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Nutritional Profile and Health Benefits of Quinoa (*Chenopodium quinoa*)

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INTRODUCTION

Quinoa including green plants and seeds are the wonderful source of bioactive compounds and mineral nutrition's. Large number of quinoa species, germplasm lines and accessions are available to impart the breeding strategy of the crop improvement (Bazile, et al., 2015). Utilization of breeding lines and germplasm to develop eco-friendly quinoa cultivars is one of the promising goals for the breeders to accumulate several major and minor traits to make sustainable crop. Quinoa plant is gynomonoecious having both hermaphrodite and female flowers. The bisexual flowers are located at terminal position of a group whereas the female flowers are present at the proximal end close to the stem (Jensen, et al., 2000). Hermaphrodite flowers contain a single pistil usually surrounded by five anthers, although the number of anthers can vary considerably in some quinoa varieties. Female flowers are smaller and lack anthers. In quinoa, anthesis starts at apex of each group of flowers. Both bisexual and female flowers open at same time in the morning and maximum number of flower open by mid-day. Quinoa flowering patterns are quite complex and there are differing classifications of flower types and arrangements (Jacobsen and Mujica, 2003). Large number of germplasm lines is accessions of quinoa are available and may be useful in the molecular study and future breeding of the crop improvement to develop high yielding and nutri-dense quinoa cultivars (Kolano, et al., 2016).

Important trends related to breeding strategy and crop improvement are well illustrated in this article. Quinoa responds to such stress through drought escape, tolerance, and avoidance. Some other preventative mechanisms employed by quinoa include tissue elasticity, low osmotic potential, decreased leaf area through dehiscence, and the presence of vesicular calcium oxalate and structurally with small and think-walled cells. Garcia et al. studied the stomatal response to water under irrigation and stressed conditions and observed that there was a ~50% reduction in water potential in the stressed plants (Yang, et al., 2016).

Male sterility in quinoa is also a promising alternative to laborious emasculation technique. However, prior development of male sterile lines and maintainer lines is required for utilization of this approach in breeding programme. Cytoplasmic male sterility found in PI 510536 quinoa line is the most suitable source for breeding purpose (Kolano, et al., 2016). The restorer genes for the CMS line are available in quinoa germplasm. However, the introgression of male sterility into female parent before conducting each cross increases the length of time taken for attempting crosses as compared to manual emasculation. Although crossing is very difficult in quinoa, there are few repots of attempting crosses using manual emasculation. For attempting crosses, quinoa plants were sown in small pots with minimal fertilization to restrict vigorous growth of plants. There should be proper monitoring of plants as flowering begins (Kolano, et al., 2016).

Nutritional profile of quinoa

Quinoa is the richest source of proteins, vitamins, amino acids, minerals, sugars, iron, and fat. Mineral nutrients like calcium, potassium, zinc, phosphorus are also found in quinoa (Galwey, 1989). Major vitamins in quinoa are vitamin, A, C, E and vitamin B1, B2 and B3. Quinoa seed carbohydrates contain between 58 and 68% starch and 5% sugar, making it an ideal source of energy that is slowly released into the body owing to its high fibre content. Starch is the most significant carbohydrate in all grains, representing approximately 60 to 70% of dry matter.

Quinoa starch content is 58.1 to 64.2%. Linoleic, oleic and alpha-linolenic acids are the predominant unsaturated acids with concentrations of 52.3, 23.0 and 8.1% of total fatty acids, respectively. Quinoa oil also contains approximately 2% erucic acid. Other researchers found that quinoa´s main fatty acid was linoleic acid (56%), followed by oleic acid (21.1%), palmitic acid (9.6%) and linolenic acid (6.7%). According to these authors, 11.5% of quinoa´s total fatty acids are saturated. Quinoa helps reduce LDL (or bad cholesterol) in the body and raise HDL (good cholesterol) due to its omega 3 and omega 6 content. 100 grams of quinoa contains nearly fivefold lysine, more than double isoleucine, methionine, phenylalanine, threonine, valine, and much larger amounts of leucine (all essential amino acids along with tryptophan) than 100 grams of wheat.

In addition, it also exceeds wheat, in some cases by the triple, in the amounts of histidine, arginine, alanine and glycine as well as containing amino acids not present in wheat such as praline, aspartic acid, glutamic acid, cysteine, serine and tyrosine (all nonessential amino acids). The unique benefits of quinoa are related to its high nutritional value (Konishi, 2002). The protein content of quinoa ranges between 13.81 and 21.9% depending on the variety. Due to the high content of essential amino acids in its protein, quinoa is considered the only plant food that provides all essential amino acids, which are extremely close to human nutrition standards established by the FAO. The balance of essential amino acids in quinoa protein is superior to wheat, barley and soybeans, comparing favorably with milk protein. Grains, leaves and inflorescences are rich source of high quality proteins.

Quinoa is rich in Lysine and sulphur containing amino acids unlike cereals which are deficient in such amino acids. Quinoa has a high percentage of total dietary fibre (TDF), which makes it an ideal food to detoxify the body, eliminating toxins and waste products that may harm the body. Quinoa produces a feeling of fullness (Miranda, et al., 2012). Cereals in general and quinoa in particular, have the ability to absorb water and stay longer in the stomach.

Health benefits of quinoa

This crop has the potential to mitigate the global challenges of ever-increasing global population accompanied by demand for healthy diet and the problems associated with degrading environmental conditions such as Climate change, phytoremediation, salinization etc. Quinoa being gluten free and a store house of all the essential nutrients can be categorized as a super food that can act as one the strongest weapon against the fight with Poverty and nutritional insecurity (Metz, et al., 2005).

Quinoa has a high percentage of total dietary fibre (TDF), which makes it an ideal food to detoxify the body, eliminating toxins and waste products that may harm the body. Quinoa produces a feeling of fullness (Jacobsen, et al., 2009). With regard to "non-essential" amino acids, quinoa contains more than triple the amount of triple histidine in wheat, a substance which is essential for infants because the body cannot synthesize it until adulthood so it is strongly recommended that children acquire it through their diet, especially during periods of growth.

It also has a slightly anti-inflammatory action and participates in the immune system response. The quinoa starch is highly freeze/thaw stable and is resistant to retro gradation (Martinez, et al., 2009). These starches could provide an interesting alternative to replace chemically modified starches. Genetic variation of starch granule size in the Bolivian quinoa collection ranged from 1 to 28 μm, this variable can be used to make different mixtures with cereals and legumes, and establish the functional nature of quinoa.

REFERENCES

Bazile, D., Barter, H.D., Nieto, C. (2015). State of the Art Report on Quinoa around the World in 2013; Available online: http://www.fao.org/3/i4042e/I4042E.

Galwey, N., Leakey, C.L.A., Price, K.R., Fenwick, G.R. (1989). Chemical composition and nutritional characteristics of quinoa (Chenopodium quinoaWilld.). Food Sci. Nutr. 42, 245–261.

Jacobsen, S. and Mujica, A. (2003). The genetic resources of Andean grain amaranths (Amaranthus caudatus L., A. cruentus L. and A. hipochondriacus L.) in America. Plant Genet. Resour. Newsl. 133, 41–44.

Jacobsen, S.E., Liu, F., Jensen, C.R. (2009). Does root-sourced ABA play a role for regulation of stomata under drought in quinoa (Chenopodium quinoaWilld.). Sci. Hortic. 122, 281–287.

Jensen, C., Jacobsen, S.E., Andersen, M., Andersen, S., Mogensen, V., Núñez, N., Rasmussen, L. (2000). Leaf gas exchange and water relation characteristics of field quinoa (Chenopodium quinoaWilld.) during soil drying. Eur. J. Agron. 13, 11–25.

Kolano, B., McCann, J., Orzechowska, M., Siwinska, D., Temsch, E., Weiss-Schneeweiss, H. (2016). Molecular and cytogenetic evidence for an allotetraploid origin of Chenopodium quinoa and C. berlandieri (Amaranthaceae).Mol. Phylogenet. Evol. 100, 109–123.

Kolano, B., McCann, J., Orzechowska, M., Siwinska, D., Temsch, E., Weiss-Schneeweiss, H. (2016). Molecular and cytogenetic evidence for an allotetraploid origin of Chenopodium quinoa and C. berlandieri (Amaranthaceae).Mol. Phylogenet. Evol. 100, 109–123.

Konishi, Y. (2002). Nutritional characteristics of pseudo-cereal amaranth and quinoa: Alternative foodstuff for patients with food allergy. J. Jpn. Soc. Nutr. Food Sci. 55, 299–302.

Martinez, E.A., Veas, E., Jorquera, C., San Martín. R., Jara, P. (2009). Re-introduction of quinoa into Arid Chile: Cultivation of two lowland races under extremely low irrigation. J Agron Crop Sci.195:1–10. DOI: 10.1111/j.1439-037X.2008.00332.x

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Metz, B., Davidson, O., De Coninck, H., Loos, M., Meyer, L. (2005). IPCC, 2005: IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/srccs.

Miranda, M., Vega-Gálvez, A., Quispe-Fuentes, I., Rodríguez, M.J., Maureira, H.,Martínez, E.A. (2012). Nutritional aspects of six quinoa (Chenopodium quinoaWilld.) ecotypes from three geographical areas of Chile. Chil. J.Agric. Res. 72, 175.

Yang, A., Akhtar, S.S., Amjad, M., Iqbal, S., Jacobsen, S.E. (2016). Growth and physiological responses of quinoa to drought and temperature stress. J. Agron. Crop Sci. 202, 445–453.