in the twenty evaluated samples of chick pea. The protein content was ranged from 22.12% to 24.42%. and the mean value of protein is 24.33%, The essential amino acids are present in the crop samples are Histidine was present from 1.86% to 3.66 and the mean value is 2.90, argenine ranged from 0.11% to 2.84% and the mean value is 0.90 valine amino acid was present from 5.18% to 7.29%. the mean value is 6.23. The aromatic amino acid such as phenylalanine was present from 0.43% to 4.95%. the mean value is 1.78. The isoleucine was ranged from 7.48% to 9.78%. the mean value is 8.97. The sulphur containing amino acid methionine ranged from 0.15% to 1.16%. and the mean value is 0.83. Leucine was present from 7.34% to 10.60%. and the mean value is 9.37 (Pande, 2005). The tryptophan amino acid was present from 0.63% to 1.38%. and the mean value is 0.75. The lysine which is mostly deficient in cereals was ranged from 2.36% to 2.80% the mean value is 2.31 and

Table 2: To study the protein and essential amino acid of chickpea.

Sample number	Protein (%)	Histidine (%)	Arginine (%)	Valine (%)	Phenylal (%)	Isoleucine (%)	Methionine (%)	Leucine (%)	Tryptophan (%)	Lysine (%)	Threonine (%)
K 850	23.76	3.13	1.27	6.06	1.55	8.82	0.67	9.66	0.79	2.45	5.49
K 3256	24.42	1.86	1.87	7.29	4.95	7.48	0.97	7.34	1.38	2.80	1.76
KPG-59	24.13	3.55	1.87	5.69	2.98	8.70	0.45	9.03	0.83	2.43	5.20
KGD-1168	23.75	3.66	2.04	5.32	2.41	8.47	0.32	9.02	0.80	2.43	5.29
AVRODHI	23.83	3.91	2.84	5.18	2.95	8.12	0.15	8.40	0.92	2.43	4.63
KGD-1170	22.25	2.70	0.32	6.83	1.77	9.67	1.25	10.54	0.63	2.42	6.54
KGD-2021	22.25	2.92	0.25	6.77	1.97	9.78	1.25	10.60	0.63	2.38	6.60
KGD-1320	22.12	2.80	0.14	6.70	1.74	9.56	1.14	10.48	0.65	2.41	6.50
KGD-1122	22.04	3.29	0.11	6.68	2.57	9.75	0.97	10.36	0.68	2.34	6.45
KGD-1355	22.95	2.88	0.16	6.57	1.87	9.45	1.17	10.35	0.68	2.41	6.24
KGD-1355 12	22.48	3.69	1.62	5.77	1.18	8.57	0.91	10.43	0.89	2.36	5.35
KGD-1296	23.90	2.83	0.46	6.28	0.78	9.01	0.73	10.16	0.67	2.45	6.18
KGD-1288	22.16	3.04	0.20	6.46	1.71	9.51	1.16	10.49	0.68	2.38	6.40
KGD-1321	22.96	3.02	0.51	6.24	1.55	9.19	1.02	10.23	0.69	2.41	6.18
KGD-2088	23.13	2.71	0.63	6.20	0.70	8.81	0.66	9.95	0.69	2.49	5.99
KGD-2035	23.24	2.90	0.66	6.19	0.69	8.89	0.67	10.12	0.70	2.45	6.06
KGD-1316	23.36	3.15	1.09	5.72	0.43	8.60	0.64	10.06	0.75	2.44	5.82
KGD-2012	23.98	2.84	0.79	6.11	0.81	8.78	0.60	9.89	0.70	2.48	5.94
KGD-99-5	22.95	2.89	0.14	6.59	1.80	9.52	1.11	10.37	0.69	2.41	6.33
KGD-99-9	24.06	3.28	1.15	5.79	0.82	8.83	0.71	10.00	0.73	2.40	6.04
Mean	24.33	2.90	0.906	6.23	1.78	8.97	0.83	9.37	0.75	2.31	5.74

threonine amino acid was ranged from 1.76% to 6.60% and the mean value is 5.74. (Moreno,1978). Among the samples the superior in protein content was K-3256, KPG-59, KGD-99-9. The histidine was rich in KGD-1168, KGD-59. The amino acid compositions of chick pea which was made from the cotyledons and from the whole seeds of a disease resistant, stable and high yielding cultivar of chickpea (*Cicer arietinum* L) (Wood,2007). The protein and amino acid composition correlates to each other. The proportion of basic amino acids in the albumin was low whereas the reverse was true in the globulin (Singh,1985). The legumin fraction seems to be superior in terms of total essential amino acids to those from other sources. Sulphur amino acids were the most limiting, followed by tryptophan or threonine depending on the fraction (Pande, 2005). However, the ratio of methionine to cystine was high (Zohary,2000). The amino acids were classified several categories but among them Sulphur amino acids, methionine and cystine when considered together were the first limiting amino acids of chickpea (Zia,2007). On the evaluation bases of several genotypes, tryptophan was not found to be the limiting amino acid of chickpea whereas pigeonpea cultivars were invariably deficient in this amino acid. But among the all amino acids threonine was observed to be the second limiting amino acid of chickpea (Sanchez,1998).

ACKNOWLEDGEMENT

This research was conducted at Directorate of Research, the Chandra Shekhar Azad University of Agriculture and Technology, Kanpur under NAHEP Center for Advanced Agriculture Science and Technology on Nutritional Crops Sponsored by ICAR, New Delhi. The financial assistance is duly acknowledged and thanks for Director Research of the University for providing me with the research support.

REFERENCES

Aguilera, Y., Esteban, R.M. and Benítez, V. (2009). Starch, functional properties and microstructural characteristics in chickpea and lentil as affected by thermal processing. J. Agric. Food Chem. 57: 10682-10688.

Alessio, S., Elisa, G., Alberto, B., Aristodemo, C., Armando N. and Marcello, D. (2011). Biochemical and functional characterization of an albumin protein belonging to the hemopexin super family from lens culinaris seeds. Journal of Agricultural and Food Chemistry. 59(17): 9637-9644.

Bernabé, M., Fenwick, R. and Frias, J. (1993). Determination, by NMR spectroscopy, of the structure of ciceritol, a pseudotrisaccharide isolated from lentils. J. Agric. Food Chem. 41: 870-872.

Chibbar, R.N., Ambigaipalan, P. and Hoover, R. (2010). Molecular diversity in pulse seed starch and complex carbohydrates and its role in human nutrition and health. Cereal Chem. 87: 342-352.

Chibbar, R.N., Baga, M., Ganeshan, S. (2004). Carbohydrate Metabolism. In: Encyclopedia of Grain Science. 168-179.

Du, D.A., Pont, M.S. and Ambrose, M.J. (1999). The discovery of compositional variation for the raffinose family of oligosaccharides in pea seeds. Seed Sci. Res. 9: 305-310.

Frimpong, A., Sinha, A. and Taran, B. (2009). Genotype and growing environment influence chickpea (*Cicer arientinum* L.) seed composition. Journal Science Food Agriculture. 89: 2052-2063.

Guillon, F. and Champ, M.M. (2002). Carbohydrate fractions of legumes: uses in human nutrition and potential for health. Br. J. Nutr. 88(Suppl. 3): S293-S306.

Ibrikci, H., Knewtson, S.J.B. and Grusak, M.A. (2003). Chickpea leaves as a vegetable green for humans: evaluation of mineral composition. J. Sci. Food Agric. 83: 945-950.

Jambunathan, R. and Singh, U. (1980). Studies on *desi* and *kabuli* Chickpea (*Cicer arietinum* L.) Cultivars. Chemical Composition. In: Proceedings of the International Workshop on Chickpea Improvement, 28 February-2 March 1979, ICRISAT, Hyderabad, India, Patancheru, AP: ICRISAT. 61-66.

Javier, V., Alaiz, M. and Girón-Calle, J. (2012). Nutritional and functional properties of Vicia faba protein isolates and related fractions. Food Chemistry. 132(1): 67-72.

Kozlowska, H, Aranda, P. and Dostalova, J. (2001). Nutrition. In: Carbohydrates in Grain Legume Seeds: Improving Nutritional Quality and Agronomic Characters. Oxon: CAB International.

Lev-Yadun, S., Gopher, A. and Abbo, S. (2000). The cradle of agriculture. Science. 288: 1062-1063.

Madhusudhan, B. and Tharanathan, R.N. (1996). Structural studies of linear and branched fractions of chickpea and finger millet starches. Carbohydr Res. 184: 101-109.

Moreno, M. and Cubero, J.I. (1978). Variation in *Cicer arietinum* L. Euphytica. 27: 465-485.

Pande, S., Siddique, K.H.M. and Kishore, G.K. (2005). Ascochyta blight of chickpea: biology, pathogenicity and disease management. Aust. J. Agric. Res. 56: 317-332.

Sánchez, Mata, M.C., Peñuela, Teruel, M.J., Cámara, Hurtado, M. (1998). Determination of mono-, di- and oligosaccharides in legumes by high-performance liquid chromatography using an amino-bonded silica column. J. Agric. Food Chem. 46: 3648-3652.

Singh, U. (1985). Nutritional quality of chickpea (*Cicer arietinum* L.) current status and future research needs. Plant Foods Hum. Nutr. 35: 339-351.

Wood, J.A. and Grusak, M.A. (2007). Nutritional Value of Chickpea. In: Chickpea Breeding and Management. pp. 101-142.

Zohary, D. and Hopf, M. (2000). Domestication of Plants in the Old World, 3rd ed. Oxford: Clarendon Press.

Zia, Ul-Haq, Iqbal, M.S. and Ahmad, S. (2007). Nutritional and compositional study of *desi* chickpea (*Cicer arietinum* L.) cultivars grown in Punjab, Pakistan. Food Chem. 105: 1357-1363.