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Exploring the Nutritional Properties of an Innovative Cake

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Abstract: This study aimed to develop and characterise an innovative cocoa cake enriched with chia seeds, designed to improve its nutritional and functional value while maintaining desirable sensory characteristics. Two formulations were evaluated: a conventional cocoa cake (control sample) and a cocoa cake supplemented with chia seeds (5% of flour weight). The addition of chia seeds represents an innovative approach due to their high dietary fiber, antioxidant compounds, and omega-3 fatty acid content. The objectives of the study were to evaluate the influence of chia seed incorporation on the physicochemical properties, nutritional value, color parameters, texture, and antioxidant capacity of the final product.

Introduction

The development of functional bakery products has gained increasing interest due to the demand for healthier foods. Chia seeds (*Salvia hispanica* L.) are rich in dietary fiber, protein, and polyunsaturated fatty acids, making them a promising ingredient for improving the nutritional quality of baked products. This study aimed to evaluate the effects of chia seed incorporation on the physicochemical, nutritional, and color properties of cakes compared with a traditional formulation.

Material and method

Cakes were prepared using eggs, wheat flour, sugar, cocoa powder, vegetable oil, vanilla sugar, baking powder, and salt, following a traditional recipe. For the innovative formulation, chia seeds were incorporated into the batter before baking. The batter was homogenized and baked at 180 °C for approximately 20 min. After cooling, the samples were subjected to physicochemical and color analyses.

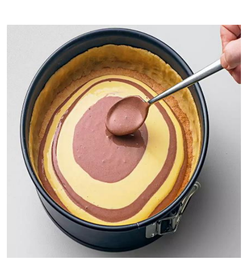
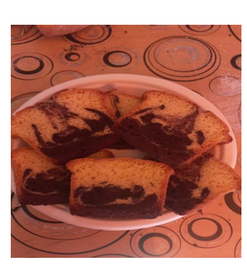
Moisture content and dry matter were determined using the oven-drying gravimetric method (AOAC 925.10). Protein content was determined using the Kjeldahl method, while lipids were quantified by Soxhlet extraction. Dietary fiber was measured using the enzymatic-gravimetric method (AOAC 991.43/985.29). Carbohydrate content was calculated by difference. Color parameters ($L*$, $a*$, and $b*$) were measured using a colorimeter or spectrophotometer based on the CIELAB system.

All determinations were performed in triplicate, and results were expressed as mean ± standard deviation. Statistical analysis was conducted to evaluate differences between the formulations, with significance set at $p<0.05$

Results and discussions

The incorporation of chia seeds significantly enhanced the nutritional profile of the cocoa cake. The enriched formulation presented a higher dietary fiber content and increased antioxidant activity due to the presence of phenolic compounds and natural antioxidants from both cocoa and chia seeds. Color analysis revealed lower lightness values (L*) for the enriched sample, while redness (a*) and yellowness (b*) increased slightly, resulting in a more intense chocolate appearance. The addition of chia seeds also improved texture by providing a moister crumb structure and enhanced freshness retention during storage.

Furthermore, the innovative cake exhibited improved functional properties through the enrichment with omega-3 fatty acids, making it a more attractive option for health-conscious consumers seeking bakery products with added nutritional benefits.


Conclusions

The results demonstrate that chia seed incorporation positively influences the physicochemical, nutritional, and functional characteristics of cocoa cake. The innovative formulation showed increased antioxidant capacity, higher dietary fiber content, improved moisture retention, and enhanced nutritional value compared to the conventional recipe.