

A study on nutrient analysis and sensory evaluation on Quinoa Millet flour (*Chenopodium quinoa*) in developed recipes

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Abstract

Quinoa is a pseudocereal/millet which contains mainly starch and a small proportion of sugars. Quinoa is loaded with huge nutritional elements that do wonders for human body. It contains a large amount of fiber, vitamin B complex, Vitamin C and E and also minerals such as magnesium, calcium, potassium, manganese, zinc, copper, and sodium. Moreover, quinoa contains all the essential aminoacids, which is quite unique to cereals. So, if quinoa is incorporated in cereal or millet preparation, the essential amino acid content can be balanced. The present study aims at incorporation of quinoa flour to rice flour, ragi flour, and bajra flour and were incorporated at 5 to 20percent level in the standard recipes. Both nutrient analysis and sensory evaluation were done. The developed recipe were evaluated for using five point hedonic scale rating in selected subjects to assess or identify the appearance, colour, flavour and taste of the standard and Quinoa millet incorporated recipes. Among the formulated recipes, steamed food was accepted by the consumers when compared to other varieties, though the nutritive value of the entire nutrient was higher in quinoa incorporated steamed food.

Key words: Consumer acceptability, Nutrient analysis, Sensory evaluation, Standardization, Quinoa Millet Flour

INTRODUCTION

Quinoa (*Chenopodium quinoa*) is a plant belonging to the family Amaranthaceae, native to the Andean regions being adaptable to different types of soil and climatic conditions. Its composition has aroused the attention of the scientific community for its high nutritional value, being rich in proteins, unsaturated fats, dietary fiber, vitamins and minerals, with an extraordinary balance of essential amino acids. It is also characterized by being a gluten-free grain, that enables its use in the diet of celiac patients (Valencia-Chamorro, 2003).

The nutritional value of quinoa is another aspect invoked by FAO to promote its world cultivation and consumption. The presence of the 20 amino acids in quinoa seed, and twice the quantity of proteins than that of many cereals, in addition to minerals, vitamins, good quality oils and antioxidants, and good quality starch, make quinoa seed of high nutritional and functional value (Vega-Galvez et al., 2010).

The absence of gliadin 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 nutritious and suitable for patients with celiac disease (Galway, 1993).

Quinoa is also an excellent example of “functional food” which may help reduce the risk of various diseases. Its functional properties may be related to the presence of fibers, minerals, vitamins, fatty acids, antioxidants and phytonutrients, which contribute to human nutrition, especially in the protection of cell membranes, with proven results in improving neuronal functions. These characteristics provide the grain great advantage over other plant foods for human nutrition and health maintenance (Schlock and Bodenheimer, 1996). Coronary heart disease is a leading cause of death in most developed countries and is growing rapidly in developing countries. Appropriate diets that include fruits, vegetables and whole grains may contribute to cardiovascular protection. Among these foods, cereals and pseudo-cereals play an important role (Varli, 2016). Quinoa is rich in soluble dietary fiber, which makes it beneficial in non-communicable diseases like diabetes, cardiac disease, and obesity.

MATERIALS AND METHODS:

Selection of sample: Quinoa, Ragi flour, Rice flour, Bajra flour, jaggery, coconut, cardamom, were purchased from the local market at Thanjavur, Thanjavur, India.

Preparation of Quinoa millet powder:

Recipes were standardized by incorporating quinoa powder at 5 to 20 percent level incorporation. The



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grains were subjected to blanching by steeping the grain in boiling water at 98degrees Celsius for 30 seconds and drying at 50 degrees Celsius for one hour after which quinoa is made into a flour and utilized(Journal of Food Science and Technology, 2006).

Quinoa should be screened properly for infestations, size and shape of the grain, fungal and bacterial contamination and presence of other foreign substances. The first step is cleaning, where the product is cleaned without any contaminants such as seed, sticks, small stones and insects. Then the seeds are washed to remove mud and other impurities and is dried to remove the moisture and improve the shelf-life of the product. The cleaned quinoa millets are ground into a fine flour and sieved to remove contaminants and coarse substances. The sieved quinoa powder can be used for preparation of various food products.

Preparation of steamed food (kozhukattai) by the incorporation of quinoa powder:

Quinoa flour is incorporated at 5 to 20 percent level in standard recipes using ragi, rice, and bajra flour.

Standard: A standard *kozhukattai* was prepared using rice flour, which was used as the control for

Table 1. Ingredients and Procedure for the Standard Rice *Kozhukattai* Making

S. No.	INGREDIENT	QUANTITY
1	Rice flour	100 g
2	Jaggery	75 g
3	Coconut	15 g
4	Cardamom	5 g
5	Ghee	10 ml

comparison and variations were prepared which are tabulated (Table 1).

METHODS

The jaggery water was heated and when it starts boiling grated coconut and Cardamom powder were added. Then the heat was lowered and rice flour was added with one hand and stirred continuously to prevent formation of lumps. Once all the water has evaporated, a teaspoon full of ghee was added and cooked stirring now and then over low flame for 5-6 minutes. Then it was transferred to a plate. When it is warm, it was greased with a little ghee and made into oval shapes out of the mixture. The same process was repeated for the rest of the dough. Then steam cooking was done for 10-15 minutes. The same standard procedure was used in the preparation of other variants (Tables 2-4)

Table 2. Ingredients and Procedure for the Preparation of Quinoa Millet Powder incorporated Rice Flour *Kozhuoattai* (5 to 20 Percentage)

S. No.	INGREDIENTS	LEVEL OF INCORPORATED			
		5%	10%	15%	20%
1	Quinoa millet powder	5	10	15	20
2	Rice flour	95	90	85	85
3	Jaggery	75g	75g	75g	75g
4	Coconut	15g	15g	15g	15g
5	Cardamom	5g	5g	5g	5g
6	Ghee	10 ml	10 ml	10 ml	10 ml

Three samples of rice *kozhukattai* were developed by incorporation of quinoa millet powder at 5, 10, 15, 20 percent with normal rice flour *kozhukattai* making procedure.

Table 3. Ingredients and Procedure for the Preparation of Quinoa Millet Powder incorporated Ragi Flour *kozhuoattai* (5 to 20 Percentage).

S. No.	Ingredients	Level of Incorporation			
		5%	10%	15%	20%
1	Quinoa millet powder	5	10	15	20
2	Ragi flour	95	90	85	85
3	Jaggery	75g	75g	75g	75g
4	Coconut	15g	15g	15g	15g
5	Cardamom	5g	5g	5g	5g
6	Ghee	10ml	10ml	10 ml	10 ml

Three samples of ragi *kozhukattai* were developing by incorporation quinoa millet powder at 5, 10, 15,20 percent with normal ragi flour *kozhukattai* making procedure.

Table 4. Ingredients and Procedure for the Preparation of Quinoa Millet Powder incorporated Bajra Flour *Kozhuoattai* (5 - 20 Percentage).

S. No.	Ingredients	Level of Incorporation			
		5%	10%	15%	20%
1	Quinoa millet powder	5	10	15	20
2	Bajra flour	95	90	85	85
3	Jaggery	75g	75g	75g	75g
4	Coconut	15g	15g	15g	15g
5	Cardamom	5g	5g	5g	5g
6	Ghee	10 ml	10 ml	10 ml	10 ml

Three samples of Bajra *kozhukattai* were developed by incorporation of quinoa millet powder at 5, 10, 15, 20 percent with normal Bajra flour *kozhukattai* making procedure..

Assessing the consumer Acceptability of the standard and Quinoa millet powder incorporated recipes:

Sensory evaluation or sensory analysis is the process of evaluating consumer products, using the five senses. Consumer panels are organized to test a particular product before it hits store shelves using sensory evaluation. The results of these tests can determine whether or not a product will reach a consumer (Vijaya Kumar ,2006).A total number of 50 consumers were randomly selected to assess the appearance, color, taste, texture, and flavor of the Quinoa millet powder incorporated recipes. To assess the appearance, color, flavour, texture and taste a score card was provided with 5 point hedonic scale rating viz.,Excellent = 5; Very Good = 4; Good = 3; Fair = 2; Poor = 1. The consumers were given the standard and followed by test recipes along with control and assessment was conducted on the same day.

Estimation of nutrient content of the most acceptable Quinoa millet powder incorporated recipes:

The nutrient content of most acceptable Quinoa millet powder incorporated recipes and the standard was analyzed by standard procedures.

RESULTS AND DISCUSSION

The recipes like quinoa millet powder incorporated Rice flour *kozhukattai*, Ragi flour *kozhukattai*, Bajra flour *kozhukattai* were selected and the recipes were tested for quality, quantity, procedure, time, temperature, equipment and yield ie. ,standardization of recipes. Standardized recipes ensured high quality in food preparation. The use of exact amounts of the various ingredients produce accurate yield, prevents left overs and promotes food control.

Table 5. Methods of preparation and timings involved in the standardization of recipes through Incorporation

S.No.	Name of the Recipes	Methods of Preparation	Time in Minutes
1	Quinoa millet powder incorporated with Rice flour	Grinding, Mixing, Steaming	15Minutes
2	Quinoa millet powder incorporated with Ragi flour	Grinding, Mixing, Steaming	15Minutes
3	Quinoa millet powder incorporated with Bajra flour	Grinding, Mixing, Steaming	15Minutes

The steps involved in the preparation of of *kozhukattai* varieties were grinding, mixing, and steaming. The time taken for the preparation of *kozhukattai* were 15 minutes.

Table 6. Mean Score for overall acceptability of Quinoa Millet Powder incorporated Rice *Kozhukattai* (n=50).

S.No.	Level of Incorporation	Overall Acceptability
1	5Percent	15.9± 0.6940
2	10 Percent	14.52±0.8360
3	15 Percent	18.4 ±0.380
4	20 Percent	19.12± 13.7

The mean score of overall acceptability of 5%, 10%, 15%, and 20% Quinoa millet powder incorporated rice flour *kozhukattai* were 15.9±0.6940, 14.52±0.8360, 18.4±0.380 and 19.12±13.7 respectively.

Table 7. Mean Score for Overall Acceptability of Quinoa Millet Powder Incorporated Ragi *Kozhukattai*.

S.No.	Level of Incorporation	Overall Acceptability
1	5Percent	16.6 ± 1.02
2	10 Percent	12.11± 2.15
3	15 Percent	16.7 ± 0.9410
4	20 Percent	21.8 ± 0.5960

Table 7 reveals that the mean score of overall acceptability of Quinoa millet powder incorporated ragi flour *kozhukattai* at 5%, 10%, 15%, and 20% were 16.6±1.02,12.11±2.15,16.7±0.9410,and 21.8±0.5960, respectively. The 20 % Quinoa millet powder Incorporated ragi *kozhukattai* was most accepted and scored 21.8 ±0.5960..

Table 8. Mean Score for Overall Acceptability of Quinoa Millet Powder Incorporated Bajra *Kozhukattai*.

S.No.	Level of Incorporation	Overall Acceptability
1	5Percent	17.6± 0.354
2	10 Percent	17.8± 0.434
3	15 Percent	11.32± 2.06
4	20 Percent	20.6± 1.105

Table 8 reveals that the mean score of overall acceptability of Quinoa millet powder incorporated Bajra flour *kozhukattai* at 5%,10%,15%,and20% were 17.6± 0.354, 17.8± 0.434,11.32± 2.06, and 20.6± 1.105, respectively. The 20 % Quinoa millet incorporated *kozhukattai* was most accepted and scored was 20.6± 1.105.

Table 9 gives the nutrient content of the most acceptable Quinoa Millet Powder incorporated Bajra *Kozhukattai*.

Table 9. Nutrient Content of the Standard and most acceptable Quinoa Millet Powder incorporated Bajra Kozhukattai .

S. No.	Nutrients	Nutritive Value
1	Carbohydrate	31.36kcal
2	Protein	48.53g
3	Fat	1.20g
4	Fiber	12.41g
5	Iron	16.4
6	Phosphorus	22.14mg

The shelf life of Quinoa Millwt powdwer incorporated recipes are given in table 10.

The present study concludes that Quinoa millet powder incorporated recipes did not have any adverse effect on quality attributes viz., appearance, color,

Table 10. Shelf Life of the Quinoa Millet Powder incorporated Recipes.

S. No.	RECIPES	NUMBER OF DAYS	
		Room temperature	Refrigerator temperature
1	Rice kozhukattai	1day	2 days
2	Ragi kozhukattai	1 day	2 days
3	Bajra kozhukattai	1 day	2 days

flavour, texture and taste of the product. Quinoa millet was used in diet, because they do not have any nutritional awareness about Quinoa miller. By organoleptic evaluation Quinoa millet incorporated Bajra flour *kozhukattai* was highly accepted by the consumers compared to other selected recipes. The Quinoa millet powder incorporated recipes could be used for cancer, heart disease, weight loss, cough and other bacterial infectious disease and could cause positive effects on the levels of protein, fat, fiber, calcium, vitamin C, potassium, thiamine. Quinoa millet powder could be used to prepare new value added product to improve the nutritional status. Quinoa millet powder can be incorporated with varieties of food products. Awareness programs can be created to promote the nutritional value of Quinoa millet among the local people.

REFERENCES

Bazile, D. et.al., 2013. Quinoa in Chile. Chapter 5.4. In: FAO & CIRAD. State of the Art Report of Quinoa around the World in 2013. p401-421. Rome.

Chambers, E. and Wolf, 1996. Sensory Testing Methods, 2nd ed. ASTM

Cleary, L. and Brennan, C. 2006. The influence of (1'13) (1'14) à glucan rich fraction from barley on the physic-chemical properties and in vitro reducing sugars release of durum wheat pasta. *Int. J. Food Sci. Technol.* 41: 910-918.

Foote, C.S and Denny, R.W. 1968. Chemistry of singlet oxygen. VII. Quenching by à-carotene. *Am. Chem. Soc. J.*, 90: 6233-6235. [https://doi.org/10.1016/S0040-4039\(00\)70787-8](https://doi.org/10.1016/S0040-4039(00)70787-8)

Galwey N.W. 1993. The potential of quinoa as a multi-purpose crop for agricultural diversification: a review. *Industrial Crops and Products* 1: 101-106.

Kozio³, M.J. 1992. Chemical composition and nutritional evaluation of quinoa (*Chenopodium quinoa* Willd.) *J. Food Compos. Anal.* 5:35-68. doi: 10.1016/0889-1575(92)90006-6.

Nowak, V and Charrondièrè, U.R. 2015. Assessment of the nutritional composition of quinoa (*Chenopodium quinoa* Willd.) *Food Chem.* 193:47-54.

Ray, K.B. 2004. A Strategic Analysis for New Product Entry into the Nutraceuticals [sic], Functional Foods, and Vitamins and Supplements Markets. M.B.A. Dissertation, Simon Fraser University, British Columbia.

Reguera, María, Carlos Manuel Conesa, Alejandro Gil-Gómez, Claudia Mónica Haros³, Miguel Àngel Pérez-Casas, Vilbett Briones-Labarca, Luis Bolaños, Ildefonso Bonilla¹, Rodrigo Àlvarez, Katherine Pinto⁶, Àngel Mujica⁷ and Luisa Bascañán-Godoy. 2018. The impact of different agroecological conditions on the nutritional composition of quinoa seeds. *PeerJ* 6:e4442; DOI 10.7717/peerj.4442

Schlick, G and Bubenheim D.L. 1996. Quinoa: candidate crop for NASA's controlled ecological life support systems, p. 632-640. In: J. Janick (ed.), Progress in new crops. ASHS Press, Arlington, VA..

Tanwar, B. Ankit Goyal, Syed Irshaan, Vikas Kumar, Manvesh Kumar Sihag, Ami Patel, and Intelli Kaur., 2019. Quinoa; pp. 269-305. In: Whole Grains and Their Bioactives. Composition and Health. John Wiley & Sons, Ltd.; Chichester, UK.

Valencia-Chamorro, S. A. 2003. Quinoa In: Caballero B. Encyclopedia of Food Science and Nutrition, vol. 8. Academic Press, Masterdam. pp.4895-4902. [https://doi.org/10.1016/S0040-4039\(00\)70787-8](https://doi.org/10.1016/S0040-4039(00)70787-8)

Varli, S. N and Sanlier. N. 2016. Nutritional and health benefits of quinoa (*Chenopodium quinoa* Willd), *J. Cereal Sci.*, 69:371-376.

Vega-Galvez, A. Margarita Miranda, Judith Vergara, Elsa Uribe, Luis Puente, and Enrique A Martínez. 2010. Nutrition facts and functional potential of quinoa (*Chenodium quinoa* Willd.), an ancient Andean grain: a review. *J Sci Food Agric* . (15):2541-2547.

Vidueiros, S.M and Curti, R.N. 2015. Diversity and interrelationships in nutritional traits in cultivated quinoa (*Chenopodium quinoa* Willd.) from Northwest Argentina. *J. Cereal Sci.* ;62:87-93.