

Quinoa: A Potential Crop For Nutritional Security

Sanju Choudhary^{1*}, Devilal Birla¹, Biswajit Pramanick¹ and Manju Choudhary²

¹Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University, Pusa-848125, Samastipur, Bihar, India

²Department of Agronomy, Sri Karan Narendra Agriculture University, Jobner-303328, Jaipur, Rajasthan, India

*Corresponding author: 98sanjuchoudhary@gmail.com

ARTICLE ID: 019

Introduction:

Quinoa (*Chenopodium quinoa* Willd.) is an annual herbaceous plant belongs to Amaranthaceae family, that originated in the Pacific slopes of the Andes in South America. It was cultivated and used by the Inca (ruling class) people since 5,000 B.C. Quinoa was the principal crop for the Inca Empire. They named to it as the “mother of all grains” and accept it to be sanctified. Quinoa has been ingested for thousands of years in South America, although it only became popular as “super-food status” a few years ago. It’s production in the world is 158 thousand tonnes. Peru is the biggest producer of quinoa with 54 per cent of world production followed by Bolivia with 44 per cent. (FAOSTAT of the United Nations: 2018). The Food and Agriculture Organization of the United Nations (FAO) has officially announced the year 2013 as” The International Year of the Quinoa.”



Fig 1: Quinoa crop

It is a pseudo cereal, climate-change-resilient crop and adaptable crop with potential to meet the global food demand. Quinoa is a gluten-free and highly nutritious seed crop which will play important role in nutritional security because it has unique agronomic adaptations to different adverse climatic conditions, making it appropriate for cultivating in countries which are susceptible to the effects of climate change on food production. Quinoa adapts to extreme and unforgiving weather conditions, drought, high salinity, and frost. It has a great level of adaptability, can survive in lowlands, deserts, and areas over 4000 meters above mean sea level. Quinoa tolerates a wide range of pH of the soil, from pH 6.0 to 8.5 and is not affected by low temperature at -1°C and high temperatures up to 35°C . Quinoa is frost resistant before flowering and significant damage if frost occurs at a later stage of crop. It is grown and gives sufficient yield at regions where annual rainfall is 200–400 mm (Valencia-Chamorro, 2003). The unique benefits of quinoa are its high nutritional value, it is a rich source of protein content, ranging between 13.81 to 21.9% depending on the variety. Due to the high content of essential amino acids in its protein, it is only plant food that provides all essential amino acids and is very close to human nutrition standards established by the FAO.

Reasons for Quinoa acceptance in India:

In India 65% population was dependent on agriculture, though more than 50% population practiced it was very difficult to feed the rapidly growing population, hence India imports food grains from other countries, but during 1966-67 green revolution in India played an important role especially on rice and wheat production, the dwarf gene varieties of rice and wheat were introduced from Mexico to India for the higher cereal production. In a similar way it is the right time to introduce the crop like quinoa in India to check some of the health problems facing by Indian population. Security of food production for an increasing population by low-input use is a major task for research in the present time. In the present scarcity of water resources and the increasing salinization of soil and water are the main reasons behind low crop yield and high loss of crops in India and worldwide and become more severe as a result of desertification (FAO 2011).

Quinoa's extraordinary tolerance to adverse environments like drought, low temperature, salinity and wide range of pH makes it a good option for food security in these challenging Indian conditions. (Martínez *et al.*, 2009) We may also increasingly need of plants like quinoa for revegetation and restitution of salt affected and low rainfall receiving lands and quinoa is

very useful for investigating the mechanisms that plants adopt and deal with high salinity and drought conditions.

Interesting facts about this popular super food:

- Quinoa is not truly a grain, we cook and eat quinoa like many other grains, but botanically similarly to spinach and beets and Its leaves are also edible.
- In many researches, studies and authors of “Nutritive Values of Crops, Nutrient Content and Protein Quality of Quinoa” found the nutritional ability of quinoa and Extract that quinoa is a complete protein.
- You should rinse quinoa before eating because dried seeds would taste pretty sour due to a compound by which quinoa is coated with, but mostly in modern-day packaged quinoa has been already rinsed and processed.

Nutritional status of quinoa vs cereal crops:

In comparison to cereal crops like wheat, rice, maize, pearl millet and sorghum, quinoa provide higher amount of energy, fat, fibre, protein, vitamins and minerals; that’s why quinoa is called world’s most nutritious crop. Quinoa provides good amounts of heart-healthy fats such as monounsaturated fat (oleic acid) and also provide small amounts of the alpha-linolenic acid (ALA) and omega-3 fatty acid. Recent studies have shown that it does not get oxidized as rapidly even higher fat content. During boiling, simmering, and steaming do not reduction in quality of quinoa’s fatty acids, allowing us to enjoy its cooked texture and flavour while maintaining this nutrient benefit at the final eating product. Quinoa has diverse array of antioxidants including various members of the vitamin E family such as alpha, beta, gamma and delta-tocopherol. It also contains flavonoids such as quercetin and kaempferol that contribute in protection of oxidation.

Nutritional value of quinoa (per 100 gram)

Energy	1539KJ(368 Kcal)
Carbohydrate	64.2 g
Dietary fibre	7.0 g
Fat	6.1 g
Protein	14.1 g

Vitamins	
Vitamin A	1 µg
Thiamine	0.36 g
Riboflavin	0.35 g
Niacin	1.52 g
Pyridoxine	0.49 g
Vitamin E	2.4 g
Minerals	
Calcium	47 mg
Iron	4.6 mg
Magnesium	1.97 mg
Manganese	2.0 mg
Phosphorus	457 mg
Potassium	563 mg
Sodium	5 mg
Zinc	3.1 mg

Source: Nutrient data laboratory, USDA

Health benefits of Quinoa:

1. Very nutritious

An article published in the Journal of the Science of Food and Agriculture, in 2009 stated that quinoa has “unusual composition and exceptional balance” of oil, protein, vitamins as well as its minerals, fatty acids, and antioxidants, making it a most nutritious food. Quinoa also accommodate plant hormones which help in regulating plant growth. Phyto-estrogens are a type of phyto-hormone which is being studied for the treatment of menopause symptoms because these phyto-estrogens have the potentiality to act like estrogens in the human body. Quinoa is non-GMO, gluten free and generally grown organically.

2. Rich in fibre

Quinoa is high in fibre. Its high fibre content can help to lower cholesterol levels, reduce blood sugar levels and increase fullness. Digestion is stimulated by fibre, that requires bile acids which are made partially with cholesterol. As your digestion process improves, the liver drags cholesterol from the blood for the production of more bile acid, in that way reducing the amount of cholesterol. According to a study conducted by the German Institute of Human Nutrition has found that the consumption of dietary fibre contributes to a lot of surprising metabolic effects which independent from changes in body weight, which include improvement of insulin sensitivity and modulation of the secretion of some gut hormones.

3. Gluten-free

People who are suffering from celiac disease are suggested for the consumption of gluten free diet. A gluten-free diet can be healthy as it is based on foods that are naturally gluten free. People who are on a gluten-free diet can face difficulty to getting all the essential nutrients they need. Quinoa has been suggested for incorporating as a gluten-free product which significantly improve their polyphenol content as compared with other gluten-free ingredients, such as refined tapioca, potato, rice flour, and corn. Polyphenols are those substances which protect cells and body chemicals against damage caused by free radicals. Quinoa made products can significantly improve the antioxidant value and nutrients of the diet compared with both control gluten – free products and the wheat products.

4. High and essential amino acids

Amino acids are essential for protein. Some of the amino acids which cannot produce by our body are called “essential”. We can get them from the diet. If a food comprise all the essential amino acids, it is considered a “complete” protein. Problem is that a certain essential amino acids are not present in many plant foods whereas quinoa offers all essential amino acids in a healthy balance, including lysine. According to a study of the Ohio Agricultural Research and Development Centre, quinoa is a good source of lysine. Moreover, it contain 25% more and better quality protein than refined grains. Quinoa is considered as an excellent plant based protein source for vegetarians as it contains 14 grams of quality protein.

5. Rich in iron and prevents anemia

Quinoa also very helpful of peoples who have trouble in maintaining their iron needs by daily dite. In only one cup of quinoa, fill the 15% of the daily recommendation of iron, which is

improve to system, and reduce chance of any deficiencies. Iron is essential for brain function and muscles. Because of very small amounts of zinc are necessary for human health and one cup of quinoa contains 13% of the daily recommendation of zinc, so it makes one of the greatest sources of zinc. Zinc is very play important role in the liver functioning, in antioxidants are especially for keeping healthy skin, in antioxidant which protecting against free radical induced oxidative damage and protects against UV radiation and enhances wound healing.

6. Protects the liver

Another health benefit of quinoa to help in proper liver functioning because it use as a source of zinc. Zinc is essential for human because it provides normal growth, development, and differentiation of cell. Generally zinc deficiency has been noted in patients with liver disease. It observed that patients who take a recommended dose of zinc for treatment of liver disease make faster progress toward curing the disease. The recommended dose of zinc for treating liver disease is 50 mg of elemental zinc taken with a meal to decrease the potential side effect of nausea. quinoa is good source of zinc and when include 100 gram of quinoa in dite it provide 3.1mg zinc.

7. Supports weight loss

For weight loss, people require to take in less calories than they burn everyday. Certain foods can include in our diet which either reduce apatite or boost metabolism. Quinoa has several such properties therefore if you are on a diet, you will likely allowed to eat quinoa. It is a good source of protein, which can both decrease appetite and increase metabolism significantly. It is high in fibre, which should help you improve the feeling of satisfaction, making you ingest fewer calories overall. Another important feature for losing weight is that it has a lower glycemic index.

8. Anti-inflammatory properties

Quinoa contains many anti-inflammatory nutrients, like saponins to hindering inflammation, metabolic disease and obesity. According to the Chinese Academy of Agricultural Sciences, Beijing, quinoa may be used as functional food components for hindering and treating inflammation. Flavonoids, cell wall polysaccharides, vitamin E family nutrients, e.g., gamma tocopherol, and phenolic acids are also reported to have anti – inflammatory properties.

9. Improves digestion

Now a- days millions of people are suffering from digestive disorder. These can be minor problems, such as constipation, diarrhea, gallstones, or more serious diseases, like as cancer, ulcers, and diverticulitis. It is a good source of soluble and insoluble fibre, which help to improve digestion. Quinoa contains high amount of insoluble fibre which can help digestive disorders like diverticulosis. The soluble fibre content of quinoa can help to rid the intestines of cholesterol and also help with weight management if you have a habit of eating too frequently and suffering from digestive disorders.

How to incorporate quinoa more into your diet

Quinoa have coating substances such as saponins that keep insects away without application of pesticides. You can use quinoa in place of rice. Its small grains become soft in 15 minutes. It a versatile ingredient in the kitchen due to its subtle nutty taste. Quinoa keeps its pleasant, chewy texture when served chilled, warm, or at room temperature. We can use quinoa as a breakfast grain as well in cold salads, in burgers or even hot side dishes. We can also use it to thicken stews or soups.

Conclusion

Quinoa is helps in preventing the danger from a lot of maladies and contains good amount of fat, fiber, carbohydrates, protein, antioxidants, omega-3 fatty-acids, vitamins and minerals than any other food grain crops which make it a complete food. In long term consumption of quinoa reduces the obesity. Quinoa is mostly organically produced and have no harmful effect on human as well as on animal health. Quinoa adapts to extreme and unforgiving conditions like drought, high salinity, and frost and great level of adaptability in lowlands, deserts, in higher altitude, wide range of pH and in extreme low temperature which is make It complete package of nutritional, qualitative and essential ingredients of food for healthy life style and healthy world in a present changing climatic conditions.

References

FAOSTAT. Quinoa area and production in the World, 2018. <http://www.fao.org>

FAO Dietary Protein Quality Evaluation in Human Nutrition Report of an FAO Expert Consultation. 2011. Available online: <http://www.fao.org/3/a-i3124e.pdf>.

Martinez, E.A., Veas, E., Jorquera, C., San Martin, R. and Jara, P. (2009). Re-introduction of *Chenopodium quinoa* Willd. into arid chile: Cultivation of two lowland races under extremely low irrigation. *Journal of Agronomy and Crop Sciences*. (195):1-10

Valencia-Chamorro S.A., (2003). Quinoa. In: Caballero B. Encyclopedia of Food Science and Nutrition. Vol. 8. Academic Press, Amsterdam: 4895–4902.

