JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Effect on Physicochemical and Sensory properties of Bread supplemented with Quinoa flour

[1]Shweta Verma, [2]Sangeeta Shukla
[1]Research Scholar, [2]Assistant Professor
Warner College of dairy technology
Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj, UP, India-211007
Corresponding author:

Abstract:

Quinoa is a gluten-free grain that has been gaining popularity due to its high nutritional value. In this study, quinoa flour was used as a substitute for wheat flour in the preparation of bread. The aim of this study was to investigate the effect of quinoa flour on the chemical composition and sensory properties of bread. The bread samples were prepared by substituting wheat flour with quinoa flour at different levels (10%, 20%, 30%, 40% and 50%). The physico-chemical properties of the bread samples, including carbohydrate content, fat content, moisture content, protein content, fiber content, and texture, were evaluated. The results showed that bread made with quinoa flour had a higher protein, fat and fibre content compared to bread made with wheat flour. Sensory analysis showed that the bread made with quinoa flour had a slightly nutty flavour and a denser texture compared to bread made with wheat flour. The texture of the quinoa bread was slightly different from wheat bread, but the overall acceptability score was not significantly different. Overall, the use of quinoa flour in bread making is a promising alternative for people with celiac disease or those who are looking for a gluten-free option.

Key-words: Quinoa flour, bread, physico-chemical properties, carbohydrate, fat, protein, fiber, celiac disease, gluten sensitivity.

Introduction:

Bread is one of the oldest and most widely consumed food products in the world. It is usually made from wheat flour, which contains gluten, a protein that can cause an allergic reaction in people with celiac disease. As a result, there has been a growing demand for gluten-free products, and quinoa flour has emerged as a potential alternative to wheat flour. Quinoa is a gluten-free pseudo-cereal that is rich in protein, fibre, vitamins, and minerals, making it a popular choice for health-conscious consumers.

Traditional bread made from refined wheat flour has limited nutritional value, as it lacks essential nutrients such as protein, minerals, and vitamins (**Kaur et al., 2018**). The incorporation of quinoa flour into bread has been shown to improve the nutritional quality of bread. Quinoa flour is rich in protein, which is essential for growth and development, especially in children.

The addition of quinoa flour to bread can increase the protein content of bread and provide a more complete protein profile. A study conducted by **Navruz-Varli and Sanlier (2016)** found that the addition of quinoa flour to wheat flour significantly increased the protein content of bread, from 7.5% to 10.7%. This increase in protein content can be attributed to the high protein content of quinoa flour, which ranges from 12% to 18%.

In addition to protein, quinoa flour is also rich in fiber, minerals, and vitamins. The incorporation of quinoa flour into bread can increase the fiber content of bread and provide a source of essential minerals and vitamins. A study by **Repo-Carrasco-Valencia et al. (2010)** demonstrated that quinoa flour contains antioxidant compounds that can help to reduce the risk of chronic diseases such as cancer, diabetes, and cardiovascular disease. Another study by **Vega-Gálvez et al. (2010)** reported that quinoa flour has high levels of bioactive compounds, including flavonoids, which have been linked to a range of health benefits.

A study conducted by **Zeleke and Ambelu (2016)** found that the addition of quinoa flour to bread significantly increased the protein, iron, and zinc content of the bread, which are essential nutrients that are often lacking in the diets of people in developing countries.

The use of quinoa flour in breadmaking has also been shown to have potential health benefits. A study by **Alvarez-Jubete et al. (2010)** reported that the addition of quinoa flour to bread did not negatively affect the sensory properties of bread, indicating that quinoa fortified bread can be a palatable and acceptable food product

Quinoa is a nutrient-dense grain that has gained popularity in recent years due to its health benefits. It is high in protein, fiber, vitamins, and minerals, and is a gluten-free alternative to traditional grains. Incorporating quinoa into bread can increase the nutritional value of the product, potentially improving the health outcomes of consumers. Quinoa, unlike wheat, rye, barley, does not contain gluten thus can serve as is important alternative to traditional cereals, for people suffering from Celiac disease.

In this study, we aimed to investigate the preparation and chemical composition of bread using quinoa flour. Specifically, we sought to determine the effect of quinoa flour on the protein, fibre, and glycaemic index of bread, as well as the sensory properties of the final product.

Materials and Methods:

Quinoa flour was obtained from a local supplier, and wheat flour was used as a control. Bread was prepared using a standard recipe, with the exception of the type of flour used. The dough was prepared by mixing the flour with water, yeast, sugar, and salt. The dough was allowed to rise for 1 hour and then baked in an oven at 180°C for 30 minutes. The bread was allowed to cool to room temperature before analysis.

Preparation of bread using wheat flour and quinoa flour- the bread formulation using quinoa flour & wheat flour in different proportions are given in Table-1. Wheat flour blended with 0% (control), 10%, 20%, 30%,

40% and 50% were used for making the bread. Other ingredients used are Refined Flour, Brown sugar, Whole wheat bran, Yeast, Salt, Gluten, Baby oats.

Table 1: Formulation of Bread.

	Treatments (%)					
Ingredients	Control (T_0)	T_1	T_2	T_3	T_4	T_5
Wheat flour	100	90	80	70	60	50
Quinoa	0	10	20	30	40	50

Preparation of Bread:

The blends of composite flour were baked inti bread using the modified methods of (Olaoye,2006). The wheat flour and composite flour were mixed with 5g salt, 10g yeast. 7g sugar in 250 ml water followed by manual mixing for 5 min to obtain dough. The dough was kneaded for some minutes. The kneaded dough was transferred into the baking pans greased with plasticized fat and covered with basins. The dough was allowed to ferment for 35 mins at room temperature in the baking pans. The fermented dough was then allowed to undergo proofing for 25 mins at relative humidity.

Chemical Analysis:

The bread samples were analysed for protein, carbohydrate, fat, moisture, total solid and fibre. Protein content was determined using Lowry's method. The Lowry's reaction for protein estimation is an extension of the Biuret Method. The method developed by Lowry et al. (1951) is about 10 times more sensitive than the Biuret method. Hence, it is largely followed to determine the protein content of enzyme extracts. Fibre content was determined using the AOAC method, which involves enzymatic digestion and gravimetric analysis. Total solids are measured by weighing the amount of solids present in a known volume of sample. This is done by weighing a beaker, filling it with a known volume, evaporating the water in an oven and completely drying the residue, and then weighing the beaker with the residue.

Fat content is determined using solvent extraction techniques. These are one of the most commonly used methods of isolating lipids from foods and of determining the total lipid content of foods.

Total carbohydrate content of a food can be determined by difference method which was calculated by subtracting the sum of percentage of protein, fat, ash and moisture.

Moisture (%) estimation by Hot Air Oven method (AACC, 2005)

Sensory Analysis:

Sensory quality characteristics were assessed for bread with quinoa. The liking or disliking of the bread was tested using the "nine-point Hedonic scale" method. The acceptability of the noodles was evaluated using

the 'score card method'. The sensory assessment was assessed by a panel of members using Amerine method.

Statistical analysis:

Mean value and standard deviation (SD) values are used to tabulate result. The method of Two Factor ANOVA (Analysis of variance) was used to examine all the data. The calculation has been done by using the mean of five replicates.

Results & Discussion:

Proximate Analysis of Bread:

Table 2: Physicochemical Properties of 'Bread supplemented with Quinoa Flour'

Parameters		Carbohydrates (%).	Fat (%).	Protein (%).	Ash (%)	Moisture (%)	Crude fiber (%)
Treatments	T_0	73.38	0.82	10.08	0.85	14.87	0.48
	T_1	71.74	1.16	11.01	1.27	14.82	0.87
	T_2	69.70	1.52	11.86	1.82	15.1	1.32
	T_3	68.08	1.78	12.77	2.35	15.02	1.79
	T_4	66.70	2	13.77	2.73	14.8	2.29
	T_5	66.58	1.87	13.78	2.74	15.05	2.35

The results showed that bread made with 50% quinoa flour had significantly higher protein content (13.78%) and fibre content (2.35%) compared to bread made with wheat flour (10.08% protein and 0.48% fibre). The fat content was also higher in quinoa fortified bread (1.87%) as compared to bread made with wheat (0.82%). Carbohydrate content is significantly lower in quinoa fortified bread (66.58%) than wheat bread (73.38%).

Sensory Analysis of Bread:

In sensory parameters Flavor and taste, Body and texture Color and appearance the response of sample T4 (Wheat Flour-60% & Quinoa flour- 40%) is the best. Thus, overall acceptability of T4 sample is the highest and substitution of quinoa flour up to 40% in preparation bread has the best sensory attributes.

Table 3: Sensory Properties of 'Bread supplemented with Quinoa Flour'

Parameters		Flavor and taste	Body and texture	Color and appearance	Overall acceptability
Treatments	T_0	6.4	6.6	6.6	7.2
	T_1	7.6	7	7.4	7.6
	T_2	7.4	7.4	7.8	7.8

	T_3	8	7.8	8	8.2
	T_4	8.6	8.8	8.8	8.6
	T_5	8.2	8.4	8.6	8.4

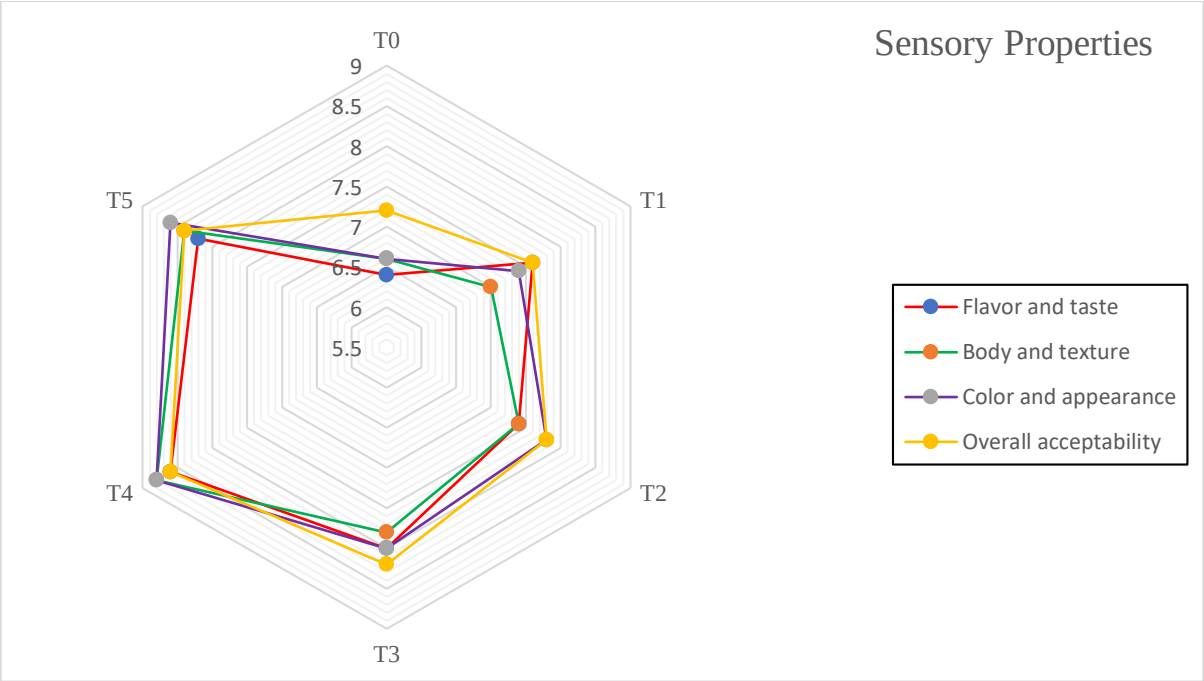

Fig-1

The sensory analysis showed that the quinoa bread had a slightly nutty flavor and a denser texture compared to wheat bread. While this may be less appealing to some consumers, the overall acceptability score of the quinoa bread was even slightly better than the wheat bread. This suggests that quinoa fortified bread could be a viable alternative for people with celiac disease or those who are looking for a gluten-free option.

The results of this study demonstrate that quinoa flour can be used as a substitute for wheat flour in the preparation of bread. The higher protein and fibre content of the quinoa bread make it a more nutritious option than wheat bread. Additionally, the lower glycaemic index of the quinoa bread is beneficial for people with diabetes, as it can help regulate blood glucose levels.

Conclusion:

In conclusion, this study provides evidence that quinoa flour can be used as a substitute for wheat flour in the preparation of bread. The higher protein and fibre content of the quinoa bread make it a more nutritious option than wheat bread, while the lower glycaemic index is beneficial for people with diabetes. While the quinoa bread had a slightly different texture and flavor compared to wheat bread, the overall acceptability score was not significantly different and it is improving with substitution of wheat flour with quinoa flour upto 40% quinoa flour. This suggests that quinoa fortified bread with 40% quinoa flour and 60% wheat flour has the highest sensory properties and optimum level of nutritional attributes. Hence quinoa fortified bread could be a viable alternative for people with celiac disease or those who are looking for a gluten-free

option. Further research is needed to confirm these findings and to explore the potential of quinoa flour in other baked goods.

There are some limitations to this study that should be acknowledged. Firstly, the sample size was relatively small, and the study was conducted under controlled laboratory conditions. Further studies are needed to confirm the results in a larger and more diverse population, as well as under different baking conditions and with different types of quinoa flour.

References:

1. **Alvarez-Jubete, L., Wijngaard, H., Arendt, E.K., and Gallagher, E. (2010)**. Polyphenol composition and in vitro antioxidant activity of amaranth, quinoa, and buckwheat flours and their antioxidant capacity in a model bread. *Food Chemistry*, 119(3), 770-778.

2. **De Carvalho, F.G., Fernandes, C.L., Da Silva, L.F.M., Da Silva, M.A.A.P., De Oliveira, F.A.R., and De Souza, E.L. (2019).** Nutritional properties, bioactive compounds and technological aspects of quinoa flour in bread making. *Journal of Food Science and Technology*, 56(9), 3933-3943.

3. **Ficco, D.B.M., De Simone, V., Giovanniello, V., Colecchia, S.A., De Leonardis, A.M., Del Nobile, M.A., and Padalino, L. (2018).** Quinoa (Chenopodium quinoa Willd.) flour in bread making: functional properties and effect on sensory quality. Foods, 7(12), 194.

4. **Gazzola, J., Macedo, A., and Macedo, G.A. (2014).** Influence of quinoa flour on textural and sensory properties of gluten-free breads. *Journal of Food Science and Technology*, 51(12), 4094-4099.

5. **Kaur, M., Sandhu, K. S., & Arora, A. (2018).** Nutritional composition, processing, and utilization of wheat: a review. *Journal of food science and technology*, 55(3), 1039-1053.

6. **Miranda, M.Z., Vega-Gálvez, A., Quispe-Fuentes, I., and Martínez, E.A. (2013).** Nutritional and antioxidant properties of quinoa flour and its effect on the sensory acceptability of bread. *Journal of Food Quality*, 36(5), 311-320.

7. **Miranda-Zamora, R., Fernandez-Lopez, J., Munoz, I.B., and Aguirre-Joya, J.A. (2019).** Nutritional and functional properties of quinoa flour in bread making. *LWT-Food Science and Technology*, 100, 33-39.

8. **Navruz-Varli, S., & Sanlier, N. (2016).** Nutritional and health benefits of quinoa (Chenopodium quinoa Willd.): a review. *Journal of Cereal Science*, 69, 371-376. https://doi.org/10.1016/j.jcs.2016.03.012

9. **Olaoye O. A, Onilude A. A and Idowu O. A. (2006).** Quality characteristics of bread produced from composite flours of wheat, plantain and soybeans. African Journal of Biotechnology, 5: 1102-1106.

10. **Ranhotra, G.S., Gelroth, J.A., and Glaser, B.K. (1993)**. Nutritional evaluation of quinoa (Chenopodium quinoa) flour. Plant Foods for Human Nutrition, 43(1), 47-57.

11. **Repo-Carrasco-Valencia, R. A., Acevedo de la Cruz, A., & Quinoa Research Network. (2010).** Quinoa (Chenopodium quinoa Willd.): composition, chemistry, nutritional, and functional properties. *Advances in Food and Nutrition Research*, 58, 1-31. https://doi.org/10.1016/S1043-4526(09)58001-1

12. **Tang, Y., and Zhang, B. (2017).** Quinoa flour in bread making: a review. *Journal of Cereal Science*, 75, 255-261.

13. **Todorov, N.A., Ivanova, S.G., and Denkova-Kostova, R. (2013)**. Nutritional composition of quinoa (Chenopodium quinoa Willd.) seeds, cultivated in Bulgaria. *Journal of Food Composition and Analysis*, 31(2), 199-203.

14. USDA. (2022). Basic Report: 20137, Quinoa, cooked. Available at: https://fdc.nal.usda.gov/fdc-app.html#/food-details/168315/nutrients. Accessed on April 30, 2023.

15. **Vega-Gálvez, A., Miranda, M., Vergara, J., Uribe, E., Puente, L., & Martínez, E. A. (2010)**. Nutrition facts and functional potential of quinoa (Chenopodium quinoa willd.), an ancient Andean grain: a review. Journal of the Science of Food and Agriculture, 90(15), 2541-2547.

16. **Zeleke, E., & Ambelu, A. (2016).** Evaluation of nutritional quality of bread made from blends of wheat flour and quinoa flour. Food Science & Nutrition, 4(2), 338-344. https://doi.org/10.1002/fsn3.310