



Quinoa (*Chenopodium quinoa* Willd.): "The Mother of All Grains"

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Quinoa (*Chenopodium quinoa* Willd.) is a annual herbaceous species belonging to family Amaranthaceae, but formerly placed in *Chenopodiaceae* family, domesticated staple food in Andean South America. It is principally a grain crop harvested and consumed in a manner similar to that for cereal grain, although its leaves are also used as potherb. Quinoa was domesticated ancient Andean civilization in region surrounding the Bolivian and Peruvian altiplano. Nevertheless cultivation of quinoa extends to south central zone of Chile in fragmented pattern. Today, out of more than 7000 species used for food only four crops viz., rice, maize, wheat and potato contribute over 60 per cent of calories obtained by human. This dramatic shrinkage of food basket brought a negative impact on nutrition security and dietary diversity, which caused the health related problems like micronutrient deficiencies or "hidden hunger". Hence there is an urgent need to include a much wider range of crop species in current agriculture system and for this purpose "Neglected and Underutilized Crops" or "Orphan Crops" can be appropriate solution for above problems. FAO nominated 2013 as International year of Quinoa. Quinoa is qualified as a functional food because its nutritional quality is superior to other grains like rice and wheat

Quinoa shows excellent amount of carbohydrate, fat, protein content balance and protein content sustainability higher than that of major cereal grains varying between 7.5 to 22 per cent. It contain high amount of Ca, Fe, Zn, Cu and Mn.

Due to its great nutritional value and inclusion of all necessary amino acids, including lysine, which is deficient in cereals and sulphur-containing amino acids, which are deficient in pulses, quinoa is also known as the "mother grain." According to the United States Department of Agriculture (USDA), quinoa seeds have a greater total protein content than other cereals (13.28g/100g), and they also include a full complement of the ten necessary amino acids for adult nutrition. Quinoa seeds are gluten-free because they have higher levels of albumin and globulin proteins and lower levels of prolamine and glutenins. Its seeds may be utilised to make gluten-free goods and consumed by both celiac disease sufferers and individuals who are allergic to wheat.

Amino acid composition

One of the report of United Nations Organisation for Agriculture and Food (2015) clearly noted that, the quinoa grain is the only vegetable food that provides ideal balance of eight essential amino acids essential to the life of humans in optimum quantities and is comparable with milk. Quinoa has a balanced amino acid composition with high levels of lysine and methionine. It is also rich in unsaturated fatty acids like oleic acid and linolenic acid.

Dietry fibre

Quinoa is regarded as a superior source of dietary fibre (12.88–14.20%) and carbs (60–70%). Quinoa contains between 51 and 61 percent starch, and because of its high viscosity and tiny granules of amylose and amylopectin, it has the potential to be utilised in industrial

applications. The range of total amylose concentration in different quinoa kinds was 4.7% to 17.3%, while the starch level ranged from 53.2 g/100 g to 75.1 g/100 g.

Fatty acid

Quinoa has a different fatty acid (FA) composition than grains, it has higher nutritious properties. Quinoa has a high quality edible vegetable oil that ranges in fat content from 5.2% to 9.7%, which is lower than soybean oil's (18.9%) and higher than wheat's (4.7%). It is rich in essential fatty acids like linoleate and linolenate (55-65 % of lipid fraction).

Quinoa seed macro/micro nutrients and vitamins

Quinoa grains have a greater mineral richness than wheat, rice, and corn, with concentrations of Fe (9.47 mg/100g), P (406 mg/100g), Ca (87 mg/100g), K (907 mg/100g), Mg (362 mg/100g), Zn (2.15 mg/100g), Cu (7.84 mg/100g), and Na (20 mg/100g). In addition, quinoa seed is rich in thiamine (0.4 mg), folic acid (78.1 mg), vitamin C (16.4 mg), riboflavin (0.39 mg) and carotene (0.39 mg) in 100 g seed respectively.

Antinutritional factors

By affecting the digestibility of carbohydrates, proteins, and minerals by forming crosslinkage bridges with macromolecules and limiting their nutrient utilisation, antinutritional factors like phytic acid, tannins, saponins, protease inhibitors, and raffinose family oligosaccharides reduce the nutritional value of food. Saponins are secondary metabolites found in the plant kingdom that include one or more sugar chain moieties together with a steroidal or triterpenoid aglycone. Food saponins have historically been regarded as "antinutritional agents." However, saponins are thought to have anti-inflammatory and anti-carcinogenic properties, therefore they offer health advantages. Because they have a surfactant and emulsifier function, they are also utilised in the pharmaceutical sector for the manufacture of hormones, steroids, and contraceptives. They are also employed as expectorants and diuretics. In comparison to soybeans and other legumes, quinoa is said to have less saponins. The quinoa grain contains between 0.1 and 5% saponin. Quinoa may be divided into two categories: "sweet" (having less than 0.11% free saponin) and "bitter" (containing more than 0.11%).

Quinoa also contain natural antioxidants like α -tocopherol (5.3 mg), γ -tocopherol (2.6 mg) in 100 g seed and phytoestrogens that prevent chronic diseases such as osteoporosis, breast cancer, heart diseases and other feminine problems caused by lack of oestrogen during the menopause.

Bioactive compounds

The natural functional food components known as bioactive compounds, such as carotenoids, tocopherols, dietary fibres, squalene, phytosterols, anthocyanins, and isoflavonols, etc., indicate a greater antioxidant potential. Food, cosmetic, and medicinal companies all utilise these naturally occurring antioxidants. Organic substances found in plants called carotenoids and isoflavonols have antioxidant properties in people. Additionally, anthocyanin has a significant function in protecting against oxidative stress and cardiovascular illnesses (CVD). In quinoa seeds, total carotenoid and anthocyanin concentrations varied from 11.87 to 17.61 and 120.4 mg CGE per 100 g⁻¹ dry weight, respectively.