Development of an innovative laminated dough with half-fat content

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Introduction and Objective

Consumers' awareness regarding the health impact of dietary intake has increased significantly over the past years, revealing serious concerns regarding the nutritional value and health-related features of the food products comprising their everyday diet. In this sense, the distinct food industry sectors have searched for, and developed, products with increasingly balanced nutritional profiles, which include, among others, reduced- or low-fat products/formulations. One such industry is the bakery industry, which offers a vast array of distinct products, and in which efforts have been undertaken to reformulate the traditional recipes to manufacture healthier products. Since butter (fat) represents 34% of the total ingredients comprising the traditional formulation, the aim of the present work was to develop an innovative laminated dough with significantly reduced fat and salt contents, but with which the products manufactured therewith would maintain the sensorial and technological properties of those produced with the conventional dough.

Methodology

Formulations

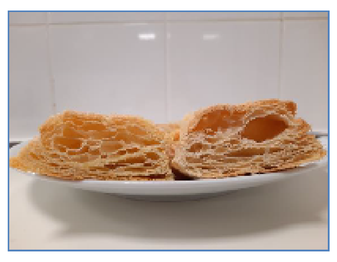
- Conventional
  - Flour
  - Salt
  - Butter
  - Water
- Alternative
  - Flour
  - Salt
  - Butter (50% of conventional recipe)
  - Acacia gum + wheat fiber
  - Water

Ingredients mixed and battered

Dough

Dough lamination

Doughs baking



Final products

Nutritional profiles

Fatty acids profiles (gas chromatography)

Firmness (texture analysis)

Color (CIELAB analysis)

Results

Table 1. Nutritional composition of conventional and alternative baked laminated doughs.

Parameter		Conventional	Alternative
Energy	kJ	2100	1793
	kcal	505	429
Total fat (lipids) (g/100g)		34.8	22.2
Saturated FA (g/100g)		18.5	12.5
Monounsaturated FA (g/100g)		12.6	7.5
Polyunsaturated FA (g/100g)		3.7	2.2
Total carbohydrates (g/100g)		44.4	53.4
Digestible carbohydrates (g/100g)		39.8	47.7
Total sugars (inv. sugars)		2.0	2.4
Total fiber (g/100)		4.6	5.7
Protein (g/100g)		5.8	6.8
Sodium / NaCl (g/100g)		0.89 / 2.23	0.46 / 1.15
Moisture (%)		12.4	16.2
Ash (%)		2.59	1.41

FA – fatty acids

Table 2. Fatty acids profiles (%distribution) of conventional and alternative baked laminated doughs.

Fatty acid	Conventional	Alternative
C8	0.02	0.03
C10	0.02	0.02
C12	0.42	0.33
C14:0	0.96	0.93
C15:0	0.02	0.04
C16:0	45.70	48.87
C16:1	0.10	0.08
C17:0	0.08	0.06
C17:1	0.01	0.02
C18:0	5.48	5.45
C18:1n9trans	0.02	0.02
C18:1n9c	36.16	33.56
C18:2n6c	10.21	9.80
C20:0	0.35	0.35
C20:1	0.01	0.01
C18:3n3(ALA)	0.24	0.25
C22:0	0.09	0.09
C24:0	0.08	0.07
C22:6n3(DHA)	0.01	0.02
Total	100	100
∑Saturated	53.23	56.23
∑Monounsaturated	36.31	33.70
∑Polyunsaturated	10.46	10.08
Total	100	100

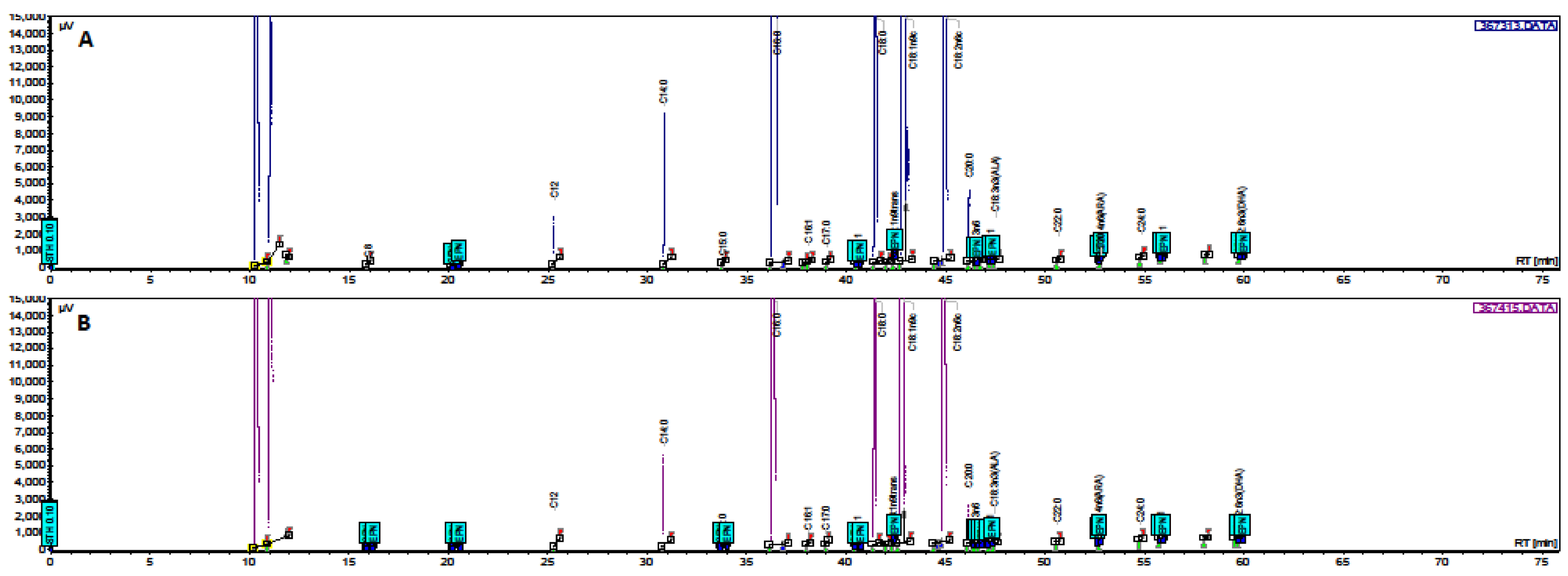


Fig. 1 Fatty acids chromatograms of the baked laminated doughs manufactured with the two formulations (A – conventional; B – alternative)

Nutritional profile

- Improved (lower) caloric value;
- Decreased fat content (ca. 40% less);
- Reduction ca. 50% salt content (Table 1).
- Similar fatty acids qualitative profiles (Table 2; Fig. 1).

Physical properties

- Similar firmness between both baked doughs.
- No significant color alterations.

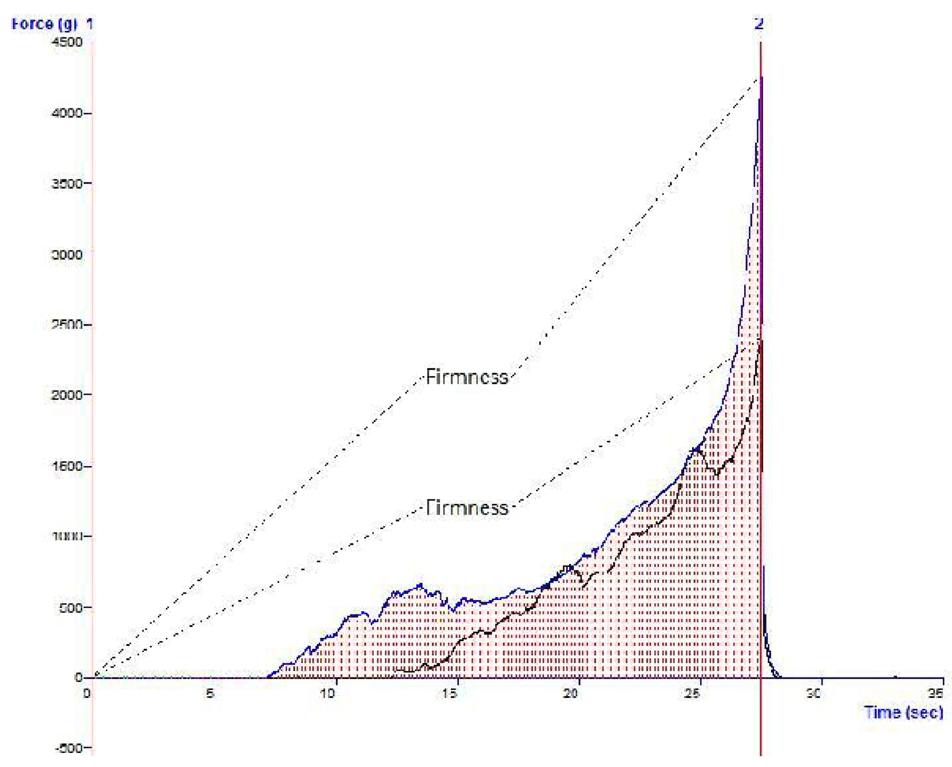


Fig. 2 Texture analysis (firmness) of the baked laminated doughs determined by cutting transversely.
(blue – conventional; black – alternative)

Table 3. CIELAB color space coordinates of conventional and alternative baked laminated doughs.

Part	Formulation	Coordinate				
		L	a	b	C	h
External	Conventional	54.2 ± 6.4	8.2 ± 3.4	19.2 ± 1.3	21.0 ± 2.3	67.4 ± 7.6
	Alternative	52.7 ± 3.00	8.2 ± 1.2	20.7 ± 0.7	22.3 ± 0.8	68.4 ± 2.9
Internal	Conventional	53.1 ± 5.7	0.45 ± 0.31	11.9 ± 1.5	11.9 ± 1.5	87.8 ± 1.5
	Alternative	44.9 ± 4.5	0.97 ± 0.15	10.1 ±0.7	10.1 ± 0.7	84.5 ± 0.8

L – lightness; a – red/green; b – yellow/blue; C – chroma ; h – hue angle

Conclusions

- Substitution of the butter by the acacia gum/wheat fiber mixture resulted in an innovative product, with an improved nutritional profile.
- Texture and color of the baked dough were not significantly impacted by the alternative lower fat formulation.
- A laminated dough with a healthier profile was achieved, presenting physical traits similar to those of the conventional formulation.

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Food Development & Production

Development of Clean Label Bakery Products with Natural Preservatives

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Introduction

Bakery products are generally well-liked and in high demand around the world, owing to their organoleptic properties as well as the wide diversity they may provide. Simultaneously, the consumer profile and level of knowledge about the health-food relationship have shifted in recent years. Furthermore, the nutritional imbalance and high energy density of some formulations have increased the association of many bakery products with unbalanced dietary patterns and their link to metabolic syndrome and chronic non-communicable diseases (NCDs). In this sense, the aim of this work was to improve the nutritional and functional profiles of bakery products by developing a healthy product line designated "Healthyfat" and "Nutrihealthy," as well as to reduce the high number of synthetic additives in these products by developing a new line of "Clean Label" products in which preservatives, aromas, and synthetic dyes were replaced by natural alternatives that were multifunctional, whenever possible.

Methodology

i) Evaluation of antimicrobial activity

Figure 1. Plant/fruit extracts utilized as natural alternatives.

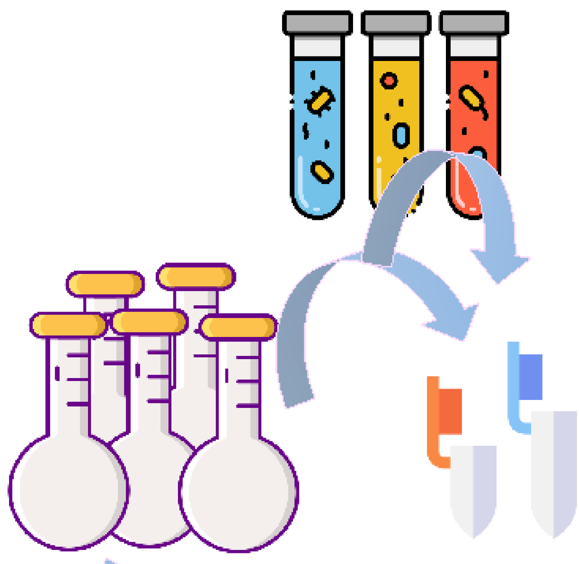

Figure 2. Assessment of extract solubility and contact with selected/target microrganisms.

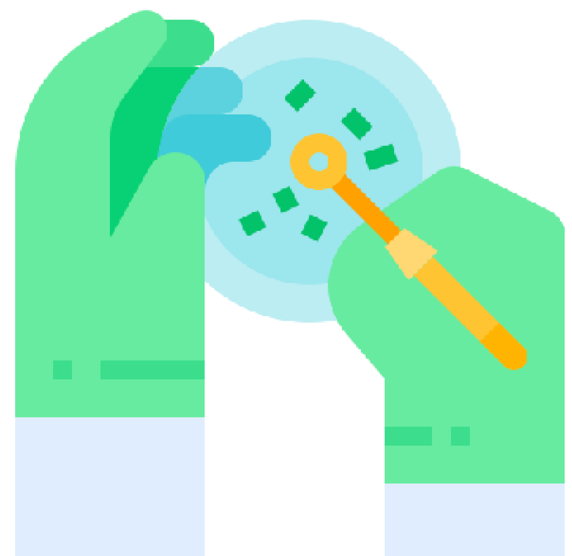

Figure 3. Determination of minimum inhibitory concentrations (MICs).

ii) Proof-of-concept

Figure 4. Baking of the new dough formulations and color measurement of the resulting products

Results

Developed formulation comprising natural coloring agent, alternative fats and selected water-soluble fibers

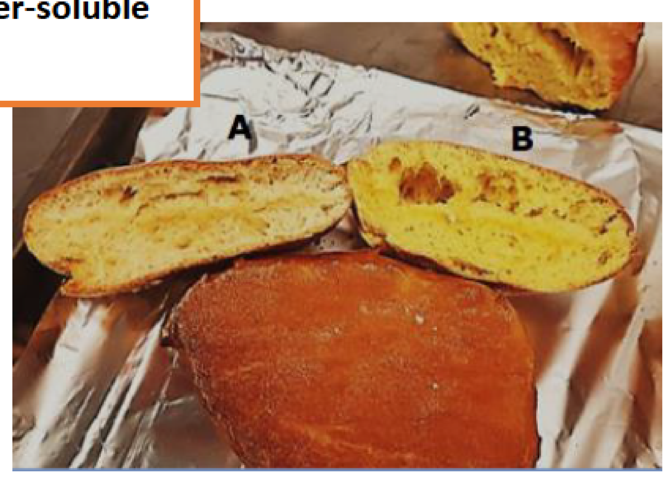

Figure 5. Interior color of breads made with control formulation (A) and natural coloring alternative (B).

Table 1. Spacial coordinates of bread produced with or without (control) coloring agent

Sample	Coordinate		
	L*	a*	b*
Control	63.93	1.76	14.76
Natural coloring agent	65.14	-2.40	22.48

L – lightness; a – red/green; b – yellow/blue

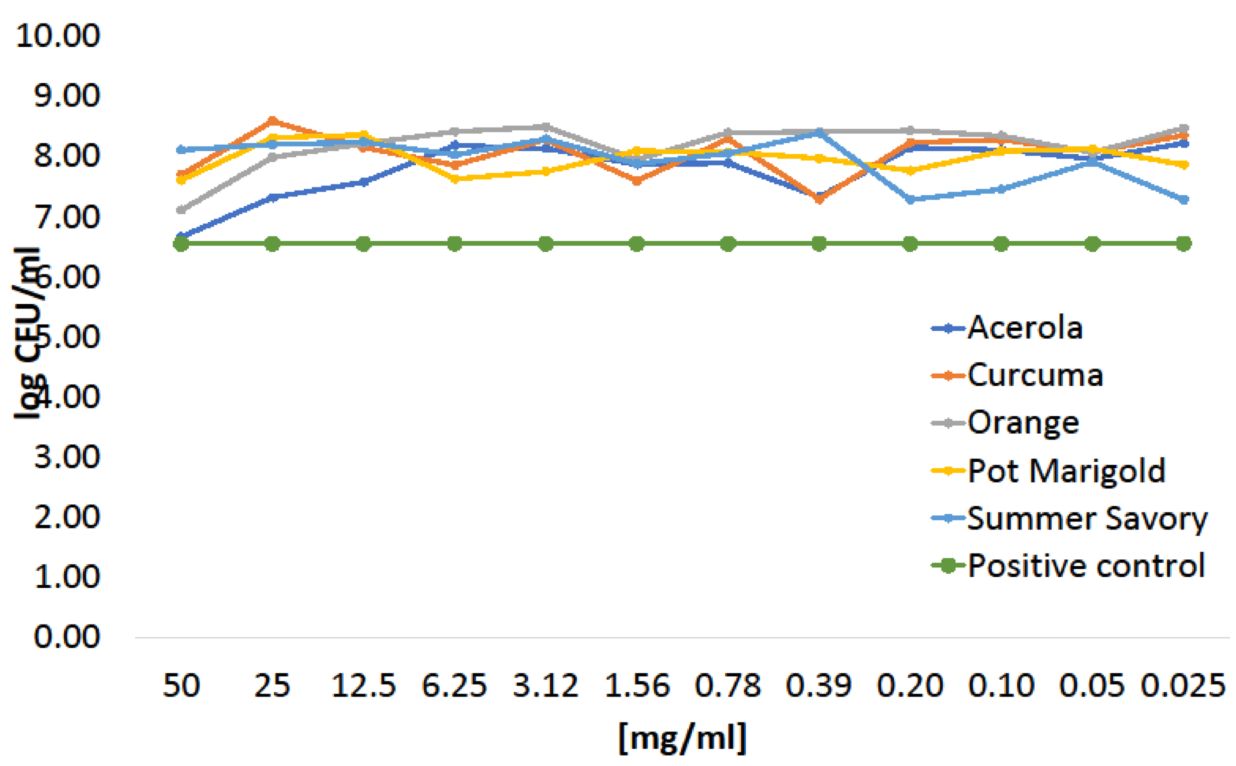

Figure 6. Minimum inhibitory concentration of each extract against *Saccharomyces cerevisiae*.

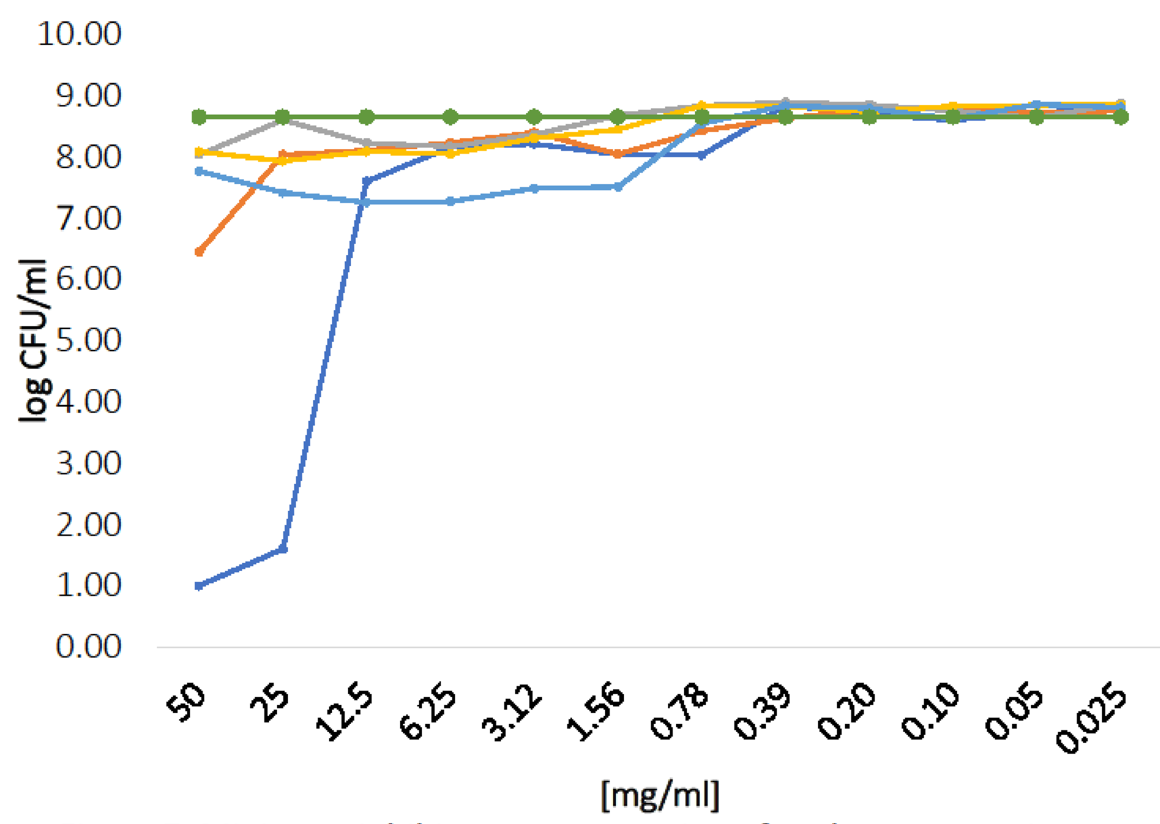

Figure 7. Minimum inhibitory concentration of each extract against *Bacillus cereus*.

Conclusions

- A new formulation was developed, containing 75% less butter (as ingredient) and 50% less total fat content than the control dough.
- Traditional brioche dough presents less yellow color than the new formulation with natural colorant.
- The formulations obtained demonstrated healthier nutritional profiles (% reduced fat) while retaining the technological and antimicrobial properties of the "brioche" dough.
- Developed alternative doughs are consistent with the "Clean label" concept.

Acknowledgements

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