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Quinoa-supergrain of the future: A Review

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Abstract

Growing trend for nutraceutical and gluten-free cereal-based products highlights the need for development of new products. Quinoa is one of the potential candidates for such products. Quinoa is a pseudo-cereal that has garnered increasing interest in recent years from global markets, as well as in academic research. In recent years, the popularity of quinoa seeds has increased due to enormous health benefits and super food properties. Quinoa seeds have an improved macronutrient profile, including gluten-free characteristics, a particularly beneficial essential amino acid ratio and a superior phytochemical composition compared with other cereals and grains. It has been promoted as an alternative agricultural crop due to its stress-tolerant characteristics and marketed as a "superfood" for its nutritious qualities. The present article is a reviewed for nutritional characteristics of quinoa seeds.

Keywords: Quinoa, pseudo-cereal, gluten free, Nutraceutical value

Introduction

Quinoa (*Chenopodium quinoa* Willd.) is a pseudo-cereal with highest nutrient potential than most grain. Quinoa is among the crop selected for food security consideration by the Food and Agriculture Organisation (FAO) as the protein quality of the seed is deemed to be better than those of cereals ^[1]. This crop constitutes a great potential for agronomic demands because it can adapt to produce high grain yields under adverse or stressing conditions. The year 2013 was designated "The International Year of Quinoa" by the United Nations, because of its potential to contribute to food security worldwide ^[2].

Quinoa seeds are flat, oval-shaped and usually pale yellow, but the color can range from pink to black, and the taste can vary from bitter to sweet. Quinoa is said to be supergrain because it is a whole grain with a low glycemic index, proteins of high biological value, healthy fats (Omega-3's and Omega-9's) and a host of phytonutrients, including flavonoids that act as powerful antioxidants with anti-inflammatory properties. Also, quinoa protein is exceptionally high in methionine, lysine and cysteine amino acids. Quinoa seed composition has aroused the attention of the scientific community for its high nutritional potential ^[3]. It is also gluten-free, so it can be enjoyed by individuals who are sensitive to gluten or wheat. Quinoa is easy to cook and has versatility in preparation. It has a naturally bitter coating called saponin which can be easily removed by rinsing quinoa with water before consumption.

Despite all these attributes, quinoa is still little used due to the high cost of the imported grain and little knowledge of its benefits by most consumers. More studies are needed to increase knowledge about this "pseudo-cereal" and prove their functional and nutritional benefits.

Nutritional Characteristics

Protein

Quinoa has attracted attention as a new food resource, because of the quality and nutritional value of its proteins. The protein content of quinoa seeds varies from 8% to 22%, which is higher on average than common cereals such as rice, wheat, and barley. Quinoa is considered to be a "complete" protein source, providing all the essential amino acids. It is exceptionally high in the amino acid lysine, which is usually lacking in the plant kingdom. It is also high in methionine and histidine, making it an excellent plant-based protein source.

The protein quality of quinoa is comparable to casein, the high-quality protein from dairy products. Quinoa does not contain gluten, and is therefore a suitable alternative for those who are sensitive or allergic to gluten ^[3]. The absence of gliadins (proteins present in wheat and gluten forming) and gliadin-related protein fractions (found in oats, barley, rye and malt) makes quinoa appropriate for the production of food products commonly referred as "gluten free", an important aspect that allows greater variety and supply of foods that are more

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Nutritious and suitable for patients with celiac disease [4]. Quinoa's exceptional amino acid richness confers it with very interesting therapeutic properties [5].

Carbohydrates

Quinoa grain is an amylaceous raw material that has high carbohydrate content, mainly consisting of starch and a small percentage of sugars. 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.

The glycemic index is a measure of how fast blood sugar levels rise after a meal, and it is known that high-glycemic foods are linked to obesity and various diseases. Quinoa has a relatively low glycemic index score of 53, which means that it should not cause a rapid spike in blood sugar after consumption. The diameter of quinoa starch granules is smaller than starch of the common grains. Small-granule starches exhibit a higher gelatinisation temperature, for quinoa this temperature range is 57–64 °C. Its excellent freeze–thaw stability makes it an ideal thickener in frozen foods and other applications where resistance to retrogradation is desired [6].

Vitamins and Minerals

Traditionally, vitamins have been among the most widely applied chemical agents to enhance the nutritional values of food products. The quinoa is found to be rich in α -carotene and niacin.

Quinoa contains appreciable amounts of thiamine (0.4 mg 100 g⁻¹), folic acid (78.1 mg 100 g⁻¹) and vitamin C (16.4 mg 100 g⁻¹). It is also rich in vitamin A, B₂ and E. The content of vitamin E in quinoa is important since this vitamin acts as an antioxidant at the cell membrane level, protecting the fatty acids of the cell membranes against damage caused by free radicals [7]. Quinoa is a good source of minerals providing more calcium, magnesium, iron, and zinc than many common grains [8].

Lipids

Oil content in quinoa ranges from 2% to 10% being rich in essential fatty acids such as linoleic and α -linolenic, and contains high concentrations of natural antioxidants such as α - and γ -tocopherol [3]. All fatty acids present in quinoa are well protected by the presence of vitamin E, which acts as a natural antioxidant [9].

Omega-6 stimulates inflammatory activity in the body, while omega-3 performs anti-inflammatory functions. A lower ratio of omega-6: omega-3 fatty acids are more desirable for reducing the risk of cardiovascular disease, cancer, and inflammatory and autoimmune diseases. The ratio between omega-6 and omega-3 in quinoa is about 6:1. Quinoa helps reduce LDL (or bad cholesterol) in the body and raise HDL (good cholesterol) due to its omega 3 and omega 6 content [2].

Dietary Fiber

Quinoa is an excellent source of dietary fiber, comprising about 2.6%-10% of the total weight of the grain; about 78% of its fiber content is insoluble and 22% soluble [10]. Dietary fiber has a number of beneficial effects related with its indigestibility in the small intestine. Therefore, the reported high content of quinoa fibers can improve digestibility by facilitating the absorption process of other nutrients present in quinoa in the large intestine [3]. Greater consumption of fiber-

rich whole grains is associated with a lower risk of type 2 diabetes and cardiovascular disease.

Quinoa as a Novel Food Ingredient

Quinoa is the most versatile of Andean grains for human consumption with great nutritional potential and protein quality due to the presence of essential amino acids, can be combined with legumes and cereals. It is usually boiled and consumed as a side dish, as breakfast porridge, added to salads, or used to thicken soups. It can be used as whole grain, raw or toasted flour, flakes, semolina and instant powder can be prepared in many different ways, producing a wide array of traditional and innovative recipes. Quinoa has a crunchy texture and nutty flavour [11]. Quinoa flour can also be used to prepare Noodles. Quinoa flour can be also drum-dried and extruded, providing products with good physical, sensorial, and nutritional qualities. The use of quinoa in the production of gluten-free flour confectionery is being explored.

Quinoa is an excellent example of functional food that aims at lowering the risk of various diseases. Quinoa flour may be a valuable and important ingredient in diets or food products, taking into consideration its nutritive value and potential promotion of human health.

Conclusion & Future Perspectives

Quinoa could be a strategic crop used to complement the diet in rural or marginal regions where energy-protein malnutrition affects most of the population of the developing countries. The use of pseudo cereals such a quinoa represents a promising area of research, as its use could improve the intake of certain macromolecules and phytochemicals that are known to be beneficial to human health. Owing to its nutritional characteristics, quinoa can be promoted as an extremely healthy food, a super grain of the future. As it offers an excellent nutritional quality and has a high commercial value, it is thought that more research is needed to increase individuals' awareness of this pseudo-grain's nutritional content and consumption, to reveal its nutritional benefits and to investigate its effects on health.

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