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GREEN BANANA FLOUR: POTENTIAL INGREDIENT IN THE PRODUCTION OF GLUTEN-FREE MUFFINS WITH IMPROVED FUNCTIONAL PROPERTIES

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Abstract: The objective of the present study was to ascertain the impact of varying ratios of rice flour (RF) to green banana flour (GBF) on the proximate composition, physical characteristics and sensory acceptability of gluten-free muffins. Four samples of muffins were prepared using varying proportions of RF and GBF, namely 100:0%, 80:20%, 70:30% and 60:40%, respectively. The proximate composition of the three muffin samples with added GBF (M20GBF, M30GBF and M40GBF) was found to be superior to that of the control sample (CS). It can therefore be concluded that muffins with 40% GBF exhibited lower fat levels (5.53%) and protein levels (3.11%) and higher ash levels (4.44%) and fibre levels (9.95%), in comparison to the control sample, which exhibited fat levels of 7.25%, protein levels of 4.22%, ash levels of 2.18% and fibre levels of 2.87%. With regard to the physical characteristics of the muffins, it can be observed that as the proportion of GBF increased, the muffins exhibited a more compact structure, with reduced heights, widths and specific volumes. Following the sensory analysis of the muffin samples, it was observed that the muffin sample obtained from 70% RF and 30% GBF was rated the highest on the hedonic scale, with scores of 8.4 for appearance, 8.1 for texture, 8.5 for taste, 8.4 for flavour and 8.5 for general acceptability.

Keywords: green banana flour, muffins, sensory evaluation, proximate composition, physical characteristics

• Introduction

In recent decades, there has been a notable trend amongst food companies to encourage the development and optimisation of functional foods. Consumers are demanding new food products that not only satisfy physiological needs but also provide the necessary nutrients to prevent nutrition-related diseases and improve physical and mental health. A strong correlation has been demonstrated between nutritional intake and overall health and well-being. Green banana flour is an excellent source of resistant starch, dietary fibre, vitamins (in particular vitamin B6 and vitamin C), minerals (potassium and magnesium) and has strong antioxidant activity. The phenolic compounds present in green banana flour make it an appealing source for the development of pasta. In order to obtain gluten-free products, certain technological processes must be optimized in order to achieve the desired properties that meet consumer expectations. Therefore, it is necessary to identify new viable raw materials and to efficiently use them to produce flour-based products.

• Material and method

- Ingredients:** Rice flour, green banana flour and the other ingredients used in this study were purchased from local market in Timisoara town, Romania.
- Production of the muffin samples:** The gluten-free muffin samples (control and with different substitution levels of RF with GBF) were prepared according to the AACC International Method 10-50.05 with minor modifications.
- Sensory evaluation of the muffin samples.** A panel of 25 panelists have evaluated gluten-free muffin samples using a 9-point hedonic scale.
- The proximate composition, physical characteristics and general acceptability of the muffin samples** using standard laboratory procedures, were evaluated.

• Results and discussion

The results obtained regarding the proximate composition of the studied muffin samples show the superior nutritional profile of all three muffin samples with added GBF (M10GBF, M20GBF and M30GBF) compared to control sample (CS). Thus, the muffins with 40% GBF presented had lower fat levels of 5.53% and of protein 3.11% and respectively higher ash levels of 4.44% and fiber levels of 9.95%, compared to the control sample, which had fat levels of 7.25%, protein levels of 4.22%, ash levels of 2.18% and fiber levels of 2.87%. In terms of the physical characteristics of muffins it can be observed that with the percentage of GBF increased, the muffins exhibited a more compact structure, with reduced heights, width and specific volume. Following the sensory analysis of the muffins, it was observed that the muffin samples obtained from 70% RF and 30% GBF had been given the highest scores on the Hedonic scale.

Table 1. Proximate composition of gluten-free muffin samples

Proximate composition (%)	Gluten-free muffin samples			
	CS	M20GBF	M30GBF	M40GBF
Moisture	24.65±0.14	26.16±0.09	27.24±0.08	28.33±0.04
Fat	7.25±0.09	6.24±0.18	5.86±0.44	5.53±0.11
Protein	4.22±0.33	3.66±0.22	3.24±0.09	3.11±0.03
Crude fiber	2.87±0.34	5.96±0.36	7.82±0.22	9.95±0.44
Ash	2.18±0.22	3.49±0.43	3.84±0.06	4.44±0.08
Carbohydrates	58.83±0.06	54.49±0.09	52.00±0.08	48.64±0.24

Table 2. Physical characteristics of gluten-free muffin samples

Physical characteristics	Gluten-free muffin samples			
	CS	M20GBF	M30GBF	M40GBF
Weight (g)	26.23±0.08	27.24±0.33	27.86±0.22	28.04±0.46
Height (mm)	4.08±0.06	3.66±0.22	3.34±0.09	3.22±0.07
Width (mm)	4.44±0.63	3.82±0.42	3.68±0.42	3.36±0.01
Specific volume (cm ³ /g)	2.06±0.02	1.88±0.36	1.76±0.09	1.59±0.55

Table 3. Sensory evaluation of gluten-free muffin samples

Sensory evaluation	Gluten-free muffin samples			
	CS	M20GBF	M30GBF	M40GBF
Texture	7.22±0.34	7.92±0.65	8.11±0.08	7.84±0.09
Appearance	7.75±0.44	8.24±0.08	8.40±0.33	7.65±0.44
Taste	7.64±0.11	8.26±0.34	8.52±0.06	7.48±0.66
Flavor	7.55±0.07	8.12±0.26	8.48±0.07	7.66±0.68
Overall acceptance	7.44±0.23	8.06±0.33	8.54±0.28	7.52±0.44

Conclusions: The findings of this study demonstrate that the incorporation of GBF in muffin production results in the obtained of a flour product with enhanced nutritional and technological characteristics. Sensory assessment of RF and GBF-based muffins indicates that the utilization of up to 30% GBF in the muffins leads to an increase in consumer acceptance. The nutritional, physical and sensory evaluation of the resulting muffins revealed that GBF can be employed as a valuable plant-based ingredient in the development of novel food products with enhanced nutritional properties.