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Nutritional and sensory evaluation of gluten-free cake obtained from mixtures of rice flour, almond flour and arrowroot flour

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Abstract: The main purpose of this study was the development and sensory and chemical evaluation of an assortment of gluten-free cake, specially designed for people with celiac disease or diabetes, made of rice flour, almond flour and arrowroot flour. Three cake samples from rice flour, almond flour and arrowroot flour were prepared, added in different proportions (80:10:10%, 60:20:20%, 40:30:30%), mixed with other ingredients and compared with control sample (100:0:0%). Standard procedures were used to estimate the proximate composition of flours and cake samples obtained in this study.

• Introduction:

Celiac disease is one of the most common food intolerances worldwide, affecting about 1% of the population. Improving textural and flavor attributes for gluten-free products is still a challenge for food technologists. This study aimed to develop a gluten-free product: nutritionally optimized gluten-free cake, which would not have the allergenic factor, but would contain the nutrients needed to correct malabsorption deficiencies created by the disease, intended to be consumed by children and adults suffering from celiac disease.

• Material and method:

Plant materials. Rice flour (RF), almond flour (ALF), arrowroot flour (ARF) and the other ingredients used in this study were purchased from local market in Timisoara town, Romania.

Technological process for obtaining gluten-free cake: In this study we have obtained 4 types of gluten-free cake, as follows: a control cake (CC) – (100% RF:0%ALF:0%ARF), cake with 10% ALF and ARF addition (CM1), cake with 20% ALF and ARF addition (CM2) and cake with 30% ALF and ARF addition (CM3) with addition carob powder, butter, *Stevia* extract sweetener, xanthan gum, salt, baking powder and egg. The four cake samples were baked in preheated electric oven (Kumatel, Turkey) at 30 minutes at 175°C.

Sensory evaluation of gluten free cake with RF, ALF and ARF. A panel of 20 panelists have evaluated gluten-free cake using a 9-point hedonic scale. The general appearance, colour, texture, taste and overall acceptability, were evaluated.

Chemical evaluation of gluten free cake with RF, ALF and ARF: In order to evaluate the average nutritional value of gluten-free cake with RF, ALF and ARF, the following parameters were determined: moisture, fat content, protein content, ash content, crude fiber content, carbohydrate content according to A.O.A.C. and A.A.C.C. standard method. All determinations were performed in triplicate, calculating their arithmetic mean of three separate determinations.

• Results and discussions

The results obtained in this study indicate that the CM2 sample, with addition of 20% ALF and ARF is the best in terms of taste and overall acceptance for studied gluten-free cake.

Table 1. Sensory evaluation of gluten-free cake by 9-points hedonic scales

Samples	Appearance	Colour	Texture	Flavor	Overall acceptance
CC	6.76 ± 0.04	7.25 ± 0.11	7.52 ± 0.14	7.77 ± 0.32	7.46 ± 0.24
CM1	6.42 ± 0.25	7.44 ± 0.41	7.48 ± 0.42	7.84 ± 0.44	7.66 ± 0.44
CM2	6.68 ± 0.21	7.65 ± 0.32	7.69 ± 0.09	8.14 ± 0.27	7.96 ± 0.62
CM3	6.24 ± 0.06	7.38 ± 0.09	7.38 ± 0.08	8.04 ± 0.08	7.56 ± 0.34



Figure 1. The assortments of gluten-free cakes

The results obtained regarding the chemical composition of the gluten-free cake samples analysed in this study, show that the addition of ALF and ARF in the manufacturing recipe, caused a significant increase in nutrient content, so the products obtained can be considered products with a high functional potential, being important sources of minerals and fibers.

Table 2. Nutritional parameters evaluation of gluten-free cakes

Samples	CC	CM1	CM2	CM3
Moisture (%)	26.86	27.74	28.53	29.66
Carbohydrates (%)	45.24	42.33	39.68	36.74
Ash (%)	0.84	1.14	1.34	1.69
Fat (%)	10.47	16.22	18.52	20.28
Protein (%)	12.33	18.45	20.24	22.48

• Conclusions:

ALF and ARF investigated in this study can be considered as suitable ingredients for gluten-free cake supplementation, due to their high nutritional value. The gluten-free cake obtained from RF, ALF and ARF has a high content of nutrients such as: protein, fiber, fat and ash, and a low content of carbohydrates. Correlating the results obtained in terms of sensory and chemical analysis of cake samples, we can appreciate that the recipe established for obtaining the cake with the addition of 20% ALF: 20% ARF can be successfully applied on an industrial scale.