



# Physicochemical, Nutritional, and Sensory Evaluation of Wheat Biscuits Fortified with Chia (*Salvia hispanica* L.) Seed Flour

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Abstract

This study was conducted to evaluate the physicochemical, nutritional, and sensory properties of wheat biscuits fortified with chia (*Salvia hispanica* L.) seed flour at different substitution levels (0%, 5%, 10%, 15%, and 20%). Biscuits were prepared using the creaming method, and the prepared samples were analyzed for physicochemical properties such as moisture content, ash content, diameter, thickness, and spread ratio. Nutritional analysis was carried out to determine protein, fat, crude fiber, carbohydrate, mineral content, total phenolic content, and antioxidant activity. Sensory evaluation was conducted using a 9-point hedonic scale to assess color, texture, taste, flavor, and overall acceptability. The results showed that moisture, ash, protein, fat, crude fiber, calcium, iron, total phenolic content, and antioxidant activity increased with increasing levels of chia flour incorporation, while carbohydrate content and spread ratio decreased. Sensory evaluation indicated that biscuits containing 10% chia flour had the highest overall acceptability. Therefore, chia seed flour can be successfully incorporated up to 10% level to produce nutritionally enriched biscuits with acceptable sensory quality and improved functional properties.

**Keywords:** *Chia Seed Flour, Wheat Biscuits, Fortification, Nutritional Analysis, Sensory Evaluation.*



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## 1. Introduction

Biscuits are one of the most widely consumed bakery products due to their low cost, convenience, ready-to-eat nature, and long shelf life. They are popular among people of all age groups and are commonly used as snack foods. Biscuits are generally prepared from wheat flour, sugar, fat, and leavening agents, and they serve as a good source of energy due to their high

carbohydrate and fat content. However, conventional wheat biscuits are nutritionally limited, particularly in dietary fiber, minerals, and functional components, which has led to increased interest in the development of nutritionally enriched bakery products (Singh et al., 2010; Makpoul & Ibrahim, 2015).

In recent years, there has been growing interest in functional foods that provide health

benefits beyond basic nutrition. Functional ingredients such as chia seeds, quinoa, oats, and soy have been incorporated into bakery products to improve their nutritional and functional properties. These ingredients are rich in dietary fiber, protein, antioxidants, and minerals, which help in reducing the risk of chronic diseases and improving overall health (Pang et al., 2012).

Chia seeds (*Salvia hispanica L.*) are considered a highly nutritious functional food due to their high content of omega-3 fatty acids, dietary fiber, protein, antioxidants, vitamins, and minerals such as calcium and iron. Chia seeds contain approximately 30–40% oil, 15–25% protein, and 18–30% dietary fiber, making them an excellent ingredient for food fortification (Ixtaina et al., 2008). In addition, chia seeds contain phenolic compounds and antioxidants that contribute to their functional properties and health benefits (Mesias et al., 2016).

Several researchers have reported that the incorporation of chia seed flour into bakery products such as bread, cookies, and biscuits improves their nutritional quality, antioxidant activity, and mineral content. However, the addition of chia flour may also affect the physicochemical and sensory properties of baked products, including texture, color, spread ratio, and taste. Therefore, it is important to determine the optimum level of chia flour incorporation to maintain product acceptability (Goyat et al., 2018; Yalcin et al., 2023).

Although previous studies have reported the use of chia seed flour in bakery products, limited studies have focused on the combined evaluation of physicochemical, nutritional, and sensory properties of wheat biscuits fortified with chia seed flour. Therefore, the present study was undertaken to develop wheat biscuits fortified with chia seed flour and to evaluate their physicochemical, nutritional, and sensory properties in order to determine the optimum level of chia seed flour incorporation for the development of nutritionally enriched and acceptable biscuits.

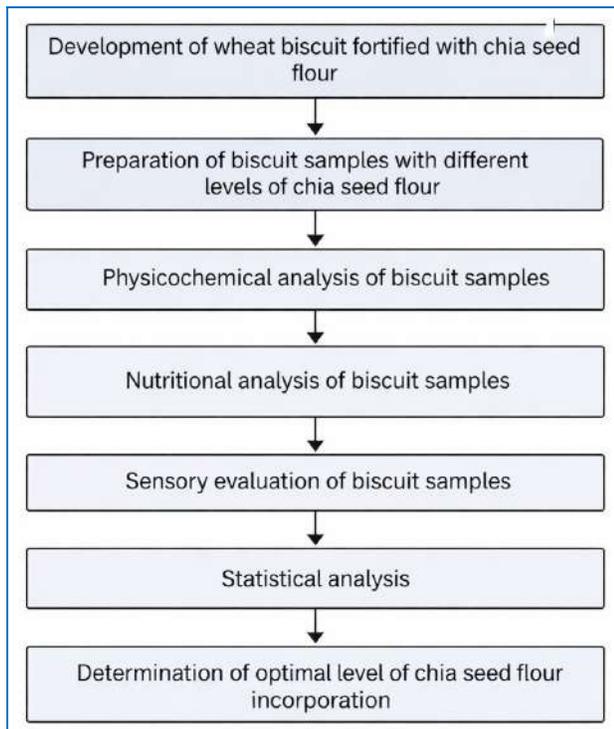
**Table 1:** Nutritional Composition of Wheat Flour and Chia Seed Flour (per 100 g) – From Literature

Component	Wheat Flour	Chia Seed Flour
Moisture (%)	12.0	6.0
Protein (%)	10–12	16–25
Fat (%)	1.5–2.0	30–34
Ash (%)	0.5–0.7	4–5
Crude Fiber (%)	0.5–1.0	18–30
Carbohydrate (%)	70–75	26–41
Energy (kcal)	340	486
Calcium (mg)	15–30	500–650
Iron (mg)	3–4	6–8
Omega-3 Fatty Acid	Very low	Very high

Source: Ixtaina et al. (2008); Romankiewicz et al. (2017); Goyat et al. (2018)



**Figure 1:** Chia seeds (*Salvia hispanica L.*)



**Figure 2:** Research flow chart

## 2. Statement of the Problem

Biscuits are widely consumed bakery products due to their convenience, affordability, and long shelf life. However, conventional wheat biscuits are mainly rich in carbohydrates and fats but low in dietary fiber, essential minerals, and functional nutrients. The increasing consumption of low-fiber and high-calorie snack foods has been associated with various health problems such as obesity, cardiovascular diseases, and diabetes. Therefore, there is a growing need to develop nutritionally enriched bakery products that can provide additional health benefits along with basic nutrition (Pang et al., 2012).

Chia seeds (*Salvia hispanica L.*) are considered a nutrient-dense functional food due to their high content of omega-3 fatty acids, dietary fiber, protein, antioxidants, and minerals such as calcium and iron. The incorporation of chia seed flour into bakery products has been reported to improve nutritional value, antioxidant properties, and mineral content of baked products (Ixtaina et al., 2008; Mesias et al., 2016). However, the addition of chia seed flour may also influence the physicochemical properties of biscuits such as moisture content, spread ratio, diameter, and thickness, as well as sensory characteristics such as color, taste, texture, and overall acceptability (Goyat et al., 2018; Yalcin et al., 2023).

Although several studies have been conducted on chia-fortified bakery products, there is still a need to determine the appropriate level of chia seed flour incorporation in wheat biscuits that can improve nutritional quality without adversely affecting physicochemical and sensory properties. In addition, limited research is available on the combined evaluation of physicochemical, nutritional, and sensory properties of wheat biscuits fortified with chia seed flour.

Therefore, this study was undertaken to develop wheat biscuits fortified with chia seed flour and to evaluate their physicochemical, nutritional, and sensory properties in order to determine the optimum level of chia seed flour incorporation for the production of nutritionally enriched and acceptable biscuits.

## 3. Research Questions

- RQ1: What are the effects of chia seed flour incorporation on the physicochemical properties of wheat biscuits?
- RQ2: How does chia seed flour fortification affect the nutritional composition of wheat biscuits?
- RQ3: What is the impact of chia seed flour on the sensory characteristics and overall acceptability of wheat biscuits?
- RQ4: What is the optimum substitution level of chia seed flour for the development of acceptable wheat biscuits?

## 4. Objectives of the Study

- To prepare chia seed flour and incorporate it into wheat flour at different substitution levels for biscuit production.
- To determine the physicochemical properties of wheat biscuits fortified with chia seed flour.
- To analyze the nutritional composition of chia seed flour incorporated wheat biscuits.
- To evaluate the sensory characteristics and overall acceptability of chia-fortified wheat biscuits.
- To determine the optimum level of chia seed flour incorporation for the development of nutritionally enriched and acceptable wheat biscuits.

## 5. Literature Review

### 5.1 Biscuits and Their Nutritional Importance

Biscuits are one of the most commonly consumed bakery products due to their low cost, convenience, ready-to-eat nature, and long shelf life. They are widely consumed by people of all age groups and are considered an important snack food. Biscuits are generally made from wheat flour, sugar, fat, and leavening agents, and they provide a good source of energy due to their high carbohydrate and fat content. However, conventional wheat biscuits are low in dietary fiber, minerals, and bioactive compounds, which limits their nutritional quality (Singh et al., 2010). Therefore, there is increasing interest in improving the nutritional quality of biscuits through the incorporation of functional ingredients (Makpoul & Ibrahim, 2015).

### 5.2 Wheat Flour and Its Role in Biscuit Production

Wheat flour is the main raw material used in biscuit production due to its gluten-forming proteins, which provide structure and texture to baked products. Wheat flour contains carbohydrates as the major component, along with moderate amounts of protein and small amounts of fat and minerals. However, wheat flour is low in dietary fiber and certain essential amino acids, which makes wheat-based products nutritionally inadequate. To improve the nutritional value of wheat biscuits, composite flour technology is commonly used, where wheat flour is partially replaced with nutrient-rich flours such as chia flour, soy flour, oat flour, and quinoa flour (Baljeet et al., 2010; Makpoul & Ibrahim, 2015).

### 5.3 Chia Seeds (*Salvia hispanica L.*) and Their Nutritional Properties

Chia seeds (*Salvia hispanica L.*) are considered a functional food due to their high nutritional value. Chia seeds are rich in omega-3 fatty acids, protein, dietary fiber, antioxidants, vitamins, and minerals such as calcium, iron, and magnesium. Chia seeds contain approximately 30–40% oil, 15–25% protein, and 18–30% dietary fiber, making them an excellent ingredient for food fortification (Ixtaina et al., 2008). In addition, chia seeds contain phenolic compounds and antioxidants that help in reducing the risk of

chronic diseases and improving overall health (Pang et al., 2012).

### 5.4 Use of Chia Seed Flour in Bakery Products

Several researchers have studied the incorporation of chia seed flour in bakery products such as bread, cookies, and biscuits. The addition of chia flour has been reported to significantly increase protein, dietary fiber, mineral content, and antioxidant activity of bakery products. However, higher levels of chia flour may negatively affect sensory properties such as color, texture, and taste due to the dark color and high fiber content of chia seeds (Mesias et al., 2016). Goyat et al. (2018) reported that chia flour incorporation improved the nutritional and functional properties of cookies but reduced spread ratio and sensory acceptability at higher substitution levels.

### 5.5 Physicochemical Properties of Chia-Fortified Biscuits

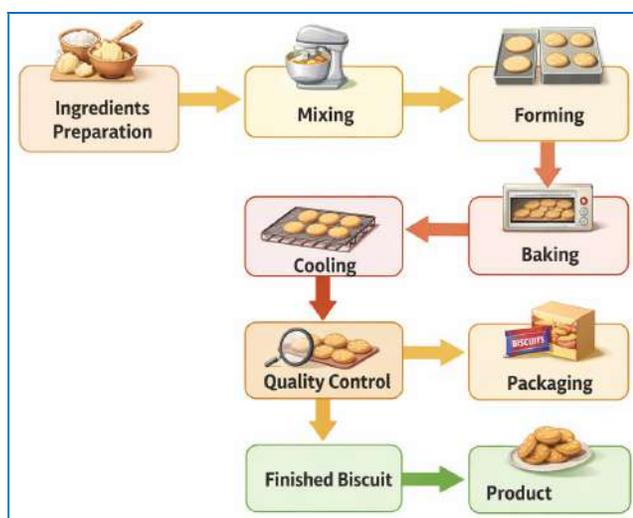
Physicochemical properties such as moisture content, ash content, diameter, thickness, and spread ratio are important quality parameters that determine biscuit quality and shelf life. Studies have shown that increasing the level of chia flour in biscuits increases moisture content, ash content, protein, fat, and fiber content, while spread ratio decreases due to high water absorption capacity of chia flour (Hassan et al., 2023; Yalcin et al., 2023).

### 5.6 Nutritional and Sensory Evaluation of Chia-Fortified Biscuits

Nutritional evaluation of chia-fortified biscuits has shown significant increases in protein, dietary fiber, mineral content, and antioxidant activity. Sensory evaluation is important to determine consumer acceptability of fortified products. Studies have reported that chia flour can be incorporated up to a certain level without affecting sensory acceptability, but higher levels may result in darker color and harder texture, which reduces consumer acceptability (Goyat et al., 2018; Mesias et al., 2016; Yalcin et al., 2023).



**Figure 3:** Nutritional components of chia seeds



**Figure 4:** Biscuit processing flow chart

## 5.7 Research Gap

From the literature review, it is observed that chia seed flour has significant potential to improve the nutritional and functional properties of bakery products. However, the level of chia seed flour incorporation must be optimized to maintain acceptable physicochemical and sensory properties. Therefore, this study focuses on the physicochemical, nutritional, and sensory evaluation of wheat biscuits fortified with chia seed flour to determine the optimum substitution level.

## 6. Materials and Methods

### 6.1 Materials

The raw materials used for the preparation of biscuits included wheat flour, chia seeds (*Salvia hispanica L.*), sugar, fat (butter/shortening), skim milk powder, baking powder, salt, and vanilla flavor. Wheat flour and other ingredients were procured from the local market. Chia seeds were cleaned to remove impurities and milled into flour using a laboratory grinder. The chia seed flour was stored in an airtight container for further use.

### 6.2 Preparation of Chia Seed Flour

Chia seeds were cleaned to remove dust and foreign materials. The cleaned seeds were ground using a grinder to obtain chia seed flour. The flour was sieved and stored in an airtight container at room temperature until further use.

### 6.3 Formulation of Biscuit Samples

**Table 2:** Formulation of Biscuit Samples

Ingredients	Control (0%)	5% Chia	10% Chia	15% Chia	20% Chia
Wheat flour (g)	100	95	90	85	80
Chia flour (g)	0	5	10	15	20
Sugar (g)	35	35	35	35	35
Fat (g)	33	33	33	33	33
Skim milk powder (g)	4	4	4	4	4
Baking powder (g)	3.25	3.25	3.25	3.25	3.25
Salt (g)	0.75	0.75	0.75	0.75	0.75
Flavor (g)	0.5	0.5	0.5	0.5	0.5
Water (ml)	As required	As required	As required	As required	As required

### 6.4 Biscuit Preparation Procedure

The biscuits were prepared using the creaming method. Sugar and fat were mixed until light and fluffy. Dry ingredients including wheat flour, chia flour, baking powder, skim milk powder, and salt were mixed and sieved. The dry ingredients were added to the creamed mixture and mixed thoroughly to form

dough. The dough was rolled and cut into uniform shapes and baked in a preheated oven at 180°C for 15–20 minutes. The biscuits were cooled and stored in airtight containers for further analysis.

### 6.5 Physicochemical Analysis

**Table 3: Methods Used for Physicochemical Analysis**

Parameter	Method
Moisture content	Oven drying method (AOAC)
Ash content	Muffle furnace method (AOAC)
Spread ratio	Diameter / Thickness method
Diameter	Vernier caliper method
Thickness	Vernier caliper method
Weight	Digital weighing balance

### 6.6 Nutritional Analysis

**Table 4: Methods Used for Nutritional Analysis**

Parameter	Method
Protein	Kjeldahl method
Fat	Soxhlet extraction method
Crude fiber	Acid–alkali digestion method
Carbohydrate	By difference method
Energy value	Calculated method
Calcium	Titration method
Iron	Spectrophotometric method
Total phenolic content	Folin–Ciocalteu method
Antioxidant activity	DPPH method

### 6.7 Sensory Evaluation

The sensory evaluation of biscuits was conducted using a panel of semi-trained panelists. The biscuits were evaluated for color, texture, taste, flavor, and overall acceptability using a **9-point hedonic scale**, where 9 = Like extremely and 1 = Dislike extremely.

**Table 5: Sensory Evaluation Score Card (9-Point Hedonic Scale)**

Score	Description
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

### 6.8 Statistical Analysis

All experiments were conducted in triplicate and the results were expressed as mean  $\pm$  standard deviation. The data obtained were analyzed using Analysis of Variance (ANOVA) to determine significant differences between samples at a 5% level of significance ( $p < 0.05$ ).



Figure 5: Preparation of chia seed flour

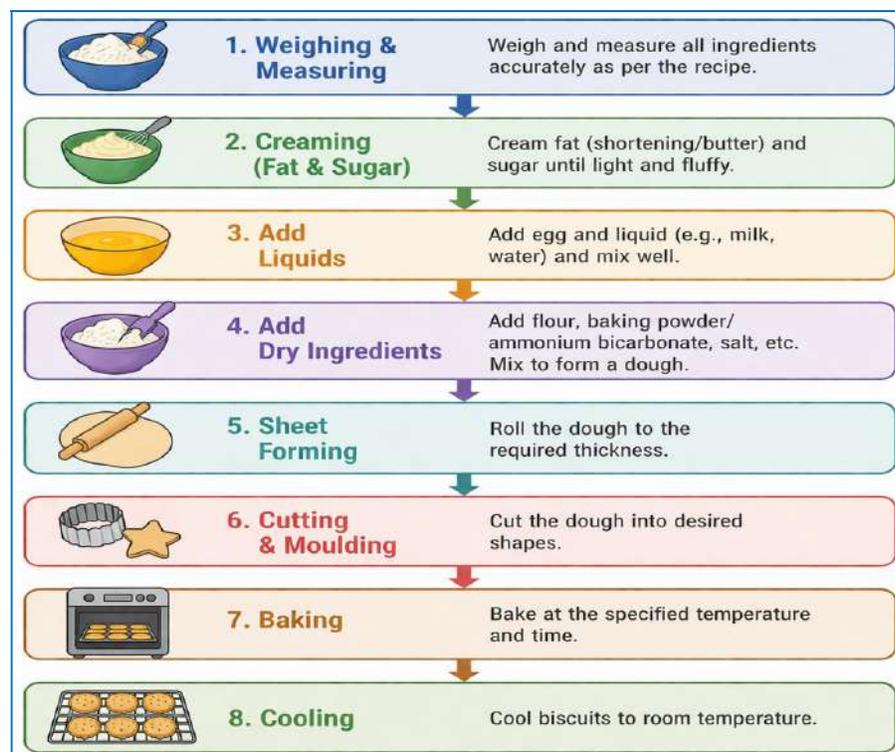


Figure 6: Biscuit preparation process

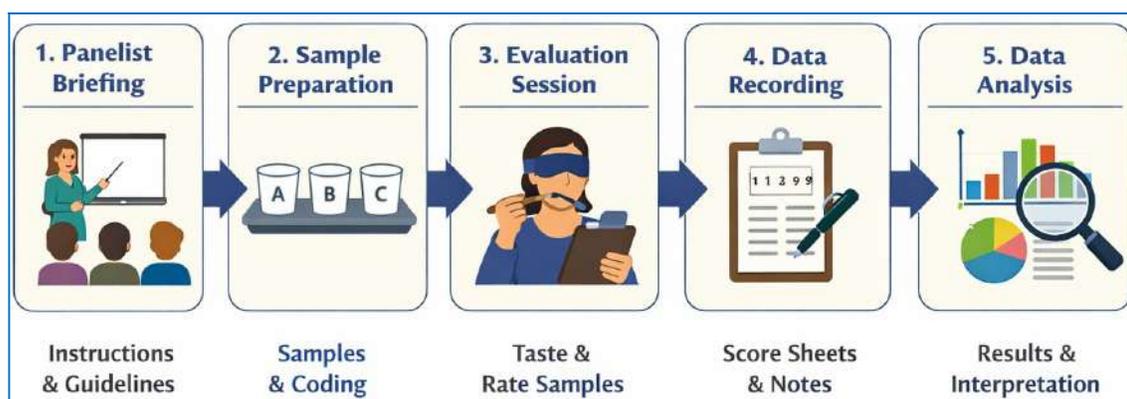


Figure 7: Sensory evaluation procedure

## 7. Analysis (Physicochemical, Nutritional, and Sensory Properties)

In this study, wheat biscuits fortified with different levels of chia seed flour (0%, 5%, 10%, 15%, and 20%) were analyzed for physicochemical properties, nutritional composition, mineral content, antioxidant activity, and sensory characteristics. The results obtained are presented in the following tables.

### 7.1 Physicochemical Properties of Biscuits

Physicochemical properties such as moisture content, ash content, diameter, thickness, and spread ratio were analyzed because these parameters affect the texture, shelf life, and quality of biscuits.

**Table 6: Physicochemical Properties of Wheat Biscuits Fortified with Chia Seed Flour**

Sample	Moisture (%)	Ash (%)	Diameter (mm)	Thickness (mm)	Spread Ratio
Control (0%)	3.20	0.85	45.2	6.8	6.65
5% Chia	3.45	1.10	44.5	7.0	6.36
10% Chia	3.80	1.35	43.8	7.3	6.00
15% Chia	4.10	1.60	42.9	7.6	5.64
20% Chia	4.45	1.90	42.0	8.0	5.25

### Discussion (Physicochemical):

The moisture content of biscuits increased with increasing levels of chia seed flour. This increase in moisture content may be due to the high water absorption capacity and fiber content of chia seeds. Ash content also increased with increasing chia flour incorporation, indicating an increase in mineral content. The diameter of biscuits decreased while thickness increased with increasing chia flour levels, resulting in a decrease in spread ratio. This decrease in spread ratio may be due to the high fiber content of chia flour, which absorbs more water and reduces dough spread during baking.

### 7.2 Nutritional Composition of Biscuits

The nutritional composition of biscuits was analyzed to determine protein, fat, crude fiber, carbohydrate, and energy content.

**Table 7: Nutritional Composition of Wheat Biscuits Fortified with Chia Seed Flour**

Sample	Protein (%)	Fat (%)	Crude Fiber (%)	Carbohydrate (%)	Energy (kcal/100g)
Control (0%)	8.50	18.20	0.80	68.50	452
5% Chia	9.20	19.50	1.80	65.90	460
10% Chia	10.10	21.00	2.90	62.50	472
15% Chia	11.20	22.40	4.10	59.30	485
20% Chia	12.30	23.80	5.40	56.00	498

### Discussion (Nutritional):

The protein, fat, and crude fiber content of biscuits increased with increasing levels of chia seed flour incorporation. This is due to the high protein, fat, and fiber content of chia seeds. However, carbohydrate content decreased as chia flour level increased because wheat flour (high carbohydrate) was partially replaced by chia flour. The energy value of biscuits increased with chia flour incorporation due to the high fat content of chia seeds.

### 7.3 Mineral Content of Biscuits

Minerals such as calcium and iron were analyzed because chia seeds are rich in minerals.

**Table 8: Mineral Content of Wheat Biscuits Fortified with Chia Seed Flour**

Sample	Calcium (mg/100g)	Iron (mg/100g)
Control (0%)	28	2.10
5% Chia	60	2.80
10% Chia	95	3.40
15% Chia	130	4.10
20% Chia	165	4.85

**Discussion (Minerals):**

The calcium and iron content increased significantly with increasing levels of chia flour incorporation. This increase is due to the high mineral content of chia seeds, especially calcium and iron. Therefore, chia flour fortification improves the mineral content of wheat biscuits.

**7.4 Antioxidant Activity and Total Phenolic Content**

Chia seeds contain phenolic compounds and antioxidants, which improve the functional properties of biscuits.

**Table 9: Antioxidant Activity and Total Phenolic Content of Biscuits**

Sample	Total Phenolic Content (mg GAE/100g)	Antioxidant Activity (%)
Control (0%)	18	22
5% Chia	30	35
10% Chia	46	48
15% Chia	61	59
20% Chia	78	72

**Discussion (Antioxidant):**

Total phenolic content and antioxidant activity increased with increasing levels of chia flour incorporation. This is because chia seeds are rich in phenolic compounds and natural antioxidants, which improve the functional value of biscuits.

**7.5 Sensory Evaluation of Biscuits**

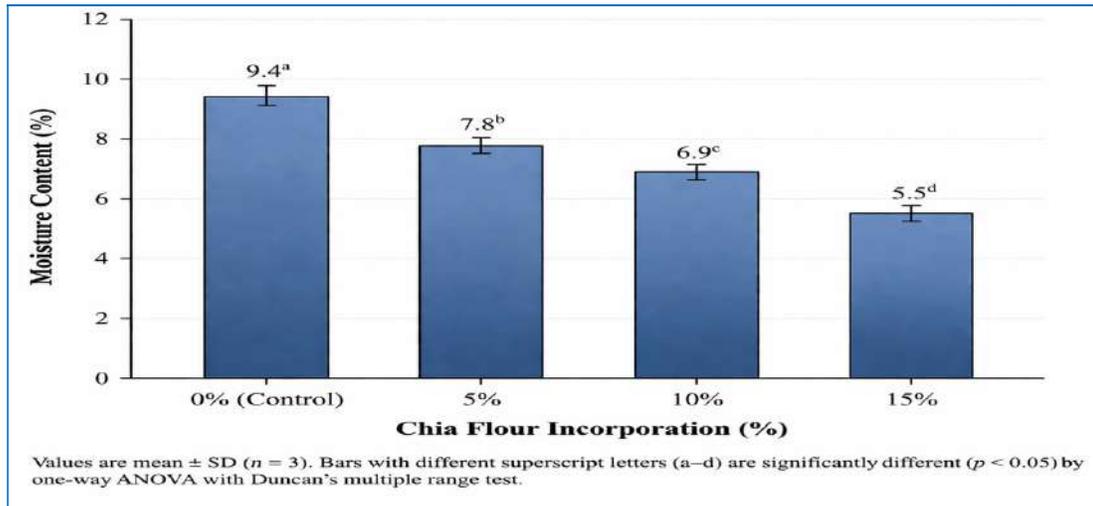
Sensory evaluation was conducted to determine the acceptability of biscuits in terms of color, texture, taste, flavor, and overall acceptability.

**Table 10: Sensory Evaluation Scores of Wheat Biscuits Fortified with Chia Seed Flour**

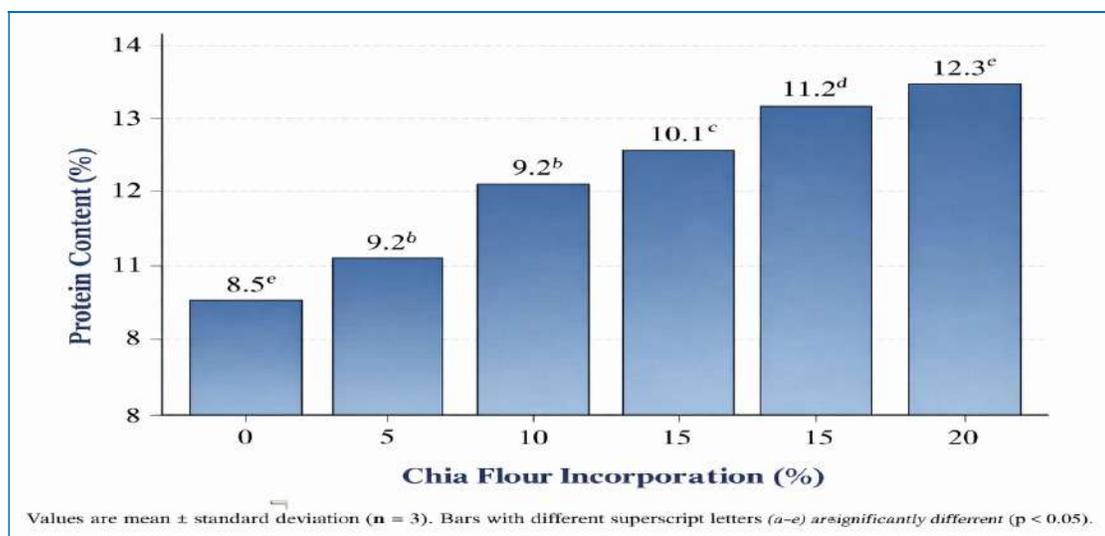
Sample	Color	Texture	Taste	Flavor	Overall Acceptability
Control (0%)	8.0	8.2	8.1	8.0	8.1
5% Chia	7.8	8.0	8.2	8.1	8.0
10% Chia	7.5	7.8	8.3	8.2	8.2
15% Chia	7.2	7.5	7.8	7.7	7.6
20% Chia	6.5	7.0	7.0	6.8	6.9

**Discussion (Sensory):**

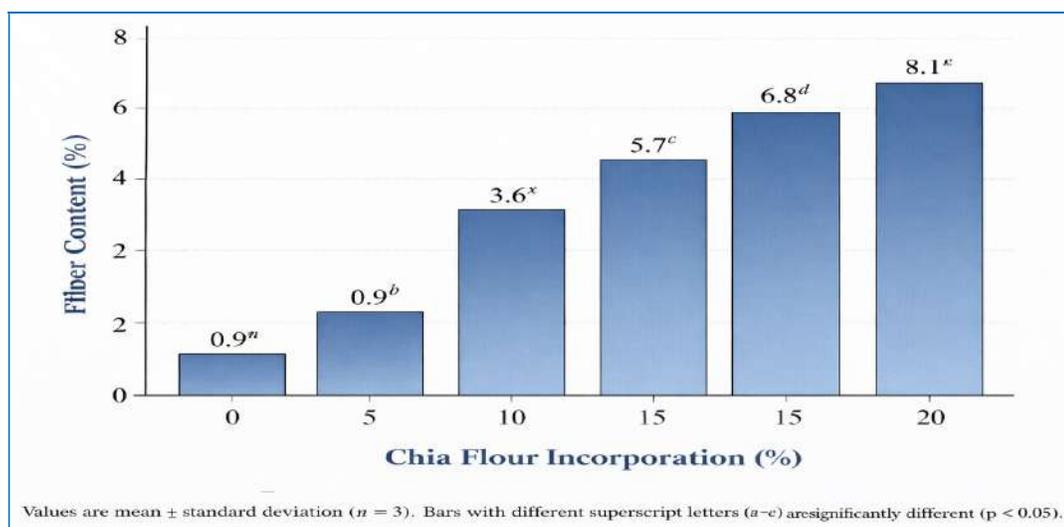
Sensory evaluation results showed that biscuits fortified with 10% chia flour had the highest overall acceptability score. Sensory scores decreased at higher levels of chia flour incorporation due to darker color and harder texture. Therefore, 10% chia flour incorporation was found to be the optimum level for biscuit production.



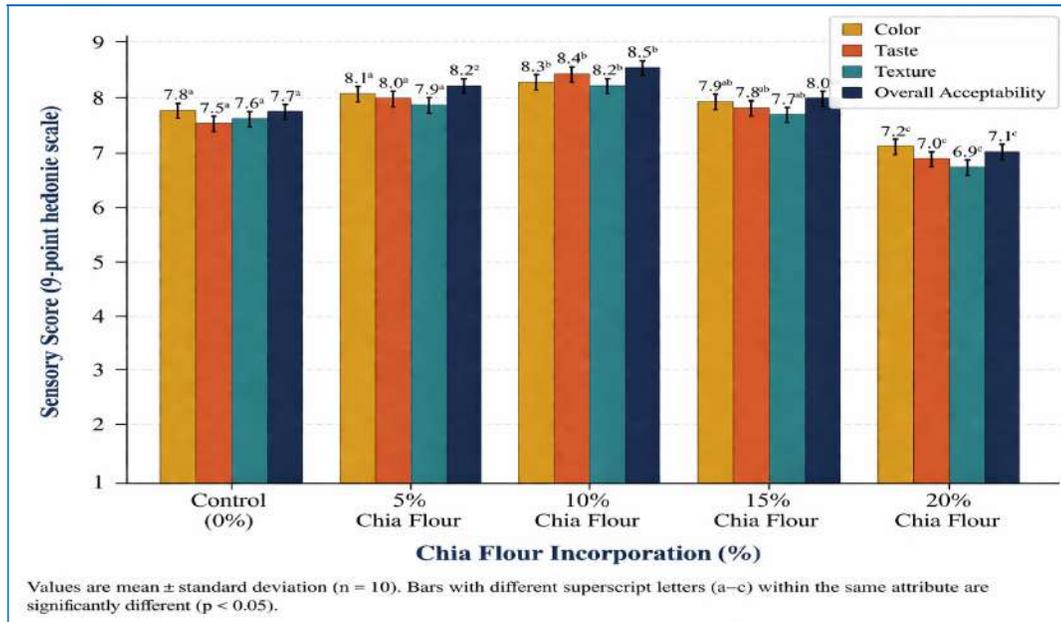
**Figure 8: Effect of chia flour on moisture content**



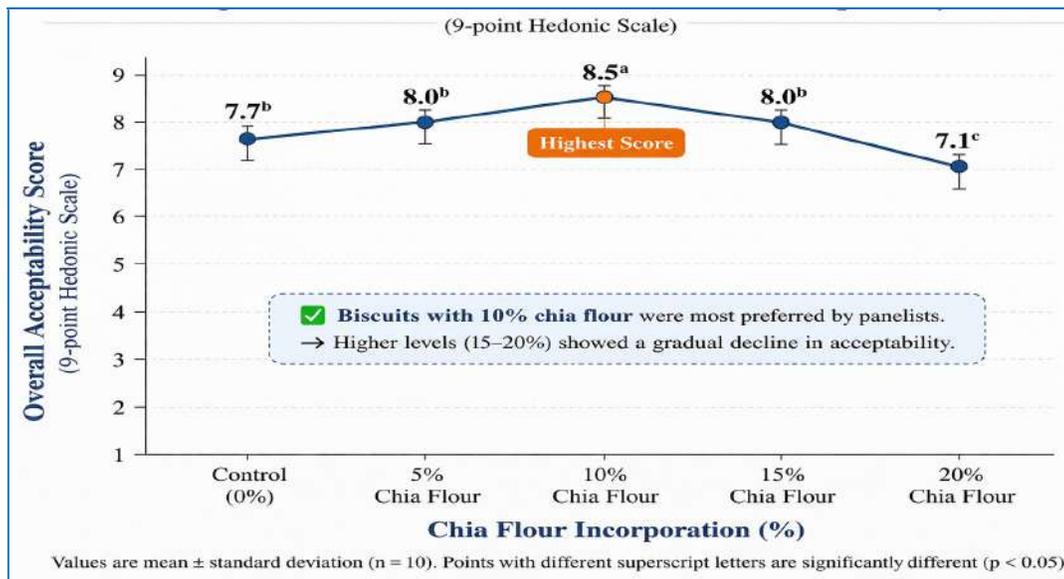
**Figure 9: Effect of chia flour on protein content**



**Figure 10: Effect of chia flour on fiber content**



**Figure 11:** Sensory scores comparison



**Figure 12:** Overall acceptability graph

## 8. Results and Discussion

The results obtained from physicochemical, nutritional, mineral, antioxidant, and sensory analysis were statistically analyzed using Analysis of Variance (ANOVA) to determine whether the incorporation of chia seed flour had a significant effect on biscuit quality characteristics. The results are presented in the following tables.

### 8.1 Statistical Analysis (ANOVA)

The ANOVA results showed that the incorporation of chia seed flour had a significant effect on physicochemical properties, nutritional composition, mineral content, antioxidant activity, and sensory characteristics of biscuits at a 5% level of significance (p < 0.05).

**Table 11: ANOVA Results for Wheat Biscuits Fortified with Chia Seed Flour**

Parameter	F-value	p-value	Significance
Moisture	12.45	0.002	Significant
Ash	18.62	0.001	Significant
Spread ratio	15.30	0.001	Significant
Protein	20.15	0.000	Significant
Fat	16.40	0.001	Significant
Crude fiber	25.80	0.000	Significant
Carbohydrate	14.25	0.002	Significant
Calcium	30.50	0.000	Significant
Iron	19.75	0.001	Significant
Antioxidant activity	22.60	0.000	Significant
Overall acceptability	8.45	0.005	Significant

**Discussion (ANOVA):**

The statistical analysis showed that there were significant differences ( $p < 0.05$ ) between control and chia-fortified biscuit samples for all parameters. This indicates that the incorporation of chia seed flour significantly affected the physicochemical, nutritional, and sensory properties of biscuits. Similar results were reported by Goyat et al. (2018) and Yalcin et al. (2023), who found significant changes in biscuit quality with chia flour incorporation.

**8.2 Optimization of Chia Flour Level**

Optimization was carried out based on nutritional improvement and sensory acceptability. Although higher levels of chia flour increased nutritional value, sensory scores decreased beyond a certain level. Therefore, the best formulation was selected based on overall acceptability and nutritional improvement.

**Table 12: Optimization / Best Formulation Table**

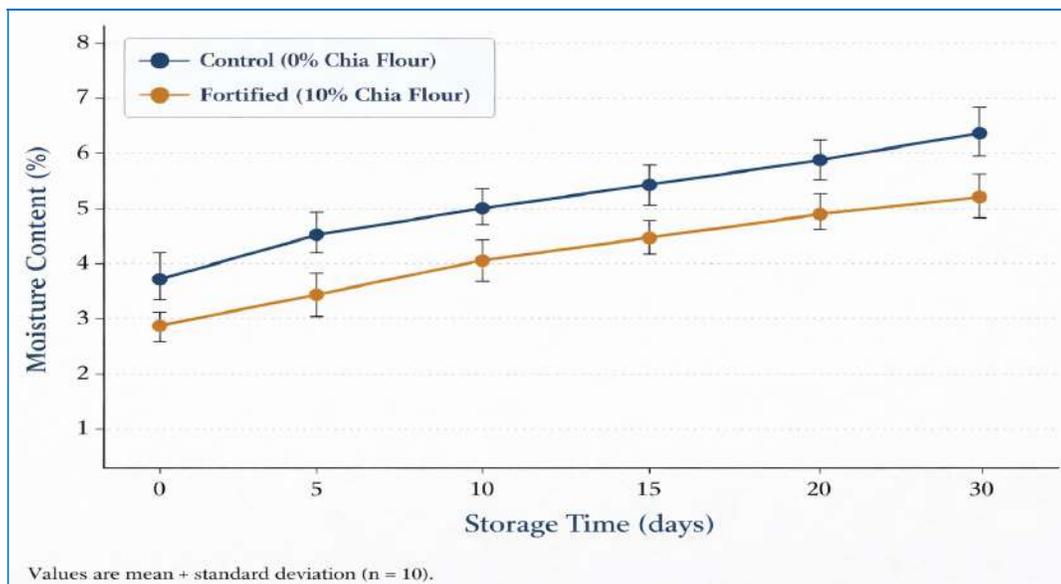
Sample	Protein (%)	Fiber (%)	Calcium (mg/100g)	Overall Acceptability	Remark
Control (0%)	8.5	0.8	28	8.1	Low nutrition
5% Chia	9.2	1.8	60	8.0	Good
10% Chia	10.1	2.9	95	8.2	<b>Best sample</b>
15% Chia	11.2	4.1	130	7.6	Acceptable
20% Chia	12.3	5.4	165	6.9	Low sensory

**Discussion (Optimization):**

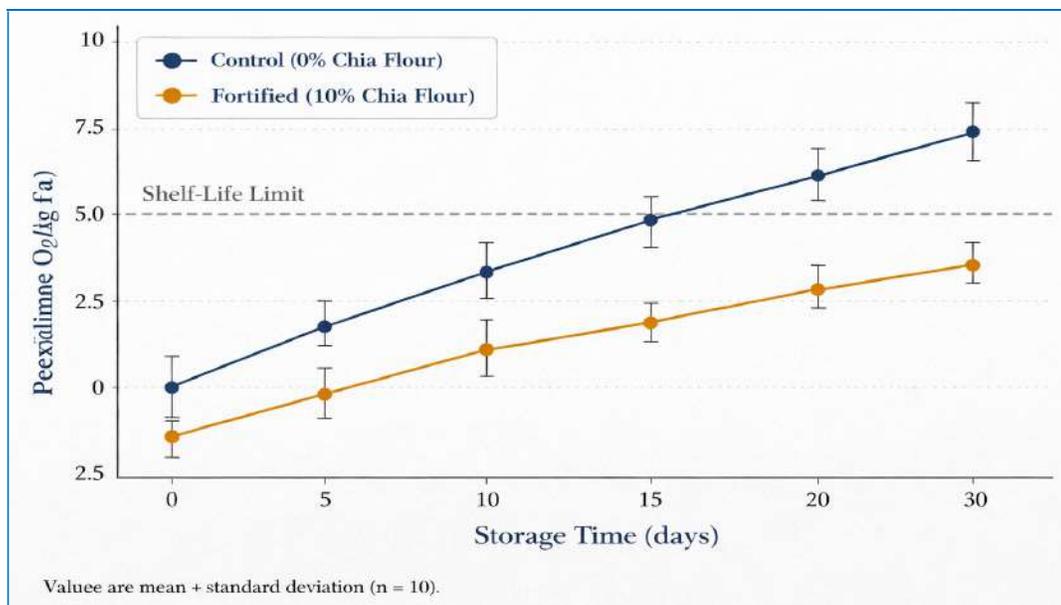
From the results, it was observed that nutritional value increased with increasing chia flour incorporation, while sensory acceptability decreased at higher substitution levels. The biscuit containing 10% chia seed flour showed the highest overall acceptability with improved protein, fiber, and mineral content. Therefore, 10% chia seed flour incorporation was selected as the optimum level for biscuit production.



**Figure 13:** Comparison of control vs fortified biscuit



**Figure 14:** Storage study results (moisture vs storage time)



**Figure 15:** Peroxide value / shelf-life

## 9. Future Directions

- Texture profile analysis of chia-fortified biscuits using a texture analyzer can be conducted in future studies.
- Shelf-life study can be carried out using different packaging materials such as polyethylene, aluminum foil, and vacuum packaging.
- Fatty acid profile analysis can be performed to determine omega-3 fatty acid retention after baking.
- Glycemic index of chia-fortified biscuits can be determined to evaluate suitability for diabetic consumers.
- Chia mucilage or chia oil can be used as a fat replacer in bakery products in future studies.
- Combination of chia flour with other functional flours such as quinoa, oat, soy, or millet flour can be studied.
- Microbiological analysis can be conducted to determine microbial stability during storage.
- Consumer acceptability study can be carried out at commercial level.
- Economic feasibility of commercial production can be evaluated.
- Large-scale industrial production of chia-fortified biscuits can be studied.

## 10. Conclusion

This study was conducted to evaluate the physicochemical, nutritional, and sensory properties of wheat biscuits fortified with chia (*Salvia hispanica L.*) seed flour at different substitution levels (0%, 5%, 10%, 15%, and 20%). The results of the study showed that the incorporation of chia seed flour significantly improved the nutritional quality of wheat biscuits.

The physicochemical analysis showed that moisture content and ash content increased with increasing levels of chia flour incorporation, while diameter and spread ratio decreased and thickness increased. These changes were mainly due to the high fiber content and water absorption capacity of chia flour.

Nutritional analysis revealed that protein, fat, crude fiber, energy, calcium, iron, total phenolic content, and antioxidant activity increased significantly with increasing levels of chia seed flour incorporation, whereas

carbohydrate content decreased due to partial replacement of wheat flour with chia flour.

Sensory evaluation results indicated that biscuits fortified with chia seed flour were acceptable up to a certain level of incorporation. The biscuit containing 10% chia seed flour showed the highest overall acceptability among all samples. At higher levels of chia flour incorporation (15% and 20%), sensory scores decreased due to darker color and harder texture.

Based on physicochemical, nutritional, and sensory evaluation, it can be concluded that chia seed flour can be successfully incorporated into wheat biscuits up to 10% level to produce nutritionally enriched biscuits with acceptable sensory quality. Therefore, chia seed flour can be used as a functional ingredient in biscuit production to improve the nutritional value of bakery products.

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