

Evaluation of the Sensory, Physical, and Chemical Properties of Gluten-Free Biscuits Made from Cornflour with the Addition of Carrot Powder

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Received: 15/12/2025, Revised: 22/01/2026, Accepted: 31/01/2026, Published: 04/02/2026

Abstract:

The demand for nutritious gluten-free bakery products continues to grow. However, limited research exists on the combined use of stevia leaf powder and carrot powder in such products, particularly regarding their comprehensive quality attributes. This study aimed to develop and evaluate gluten-free biscuits from cornflour supplemented with carrot powder and stevia as a sugar substitute. The evaluation results revealed that biscuits made from corn flour fortified with stevia leaf powder and carrot powder significantly outperformed traditional wheat biscuits (control sample) across most sensory attributes. The fortified biscuits achieved a higher overall acceptance score (9.5 vs. 8.0), displayed a more attractive color (perfect score of 10) due to carotenoid pigments from carrot powder, and exhibited an excellent chewing texture (perfect score of 10) attributed to their high fiber content. Although flavor scores were similar to those of the control sample, the fortified product excelled in shape, aroma, and texture. In addition to sensory improvements, the fortified biscuits demonstrated enhanced physical characteristics, including increased thickness and diameter, while maintaining a controlled spread ratio. Nutritional analysis further highlighted significant enhancements: protein content increased to 24.8%, fiber to 16.98%, and ash (mineral content) to 8.09%. At the same time, total carbohydrate content decreased substantially to 18.73% compared to traditional biscuits. These findings confirm that the developed formulation successfully addresses a research gap by incorporating stevia leaf powder and carrot powder, which not only improved product acceptability but also enriched its nutritional profile, making it a healthier alternative to conventional wheat-based biscuits.

Keywords: Biscuits, Corn flour, Gluten-Free, Stevia leaf powder, Carrot Powder, Rice bran oil.

1. Introduction

Gluten-free products have been gaining popularity due to consumer preferences and prevailing scientific and health-related trends (Adiamo et al., 2018). They are particularly important for individuals with gluten intolerance or celiac disease, a lifelong sensitivity to gluten that affects approximately 1% of the world's population (Di-Cairano et al., 2018). Since the only treatment for this condition requires strict adherence to a gluten-free diet, the demand for gluten-free foods has increased substantially (Kohli et al., 2023).

Biscuits are among the most widely consumed products in the bakery industry (Misra et al., 2014). Locally, they are readily available in supermarkets and small shops. Their importance to consumers derives from their nutritional value, affordable price, easy accessibility, diverse flavors, convenience of consumption, and long shelf life (Kohli et al., 2023). The primary ingredient in biscuits is wheat flour, which contains gluten proteins (Dauda et al., 2018). Gluten is a critical component that plays a pivotal role in determining the properties of baked goods, contributing to structure, adhesion, elasticity, dough strength, and product texture (Ortolan et al., 2017). However, gluten is not essential in biscuit production, which allows wheat flour to be substituted with gluten-free alternatives—unlike other baked goods such as bread, which are more dependent on gluten (Di-Cairano et al., 2018). Consequently, gluten-free flours such as corn flour, carrot powder, and stevia leaf powder have emerged as promising ingredients for the development of gluten-free biscuits.

Stevia rebaudiana leaf powder, recently introduced to Iraq, is a source of several sweet glycosides (ent-kaurene diterpenoid glycosides). The compounds primarily responsible for its sweetness are rebaudioside A and stevioside (Ramaroson, 2024). Stevia leaf powder can partially or completely replace regular sugar (Lemus-Mondaca et al., 2012).

Corn flour is a gluten-free alternative that is readily available locally and more affordable than wheat flour. In recent years, there has been growing interest in developing gluten-free baked goods using corn flour, such as biscuits formulated with varying proportions of corn, rice, and soy flours, which influence both nutritional value and sensory quality (Kohli et al., 2023). Furthermore, the properties of biscuits made from rice, corn, and sorghum flours prepared with different ingredients have been investigated (Ali and Abol-Ela, 2019). Olaimat et al. (2023) produced gluten-free biscuits from corn flour enriched with walnuts and peanuts.

Carrots (*Daucus carota* L.) are among the most important and nutritious root vegetables cultivated worldwide. They are an excellent source of phytonutrients, including phenols, polyacetylenes, and carotenoids (Hansen et al., 2003). The consumption of carrots and carrot-based products has gained widespread acceptance due to their natural antioxidant properties and anticancer activities (Speizer et al., 1999). Consequently, carrot consumption can play a significant role in alleviating vitamin A deficiency, particularly among children under six years of age and adults. Vitamin A deficiency has been identified as a major public health concern in developing countries, highlighting the need to develop enriched baked goods, such as biscuits, that are widely accepted and consumed as snacks to meet nutritional requirements and improve the health of vulnerable populations. Baked goods, including biscuits, can serve as a suitable vehicle for incorporating micronutrients and protein to address these health needs (Phebean et al., 2017).

Previous studies have demonstrated the substitution of wheat flour with corn flour in biscuits and other bakery products. However, limited research has focused on the development of gluten-free biscuits incorporating stevia leaf powder and carrot powder, particularly with respect to their physical quality, nutritional properties, and antioxidant capacity. Therefore, the specific objectives of this study were to: (1) develop gluten-free biscuits based on cornflour with the addition of carrot powder and stevia leaf powder; (2) evaluate their sensory, physical, and chemical properties in comparison to traditional wheat biscuits; and (3) assess the nutritional enhancement achieved through this formulation. This research aims to provide a healthy alternative for individuals with gluten sensitivity, contribute to the development of gluten-free bakery products, and also for managing obesity and diabetes. It will be fed to laboratory animals in subsequent new studies.

2. Related Work

Previous studies have demonstrated the substitution of wheat flour with corn flour in biscuits and other bakery products. However, limited research has focused on the development of gluten-free biscuits incorporating stevia leaf powder and carrot powder, particularly with respect to their physical quality, nutritional properties, and antioxidant capacity.

Similar studies in sensory outcomes, the studied sample also received a perfect score (10) for color, surpassing the control sample (9.5). This improvement is attributed to the natural pigments (carotenoids) present in carrot powder, which imparted a visually appealing golden-orange hue to the biscuits (Šwieca et al., 2014).

Similarly, the post-chew sensation scored a perfect 10 for the studied sample, significantly higher than the control sample (8.5). This superior texture is likely due to the combined dietary fiber content of cornflour and carrot powder, which may enhance moisture retention and provide a more consistent and desirable crumb texture after chewing (Ghadimi et al., 2025).

The findings suggest that the enhanced spreading effect typically associated with gluten absence was partially counteracted by the added fibers from carrot and stevia leaf powders. This resulted in a larger diameter than the control sample but a lower spread ratio. These results are consistent with the findings of (Blicharz-Kania et al. 2025), who reported that incorporating fruit and vegetable powders increases the firmness of baked goods and reduces spreading, particularly in gluten-free formulations, due to enhanced water absorption and dough stability.

3. Methodology

The work methods were carried out at the University of Tikrit and Baghdad, and biscuits were made using several substitution methods to obtain biscuits with high nutritional value and health, as shown below:

3.1. Biscuit Production

- **Control Sample:** High-quality wheat flour with a 72% extraction rate was used. The biscuits were prepared following the procedure described by (Lashin and Kerolles 2019), using the ingredients and quantities listed in Table 1. The dough was kneaded for 10 minutes until a smooth consistency was achieved, then refrigerated at 6 °C for 30 minutes. Afterward, the dough was cut into rounds and baked on an aluminum tray in an electric oven at 180 °C for 6 minutes.

Table 1: Preparation of biscuits made from wheat flour (control sample)

| Ingredient | Percentage (%) |
|----------------|----------------|
| Wheat flour | 100 |
| Butter | 45 |
| Powdered sugar | 30 |
| Eggs | 50 |
| Vanilla | 2 |
| Baking powder | 1 |

- **Sample with Ingredient Substitution and Added Carrot Powder:** Corn flour with a 100% extraction rate was used. The biscuits were prepared according to the recipe of (Lashin and Kerolles 2019), using the ingredients and quantities listed in Table 2, with selected substitutions and the addition of carrot powder. The dough was kneaded for 10 minutes until smooth, then refrigerated at 6 °C for 30 minutes. It was subsequently shaped using special molds and baked on an aluminum tray in an electric oven at 180 °C for 6 minutes. After baking, the biscuits were cooled for 30 minutes and stored in polyethylene bags until testing.

Table 2: Preparation of biscuits made from corn flour with added carrot powder

| Ingredient | Percentage (%) |
|--------------------|----------------|
| Corn flour | 100 |
| Rice bran oil | 45 |
| Stevia leaf powder | 30 |
| Eggs | 50 |
| Vanilla | 2 |
| Baking powder | 1 |
| Carrot powder | 2 |

After producing biscuits made from corn flour with the addition of carrot powder, the final product looked like this, as shown in both Figure 1 and Figure 2.



Figure 1: Final product of biscuits



Figure 2: Side view of the final biscuit product

3.2. Sensory Evaluation of Cornflour Biscuits with Added Carrot Powder

Sensory tests were conducted at Tikrit University, College of Agriculture, Department of Food Science. The panel consisted of 10 trained judges who are faculty members specialized in food science and sensory analysis. Their ages ranged between 45 and 60 years, and they were 4 females and 6 males. While the sample size is limited, the high level of expertise among panelists was deemed appropriate for this preliminary comparative evaluation of the novel formulation (Table 3). Consumer acceptance-preference was assessed for the following sensory attributes: shape, texture, taste, aroma, color, overall acceptability, and post-chew sensation. The Nine-point Hedonic Scale (Ajila et al., 2008) was employed, which uses a rating system from 1 to 10, where 10 indicates “liked very much” and 1 indicates “disliked very much.”

Table 3: Sensory Assessment Form

| Attribute | Assessment Options |
|-----------------------|--|
| Shape | I didn't like it at all → I liked it very much |
| Texture | I didn't like it at all → I liked it very much |
| Color | I didn't like it at all → I liked it very much |
| Flavor | I didn't like it at all → I liked it very much |
| Odor | I didn't like it at all → I liked it very much |
| General Acceptance | I didn't like it at all → I liked it very much |
| Feeling After Chewing | I didn't like it at all → I liked it very much |

3.3. Physical Tests of Cornflour Biscuits with Added Carrot Powder

- **Biscuit Diameter (cm) (W):** The total combined diameter of six biscuit discs placed side by side, and their diameter was measured. The biscuits were then rotated to a 90° angle, a second measurement was taken, and the average was calculated (Al-Zubaidi, 2009).
- **Biscuit Thickness (cm) (T):** Six discs of the biscuit sample were stacked, and the total height was measured. The average thickness was then recorded (Al-Zubaidi, 2009).
- **Spread Ratio:** The spread ratio was calculated by dividing the biscuit diameter (W) by the thickness (T), using the following Equation:

$$Spread\ Ratio = \frac{W}{T} \quad (1)$$

3.4. Chemical Tests of Cornflour Biscuits with Added Carrot Powder

- **Moisture Content:** The percentage of moisture was estimated as the weight loss before and after drying. Approximately 3 g of the sample was placed in a pre-weighed container and dried in an electric oven at 105 °C for 8 hours. Moisture percentage was calculated using the following Equation (A.O.A.C., 1995):

$$Moisture\ \% = \frac{(Weight\ before\ drying - Weight\ after\ drying)}{Weight\ before\ drying \times 100} \quad (2)$$

- **Ash Content:** The percentage of ash in the sample was estimated by incinerating the specimen in a ceramic crucible of known weight, placed in an incineration furnace at approximately 525 °C for 3 hours. The ash percentage was then calculated according to the Equation (A.O.A.C., 1995):

$$Ash\ \% = \left(\frac{Weight\ of\ crucible + ash - Weight\ of\ empty\ crucible}{Weight\ of\ sample} \right) \times 100 \quad (3)$$

- **Protein Content:** The Kjeldahl method was used to estimate protein content in the samples, following the procedure described by (van Dijk and Houba 2000). Approximately 5 g of the sample was placed in a digestion flask, to which 25 ml of concentrated sulfuric acid was added along with an appropriate amount of a catalyst mixture (potassium sulfate and copper sulfate). Digestion was carried out by heating until the mixture became a clear, pale blue liquid.

The digested solution was quantitatively transferred to the distillation flask of the Kjeldahl apparatus, which contained 40% sodium hydroxide solution. The distillation flask was connected to a condenser ending in a test tube immersed in a receiving flask containing 20% boric acid solution, prepared with a few drops of methyl red indicator and bromocresol blue dye. Distillation was continued until approximately 25 ml of distillate was collected.

The distillate was then titrated with 0.1 N hydrochloric acid. A blank solution was prepared using the same reagents, excluding the sample. Protein percentage was calculated using the following Equation:

$$\text{Protein \%} = \left(\frac{\text{Volume of HCl consumed} \times N \times 0.014 \times 6.25}{\text{Sample weight}} \right) \times 100 \quad (4)$$

- Fat Content:** was estimated using the (AOAC, 1995) method. A 10 g portion of the dried sample was placed on filter paper, wrapped, and inserted into the thimble of a Soxhlet fat extraction apparatus. The extraction flask was weighed, and 250 ml of hexane was added. The extraction process lasted approximately 5 hours. After extraction, the solvent was collected, and the flask was removed and placed in an electric oven at 80 °C for 30 minutes to ensure complete evaporation of residual solvent and preservation of the fats. The flask was then cooled and reweighed. Fat content was calculated using the Equation:

$$\text{Fat \%} = \frac{\text{Weight of flask after extraction} - \text{Weight of flask before extraction}}{\text{Weight of sample}} \times 100 \quad (5)$$

- Crude Fiber (CF):** Crude fiber is defined as the insoluble portion of food remaining after sequential digestion with 1.25% sulfuric acid and 1.25% sodium hydroxide, each heated for 30 minutes. Following fat extraction, the sample was digested with these solutions, filtered, and the residue collected. The residue consisted of crude fiber, insoluble ash, and a small amount of moisture. This portion was dried and incinerated, and the weight loss after burning was used to determine crude fiber content by using the equation 6 (McCleary et al., 2015).

$$\text{Crude Fiber \%} = \frac{\text{Weight of residue after drying} - \text{Weight after incineration}}{\text{Weight of dry sample}} \times 100 \quad (6)$$

- Carbohydrate Estimation:** Carbohydrates were estimated using the difference method, as described by using the following Equation (Pearson et al., 1981):

$$\text{Carbohydrates \%} = 100 - (\text{Moisture} + \text{Ash} + \text{Protein} + \text{Fat} + \text{Fiber}) \quad (7)$$

4. Result Discussion

4.1. Sensory Evaluation

The sensory evaluation results for biscuits made from cornflour with added carrot powder compared to the control sample are shown in Table 4.

Table 4: Sensory Evaluation Results

| Attribute | Average (Study Sample) | Average (Control Sample) |
|-----------------------|------------------------|--------------------------|
| Shape | 9.5 | 9 |
| Texture | 9 | 8 |
| Color | 10 | 9.5 |
| Flavor | 8.5 | 8.6 |
| Odor | 9 | 8 |
| General Acceptance | 9.5 | 8 |
| Feeling After Chewing | 10 | 8.5 |

Scale: 1–10, where 10 = “Very Liked” and 1 = “Very Disliked.” Overall average score for the study sample = 9.35 out of 10.

The sensory evaluation results presented in Table 4 reveal notable differences between the control sample (wheat flour biscuits) and the studied sample (cornflour biscuits fortified with stevia leaf powder and carrot powder). Analysis conducted by 10 trained judges indicated a clear preference for the fortified biscuits across most sensory attributes. The studied sample achieved a higher overall acceptance score (9.5) compared to the control

sample (8.0), demonstrating that the formulation modifications were successful in producing a more acceptable and preferred product.

The studied sample also received a perfect score (10) for color, surpassing the control sample (9.5). This improvement is attributed to the natural pigments (carotenoids) present in carrot powder, which imparted a visually appealing golden-orange hue to the biscuits (Świeca et al., 2014).

Similarly, the post-chew sensation scored a perfect 10 for the studied sample, significantly higher than the control sample (8.5). This superior texture is likely due to the combined dietary fiber content of cornflour and carrot powder, which may enhance moisture retention and provide a more consistent and desirable crumb texture after chewing (Ghadimi et al., 2025).

4.2. Physical Test Results

The study sample exhibited a larger average diameter (26 cm vs. 25 cm) and a slightly lower spread ratio (2.00 vs. 2.03) compared to the control sample (Table 5). The spread ratio, a critical indicator of baked product quality, depends on the balance between dough viscosity and the expansion forces generated by water vapor and leavening gases during baking (Laguna et al., 2011). The primary factor influencing this difference is the complete substitution of wheat flour with corn flour. Gluten proteins in wheat flour form a flexible, elastic network that provides cohesion and gas retention, thereby moderating spread. In contrast, the absence of this network in gluten-free corn flour generally results in reduced viscosity and increased spread during baking (Mancebo et al., 2015).

Table 5: Physical Test Results

| Test | Average (Study Sample) | Average (Control Sample) |
|----------------|------------------------|--------------------------|
| Diameter (cm) | 26 | 25 |
| Thickness (cm) | 13 | 12.3 |
| Spread Ratio | 2 | 2.03 |

Carrot powder, rich in dietary fiber—particularly pectin and cellulose—demonstrated a high water-binding capacity, which enhanced dough texture and viscosity. Dough with higher viscosity resists spreading during the initial expansion phase in the oven, producing a thicker, less spreadable product (Sabanis et al., 2009). The findings suggest that the enhanced spreading effect typically associated with gluten absence was partially counteracted by the added fibers from carrot and stevia leaf powders. This resulted in a larger diameter than the control sample but a lower spread ratio. These results are consistent with the findings of Blicharz-Kania et al. (2025), who reported that incorporating fruit and vegetable powders increases the firmness of baked goods and reduces spreading, particularly in gluten-free formulations, due to enhanced water absorption and dough stability.

A significant increase in thickness was also observed in the study sample (13 cm vs. 12.3 cm) (Table 5), directly attributable to compositional changes. Carrot and stevia fibers not only bind water but also contribute to a firmer structure during baking. Stevia leaf powder contains fibers and additional compounds that influence texture, while its sugars may contribute to browning and caramelization reactions, stabilizing the structure early in the baking process. Consequently, the absence of the gluten network—which would normally weaken under heat without support—is compensated for by the water-binding and retention capacity of the fibers, resulting in a thicker final product (Zoulias et al., 2002).

4.3. Chemical Composition of Cornflour Biscuits with Carrot Powder

Table 6 shows that the protein content is remarkably high (24.8%), even though corn flour is relatively low in protein compared to wheat flour. This increase is attributed to the combined addition of stevia leaf powder and carrot powder. Stevia leaves are a well-known source of plant protein, with protein potentially comprising 10–

20% of their dry weight (Gasmalla et al., 2014). Carrots also contain modest amounts of protein, but their contribution becomes significant when used in high concentrations in the ingredients. This improvement enhances the nutritional value of the biscuits, making them a product that may support satiety and meet daily protein requirements.

Table 6: Chemical Composition of Cornflour Biscuits with Carrot Powder

| Component | Concentration (%) |
|-----------|-------------------|
| Protein | 24.80 |
| Lipid | 9.25 |
| Ash | 8.09 |
| Moisture | 22.15 |
| Fiber | 16.98 |
| CHO | 18.73 |

The fat content is 9.25%, which is naturally present in the corn flour and includes added fat during preparation (rice bran oil). The significance here lies in the functional context of the mixture's ingredients. Using stevia as a natural sweetener eliminates the need to add large amounts of sugar or fat to improve the texture or taste, which would otherwise be lost due to the absence of sugar. Therefore, this level can be controlled to remain within healthy limits if healthy fat sources are chosen, such as unsaturated vegetable oils like rice bran oil. The high ash content (8.09%) indicates the product's richness in minerals. Wholemeal corn flour, stevia leaf powder, and carrot powder are all excellent sources of minerals such as potassium, magnesium, calcium, iron, and zinc. Carrot powder is a significant source of potassium, and stevia leaves contain high levels of iron and calcium (Lemus-Mondaca et al., 2012). This significantly higher ash content compared to traditional white biscuits (which are typically less than 2%) is strong evidence of the successful blending of natural, mineral-rich ingredients, giving the biscuits added nutritional value. As for the moisture content (22.15%), this can be explained by the water-retaining properties of the added ingredients (Shivanna et al., 2013). The fibers in wholemeal corn flour, the fiber and pectin in carrot powder, and the components in stevia leaf powder all have a high capacity to bind to water molecules. While this percentage may affect shelf life and necessitate proper packaging and storage, it can also contribute to a moister and softer texture in the final product, a desirable characteristic in many biscuit varieties. The fiber content (16.98%) is another significant finding in the analysis, reflecting the very high fiber content, a direct result of the modified blend. Wholemeal corn flour is rich in fiber, carrot powder is a concentrated source of dietary fiber, and stevia leaves are also beneficial. This level places the biscuit in the "high-fiber" category according to common nutritional claims, which play a role in improving digestive health, regulating blood sugar levels, and promoting satiety. The very low carbohydrate and sugar content, coupled with high dietary fiber, suggests this product has a formulation that is potentially suitable for dietary management in diabetic individuals. However, this assertion requires validation through glycemic index testing and clinical studies (Blicharz-Kania et al., 2025).

The results also showed a significant decrease in total carbohydrate content (18.73%) compared to traditional biscuits (which can exceed 70%). This is a direct reflection of the modified formula. The addition of carrot powder reduces total carbohydrates, and the use of stevia leaf powder as the primary sweetener, replacing sucrose (table sugar), significantly reduces carbohydrate and calorie content. This makes the product low in carbohydrates and particularly suitable for diabetic diets, as it helps control blood glucose levels without sacrificing sweetness (Shivanna et al., 2013).

5. Conclusion

In conclusion, this study successfully developed and performed a preliminary evaluation of gluten-free biscuits using cornflour, carrot powder, and stevia. The fortified biscuits showed superior or comparable sensory scores, favorable physical properties, and a significantly enhanced nutritional profile—characterized by high protein, fiber, and ash content alongside low total carbohydrates—compared to the wheat-based control. This work contributes a novel, nutrient-dense formulation to the range of gluten-free bakery products.

The main limitations of this preliminary investigation include the small, expert sensory panel and the use of descriptive rather than inferential statistics. Future research should focus on comprehensive statistical analysis, glycemic index determination, shelf-life studies, and large-scale consumer acceptance trials to confirm the product's market potential and health claims. Furthermore, future studies should include a larger and more demographically diverse consumer panel (considering age, gender, and consumer status) to validate the sensory acceptance reported here, as well as administering the product to laboratory animals and studying its clinical effects on diabetic and obese patients in subsequent studies.

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تقييم الخصائص الحسية والفيزيائية والكيميائية للبسكويات الخالي من الغلوتين المصنوع من طحين الذرة مع إضافة مسحوق الجزر

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الملخص:

يتزايد الطلب على منتجات المخازن المغذية الخالية من الغلوتين باستمرار. ومع ذلك، لا تزال الأبحاث محدودة حول الاستخدام المشترك لمسحوق أوراق ستيفيا ومسحوق الجزر في هذه المنتجات، لا سيما فيما يتعلق بخصائص جودتها الشاملة. هدفت هذه الدراسة إلى تطوير وتقييم بسكويات خالي من الغلوتين مصنوع من طحين الذرة المدعم بمسحوق الجزر وستيفيا كبديل للسكر. أظهرت نتائج التقييم أن البسكويات المصنوع من طحين الذرة المدعم بمسحوق أوراق ستيفيا ومسحوق الجزر تفوق بشكل ملحوظ على بسكويات الحنطة التقليدي (لعينة السيطرة) في معظم الخصائص الحسية. حقق البسكويات المدعم درجة قبول إجمالية أعلى من (٩,٥ مقابل ٨,٠)، وتميز بلون أكثر جاذبية (درجة كاملة ١٠) بفضل أصباغ الكاروتينويدات الموجودة في مسحوق الجزر، كما أظهر ملمسًا ممتازًا عند المضغ (درجة كاملة ١٠) نظرًا لمحتواه العالي من الألياف. على الرغم من تشابه درجات النكهة مع عينة السيطرة، إلا أن المنتج المدعم تفوق في الشكل والرائحة والملمس. إضافة إلى التحسينات الحسية، أظهرت البسكويات المدعمة خصائص فيزيائية محسنة، بما في ذلك زيادة في السماكة والقطر، مع الحفاظ على نسبة انتشار مضبوطة. كما أبرز التحليل الغذائي تحسينات ملحوظة: فقد ارتفع محتوى البروتين إلى ٢٤,٨٪، والألياف إلى ١٦,٩٨٪، والرماد (محتوى المعادن) إلى ٨,٠٩٪. في الوقت نفسه، انخفض إجمالي محتوى الكربوهيدرات بشكل كبير إلى ١٨,٧٣٪ مقارنةً بالبسكويات التقليدية. تؤكد هذه النتائج أن التركيبة المطورة تسد بنجاح فجوة بحثية من خلال دمج مسحوق أوراق ستيفيا ومسحوق الجزر، مما لم يُحسن فقط من قبول المنتج، بل أثرى أيضًا قيمته الغذائية، مما يجعله بديلًا صحيًا للبسكويات التقليدية المصنوعة من الحنطة.

الكلمات المفتاحية: البسكويات، طحين الذرة، خالي من الغلوتين، مسحوق أوراق ستيفيا، مسحوق الجزر، زيت نخالة الأرز.