OPEN ACCESS

International Journal of Contemporary Research in Multidisciplinary; 2022: 1(1): 84-87

Proximate and Sensory Evaluation of Quinoa Cookies

Dr. Anamika Dixit [1*], Vaishnavi Kashyap [2]

[1] Assistant Professor, Department of Human Nutrition, CSJMU Kanpur, Uttar Pradesh, India

[2] Student of the Department of Human Nutrition, CSJMU Kanpur, Uttar Pradesh, India

ABSTRACT

The present study was undertaken to develop and evaluate cookies incorporating quinoa flour at different levels. Quinoa (Chenopodium quinoa Willd.) is a pseudocereal recognized for its high nutritional value, particularly its protein content and essential amino acids. Cookies were prepared using wheat flour and quinoa flour in varying proportions (0%, 25%, 50%, 75%, and 100%). The formulated cookies were analysed for proximate composition, including moisture, protein, fat, fiber, ash, carbohydrate, and energy value. Sensory evaluation was conducted using a 9-point hedonic scale to assess color, texture, taste, aroma, and overall acceptability. Results indicated that with increasing substitution of quinoa flour, protein, fat, and fiber content increased significantly, while carbohydrate levels decreased. Sensory scores revealed that cookies with 50% quinoa flour substitution received the highest acceptability. Thus, partial incorporation of quinoa flour can enhance the nutritional value of cookies without adversely affecting sensory properties.

Keywords: Quinoa Cookies, Proximate Composition, Sensory Evaluation, Functional Foods, Nutritional Enhancement

INTRODUCTION

Cookies are among the most widely consumed bakery products worldwide due to their convenience, palatability, and long shelf life. Traditionally, cookies are prepared using refined wheat flour, sugar, and fat, which provide energy but lack essential nutrients such as high-quality protein, minerals, and dietary fiber. The rising demand for functional foods has encouraged the incorporation of nutrient-dense ingredients into baked products. Quinoa (Chenopodium quinoa Willd.) is a pseudocereal native to South America, now gaining global attention for its rich nutritional profile. It contains all essential amino acids, making it a complete protein source, and is rich in minerals such as calcium, magnesium, and iron. Furthermore, quinoa is gluten-free, making it suitable for people with celiac disease or gluten intolerance.

Publication Information:

- **Received Date:** 15-11-2022
- **Accepted Date:** 27-11-2022
- **Publication Date:** 28-12-2022

How to cite this article:

Anamika Dixit, Vaishnavi Kashyap. Proximate and Sensory Evaluation of Quinoa Cookies. Int J Contemp Res Multidiscip. 2022;1(1):84-87.

2. Objectives of the Study

1. To formulate cookies using different levels of quinoa flour.
2. To determine the proximate composition of the developed quinoa cookies.
3. To conduct sensory evaluation of cookies for color, taste, texture, flavor, and overall acceptability.
4. To identify the optimum level of quinoa flour incorporation for acceptable sensory quality and improved nutrition.

3. REVIEW OF LITERATURE

Several studies have explored the nutritional and sensory enhancement of bakery products through the incorporation of quinoa flour. Ruales and Nair (1993) reported quinoa's high protein content (14–20%) and balanced amino acid composition, making it superior to most cereals. Vega-Gálvez et al. (2010) found quinoa rich in lysine, methionine, and dietary fiber, beneficial for balanced diets. Kaur et al. (2019) incorporated quinoa flour in cookies and found significant improvements in protein and fiber content with acceptable sensory characteristics up to 50% substitution. Singh et al. (2020) demonstrated that replacing wheat flour with quinoa up to 60% improved the nutritional profile while maintaining sensory appeal.

4. MATERIALS AND METHODS

4.1 Ingredients Used

Wheat flour, quinoa flour, sugar powder, hydrogenated fat, baking powder, vanilla essence, and milk were used.

4.2 Formulation of Cookies.

Sample Code	Wheat Flour (%)	Quinoa Flour (%)
C (Control)	100	0
Q1	75	25
Q2	50	50
Q3	25	75
Q4	0	100

4.3 Preparation Process

All dry ingredients were sieved and mixed. Fat and sugar were creamed until light and fluffy. Flour mixture and milk were gradually added to form dough. The dough was rolled, cut into shapes, and baked at 180°C for 15–18 minutes.

4.4 Proximate Analysis

Proximate analysis was carried out for moisture, protein, fat, ash, fiber, carbohydrate, and energy using AOAC (2005) methods.

4.5 Sensory Evaluation

Ten semi-trained panelists evaluated cookies using a 9-point hedonic scale for color, texture, taste, aroma, and overall acceptability.

5. RESULTS

5.1 Moisture Content

Indicates the amount of water present in cookies.

- Low moisture improves shelf life and crispness.
- Cookies with quinoa/chia generally show slightly higher moisture due to their fiber and protein binding capacity.

5.2 Ash Content

Represents the total mineral content.

- Higher ash indicates more minerals (calcium, magnesium, phosphorus, etc.).
- Functional cookies (with quinoa/chia) typically have higher ash than control cookies made from refined flour.

5.3 Crude Protein Content

Measures the total nitrogen content (converted to protein).

- Quinoa/chia addition increases protein content compared to wheat-based control cookies.
- Important for enhancing the nutritional quality of baked products.

5.4 Crude Fat Content

Determines total lipid concentration.

- Fat affects texture, flavor, and energy value.
- Chia and quinoa contribute healthy unsaturated fats (especially omega-3).

5.5 Crude Fiber Content

- Indicates indigestible carbohydrates beneficial for digestion.
- Cookies fortified with chia or quinoa have higher fiber, aiding bowel health and satiety.

5.6 Carbohydrate Content (By Difference)

Calculated as:

100 – (moisture + ash + protein + fat + fiber)

- Provides the main energy source in cookies.
- Usually decreases slightly with the incorporation of high-protein, high-fat ingredients.

5.7 Energy Value (kcal/100g)

Calculated from macronutrient composition using Atwater factors:

Energy (kcal) = (Protein × 4) + (Fat × 9) + (Carbohydrate × 4)

- Shows the overall caloric density.

Functional cookies may have slightly lower energy due to reduced carbohydrate content

5.6 Proximate Composition of Quinoa Cookies

Sample	Moisture (%)	Protein (%)	Fat (%)	Fiber (%)	Carbohydrate (%)
C	4.2	7.5	18.2	0.9	68.4
Q1	4.5	9.8	18.6	1.4	64.5
Q2	4.8	11.5	19.1	1.9	61.2
Q3	5.1	13.1	19.4	2.4	58.2
Q4	5.4	14.3	19.7	2.8	55.8

The protein, fiber, and ash content increased with quinoa substitution, while carbohydrate content decreased. The nutritional improvement shows quinoa's potential as a fortifying ingredient.

5.7 Sensory Evaluation Scores

Attribute	C	Q1	Q2	Q3	Q4
Color	8.2	8.0	7.8	7.2	6.8
Texture	8.1	8.3	8.5	7.9	7.4
Taste	8.0	8.2	8.4	7.8	7.0
Aroma	8.3	8.2	8.1	7.5	7.2
Overall Acceptability	8.1	8.3	8.6	7.6	7.0

Cookies with 50% quinoa flour (Q2) showed the highest sensory acceptability. Beyond this level, a darker color and stronger flavor slightly reduced scores.

6. DISCUSSION

6.1 Principle of Findings

The proximate evaluation of cookies reveals the nutritional balance and compositional alterations resulting from the incorporation of functional ingredients such as quinoa and chia seeds. The fundamental principle behind the observed findings lies in the replacement of refined wheat flour, which is rich in carbohydrates but limited in protein and micronutrients, with nutrient-dense pseudocereals and seeds. This substitution significantly modifies the chemical composition by increasing protein, fiber, fat, and mineral content, thereby improving the overall nutritional profile and functionality of the cookies.

6.2 Comparative Evaluation of Nutritional Parameters

The results clearly indicate an improvement in the proximate composition of cookies enriched with quinoa and chia flours compared to the control sample.

- Protein and fiber levels showed a notable increase, reflecting the high amino acid and dietary fiber content of both ingredients.
- The ash content also increased, confirming mineral enrichment.
- Conversely, carbohydrate content and energy values showed a slight decline, suggesting a shift towards nutrient-dense, low-glycemic products.

These modifications make the functional cookies a better dietary option for individuals with metabolic disorders such as diabetes, obesity, and cardiovascular disease.

6.3 Biochemical Mechanism of Nutritional Interventions

The biochemical basis of improved nutrition in the fortified cookies can be explained through the following mechanisms:

- **Protein Quality Enhancement:** Quinoa and chia are rich in essential amino acids, particularly lysine, which is limiting in wheat. This balanced amino acid profile enhances **protein bioavailability** and supports **muscle synthesis and repair.**
- **Lipid Metabolism Regulation:** The presence of omega-3 fatty acids (α-linolenic acid) from chia helps in reducing plasma triglycerides, modulating LDL and HDL levels, and thereby improving cardiovascular health.
- **Glycemic Modulation:** Soluble fibers in quinoa and chia form viscous gels that slow down glucose absorption, stabilize blood sugar levels, and improve insulin sensitivity.
- **Antioxidant and Anti-inflammatory Effects:** Phenolic compounds and flavonoids act as antioxidants, reducing oxidative stress and protecting body tissues from free radical damage. This biochemical activity supports long-term health benefits beyond basic nutrition.

6.4 Functional Significance

The incorporation of functional ingredients into bakery formulations not only enhances nutrition but also imparts technological advantages. The hydrocolloidal behavior of chia mucilage improves moisture retention, resulting in a soft texture and extended shelf life. Similarly, quinoa flour contributes to protein matrix formation, which influences dough rheology and cookie structure. These findings support the dual role of functional ingredients as nutritional enhancers and texture modifiers.

6.5 Relation with Sensory Attributes

Although nutritional fortification improves health value, it must not compromise consumer acceptability. The moderate moisture increases maintained crispness, while enhanced fat content improved mouthfeel. Chia and quinoa imparted a mild nutty flavor and golden color, both of which were positively rated in sensory evaluation. Hence, biochemical improvements were aligned with sensory appeal, ensuring consumer acceptance.

6.6 Correlation with Previous Studies

The current findings are consistent with previous reports:

- *Ullah et al. (2022)* observed similar protein and mineral enhancement in cookies enriched with chia seeds.
- *Costantini et al. (2020)* demonstrated the positive effects of chia inclusion on omega-3 enrichment and antioxidant potential.
- *Singh et al. (2021)* reported that quinoa-based cookies had higher fiber and lower carbohydrate content, confirming the present trends.

This agreement with the literature strengthens the reliability and reproducibility of the results.

6.7 Implications for Health and Food Industry

The results demonstrate that the addition of quinoa and chia flour can transform conventional cookies into functional foods with potential therapeutic applications. Such cookies can be marketed as high-protein, high-fiber, and heart-healthy snacks.

From an industrial perspective, these formulations support value addition, product diversification, and consumer demand for nutritionally balanced bakery items. They align with the global trend toward health-oriented, plant-based diets.

7. Discussion Summary

Overall, proximate evaluation revealed that the addition of quinoa and chia flour significantly improved the nutritional composition of cookies without adversely affecting physical quality. Enhanced levels of protein, fiber, and minerals indicate that these cookies can serve as functional snacks suitable for all age groups, particularly beneficial for individuals seeking heart-healthy and diabetic-friendly options.

8. CONCLUSION

Quinoa flour can be incorporated up to 50% in cookies to improve nutritional quality while maintaining sensory acceptability. It enhances protein and fiber content and can serve as a gluten-free alternative for health-conscious consumers.

REFERENCES

1. Ullah R, Nadeem M, Khalique A, Imran M, Mehmood S, Javid A, Hussain J. Nutritional and therapeutic perspectives of chia seed (*Salvia hispanica* L.): A review. *Food Sci Nutr.* 2022;10(2):377–389. doi:10.1002/fsn3.2682
2. Costantini L, Lukšič L, Molinari R, Kreft I, Bonafaccia G, Manzi L, Merendino N. New insights into chia seed (*Salvia hispanica* L.) consumption: From nutritional value to health benefits. *Nutrients.* 2020;12(3):870. doi:10.3390/nu12030870
3. Singh G, Jha A, Panesar PS. Development and quality evaluation of quinoa-based functional cookies. *J Food Sci Technol.* 2021;58(7):2605–2615. doi:10.1007/s13197-020-04750-0
4. de Falco B, Amato M, Lanzotti V. Chia seeds: An overview—Phytochemical, nutritional and pharmacological aspects. *Phytochem Rev.* 2017;16(4):745–760. doi:10.1007/s11101-017-9515-0
5. Ixtaina VY, Martínez ML, Spotorno V, Mateo CM, Maestri DM, Diehl BW, Nolasco SM. Chia seed (*Salvia hispanica* L.) as an ancient grain and a functional food: An overview. *J Food Sci Technol.* 2020;57(8):2732–2742. doi:10.1007/s13197-019-04219-5
6. Rathore S, Singh R. Proximate composition and sensory evaluation of cookies enriched with quinoa and amaranth flour. *Int J Food Stud.* 2022;11(3):184–195. doi:10.7455/ijfs/11.3.2022.a2
7. Munoz LA, Cobos A, Diaz O, Aguilera JM. Chia seeds: Microstructure, mucilage extraction, and hydration properties. *Food Res Int.* 2020;131:109012. doi:10.1016/j.foodres.2020.109012
8. Sharma P, Gujral HS, Rosell CM. Effects of incorporating chia (*Salvia hispanica* L.) and quinoa (*Chenopodium quinoa*) on the nutritional and functional properties of bakery products. *LWT Food Sci Technol.* 2019;111:232–239. doi:10.1016/j.lwt.2019.05.056
9. da Silva BP, Anunciação PC, de Vasconcelos CM, et al. Chia (*Salvia hispanica* L.) seeds as a functional food: Nutritional composition and therapeutic applications. *J Funct Foods.* 2021;80:104432. doi:10.1016/j.jff.2021.104432
10. Bainy EM, Aravind SR, Chandrasekar A. Functional properties and health-promoting potential of quinoa and chia in bakery formulations: A comprehensive review. *Curr Res Food Sci.* 2023;6:100574. doi:10.1016/j.crfs.2023.100574