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FORMULATION AND SENSORY-NUTRITIONAL ASSESSMENT OF LOW-CARB KETOGENIC PASTRIES

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Abstract: This study explores the formulation and sensory–nutritional assessment of low-carbohydrate ketogenic pastry products developed using nutrient-dense, reduced-carb ingredients. Five samples were prepared: parmesan biscuits, spinach muffins, lemon cake, chocolate chip cookies, and ketogenic bread. Formulations were optimized by replacing conventional wheat flour and sugar with almond, flaxseed, and coconut flours, non-glycemic sweeteners, and lipid-rich components suitable for ketogenic dietary requirements. Processing parameters were adjusted to ensure structural stability and desirable textural properties in the absence of gluten and starch. Sensory analysis revealed that the most appreciated products among panelists were, in order, ketogenic bread, spinach muffins, and lemon cake, which received the highest acceptability scores. The most favorably evaluated sensory attributes were aroma, texture, and flavor persistence after swallowing, indicating successful optimization of both formulation and processing. Nutritional composition values highlighted a characteristic ketogenic profile across all products, defined by high lipid content (65–75%), moderate protein levels (20–25%), and very low net carbohydrate values (below 10% of total energy). Additionally, compared with conventional pastry products, the formulated samples exhibited increased dietary fiber content, contributing to improved nutritional balance. This nutritional profile underscores the potential of ketogenic pastries to support a balanced dietary approach within a low-carb nutritional framework and demonstrates their promising culinary and therapeutic potential as viable alternatives to traditional carbohydrate-rich baked goods.

Keywords: ketogenic products, reduced-carb pastries, sensory profile, nutritional values

• **Introduction**

Ketogenic pastry represents an innovative field at the intersection of food science, nutrition, and gastronomy, addressing the growing needs of people who follow the ketogenic diet or have restrictions on carbohydrate consumption. The fundamental challenge in this field lies in simultaneously replacing two essential components of traditional pastry: grain-based flours (rich in starch and gluten) and sugar (the main sweetening agent and structural element). These substitutions require a multidisciplinary approach, at the intersection of biochemistry, rheology, food science, and sensory analysis, in order to obtain products that maintain the organoleptic characteristics expected by consumers while also respecting strict macronutrient restrictions. Ketogenic pastry continues to evolve through the incorporation of innovative ingredients that overcome the limitations of traditional formulations, such as: *advanced functional flours* (lupin flour, fermented teff flour, defatted hemp seed flour); *functionalized proteins* (microparticulated whey proteins, hydrolyzed pea protein isolate, hydrolyzed collagen); *structured lipids* (beeswax–avocado oil oleogel, monoglyceride–MCT oil oleogel, enzymatically interesterified lipids); *functional fibers* (inulin modified through enzymatic hydrolysis, type-4 resistant starch fibers, fungal beta-glucans from *Ganoderma lucidum*); *innovative leavening agents* (controlled CO₂ injection, expanded protein microparticles).

• **Material and method**

Five recipes from ketogenic pastry were selected: parmesan biscuits, spinach muffins, lemon cake, chocolate chip cookies, and ketogenic bread. The technological reports outlined the yield and specific consumption for each stage of the technological process used to prepare the five ketogenic products. The sensory analysis was conducted using the descriptive method. A panel of 10 volunteers evaluated the ketogenic products. For the five ketogenic pastry samples, the energy value, macronutrient content, and salt amount were calculated. These were determined using data from the U.S. National Nutrient Database for Standard Reference, based on nutritional values per 100 g of product for proteins, total lipids, saturated fatty acids, carbohydrates, sugars, fiber, and salt.

• **Results and discussions**

Technological Preparation Reports for Ketogenic Samples

Technological sheet for the baking process of ketogenic spinach muffins

Technological stage	Raw material quantity [kg]	Final product quantity [kg]	Specific consumption	Yield [%]	Losses [%]	Technological parameters
Baking	0.647	0.582	1.11	90.0	10.0	t _{baking} = 25 min. T _{baking} = 170 °C

Technological sheet for the baking process of the ketogenic bread

Technological stage	Raw material quantity [kg]	Final product quantity [kg]	Specific consumption	Yield [%]	Losses [%]	Technological parameters
Baking	0.627	0.577	1.09	92.0	8.0	t _{baking} = 45 min. T _{baking} = 180 °C

Technological sheet for the baking process of the ketogenic parmesan biscuits

Technological stage	Raw material quantity [kg]	Final product quantity [kg]	Specific consumption	Yield [%]	Losses [%]	Technological parameters
Baking	0.400	0.350	1.17	85.6	14.4	t _{baking} = 15 min. T _{baking} = 160 °C

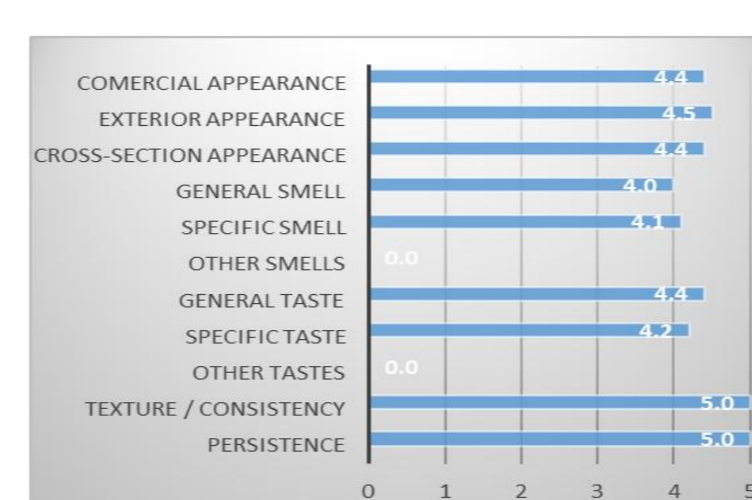
Technological sheet for the baking process of the ketogenic lemon cake

Technological stage	Raw material quantity [kg]	Final product quantity [kg]	Specific consumption	Yield [%]	Losses [%]	Technological parameters
Baking	0.808	0.751	1.08	93.0	7.0	t _{baking} = 20 min. T _{baking} = 160 °C

Technological sheet for the baking process of the ketogenic chocolate cookies

Technological stage	Raw material quantity [kg]	Final product quantity [kg]	Specific consumption	Yield [%]	Losses [%]	Technological parameters
Baking	0.472	0.425	1.11	90.0	10.0	t _{baking} = 15 min. T _{baking} = 170 °C

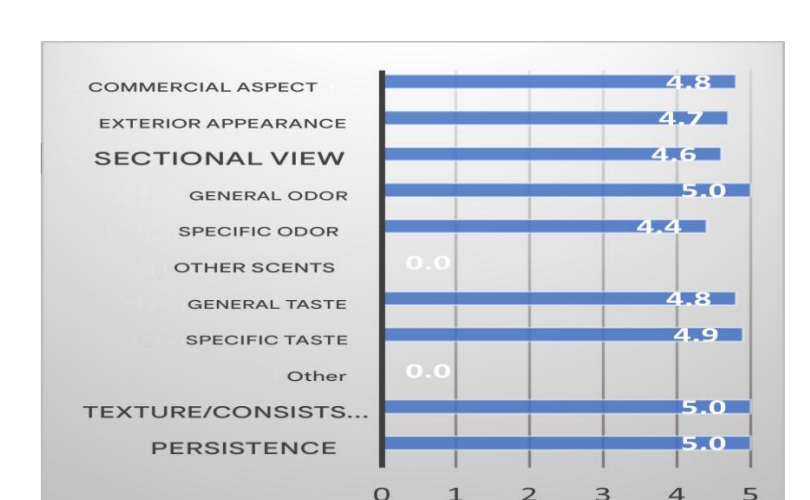
Sensory assessment of low-carb ketogenic pastries



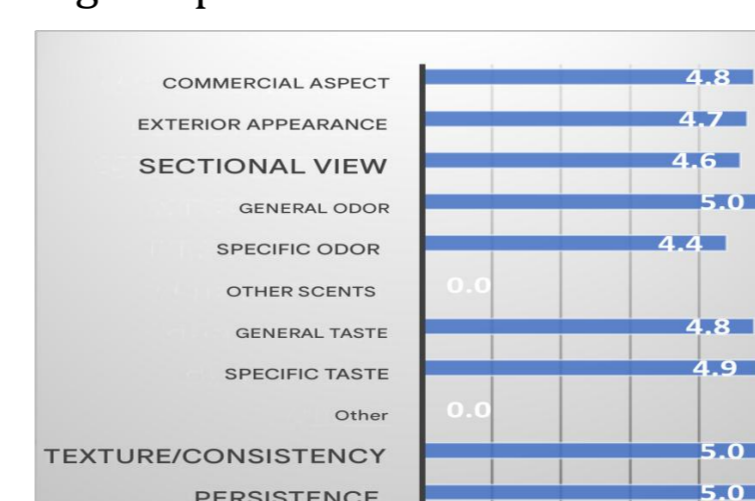
Average sensory attribute values of the ketogenic parmesan biscuits



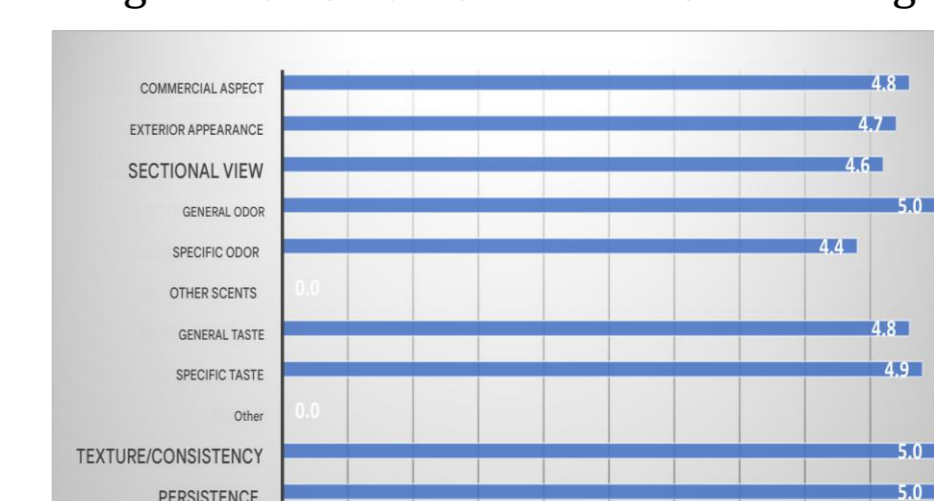
Average sensory attribute value of the ketogenic lemon cake



Average sensory attribute values of the ketogenic chocolate cookies



Average sensory attribute values of the ketogenic bread



Average sensory attribute values of the ketogenic spinach muffins

Nutritional Information of low-carb ketogenic pastries

No	Nutrient g/100g product	Ketogenic parmesan biscuit	Ketogenic bread	Ketogenic spinach muffins	ketogenic lemon cake	ketogenic chocolate cookies
1.	Fat of which:	19.8 g	19.8 g	24,7 g	20.1 g	22.8 g
2.	Saturated fatty acids	4.9 g	4.9 g	7.9 g	5.2 g	6.6 g
3.	Carbohydrates of which:	5.1 g	4.2 g	5.6 g	7.1 g	6.8 g
4.	Sugars	1.4 g	1.4 g	1.5g	1.4 g	1.4 g
5.	Fibre	3.9 g	3.8 g	4.1 g	3.4 g	3.9 g
6.	Proteine	9.2g	9.0 g	13.8 g	9.9 g	9.9 g
7.	Sare	0.5 g	0.7 g	1.4 g	0.7 g	0.4 g
Energy value:		237kcal/100g product 991 kJ/100g product	232 kcal/100g product 971 kJ/100g product	302kcal/100gproduct 1264 kJ/100g product	333kcal/100g product 1392kJ/100g product	388kcal/100g product 1624kJ/100g product

• **Conclusions**

Ketogenic pastries demonstrated higher dietary fiber content compared to conventional products, underscoring their potential to support balanced nutrition. In light of increasing metabolic disorders and the demand for personalized diets, ketogenic pastry emerges as both a culinary and therapeutic option. This study contributes to expanding low-carbohydrate pastry offerings, supporting quality of life and long-term dietary adherence.