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INNOVATIVE AND FUNCTIONAL ICE CREAM FORMULATIONS. PHYSICOCHEMICAL AND NUTRITIONAL EVALUATION

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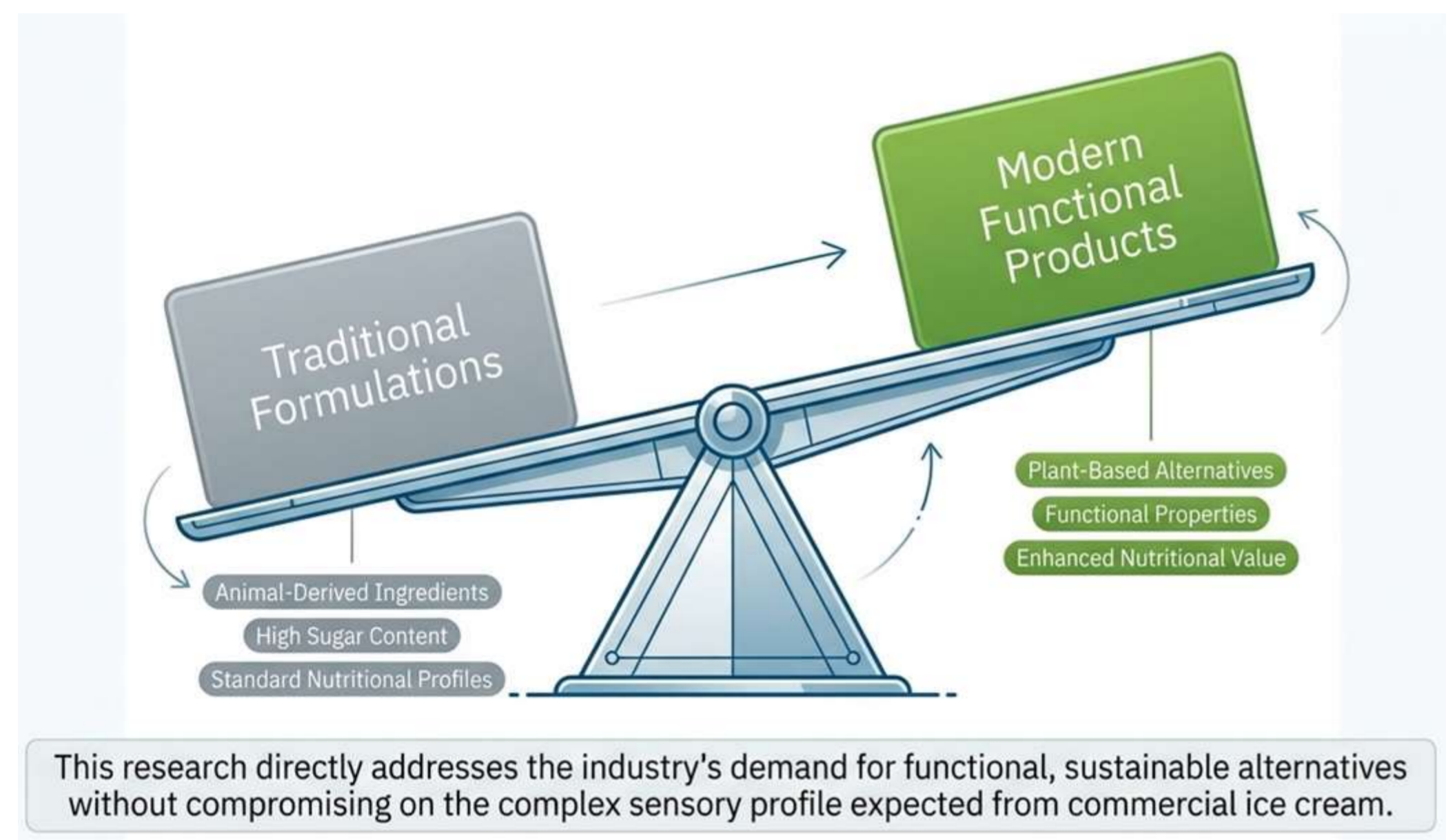
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Abstract

This research primarily aimed to develop innovative ice cream variants by replacing cream (a traditional fat source) with plant-based creams obtained from pine nuts, pumpkin seeds, sunflower seeds, and hazelnuts, in order to improve the nutritional profile and assess the impact on the physicochemical characteristics and sensory potential of the final product. In this context, the study aligns with current trends in the food industry focused on functional products and alternatives to animal-derived ingredients. Among the tested variants, the pumpkin seed ice cream showed the most promising characteristics, representing a viable alternative both technologically and nutritionally. The study's limitations include the lack of detailed analytical methods and sensory evaluation, which should be addressed in future research for comprehensive validation.

Introduction



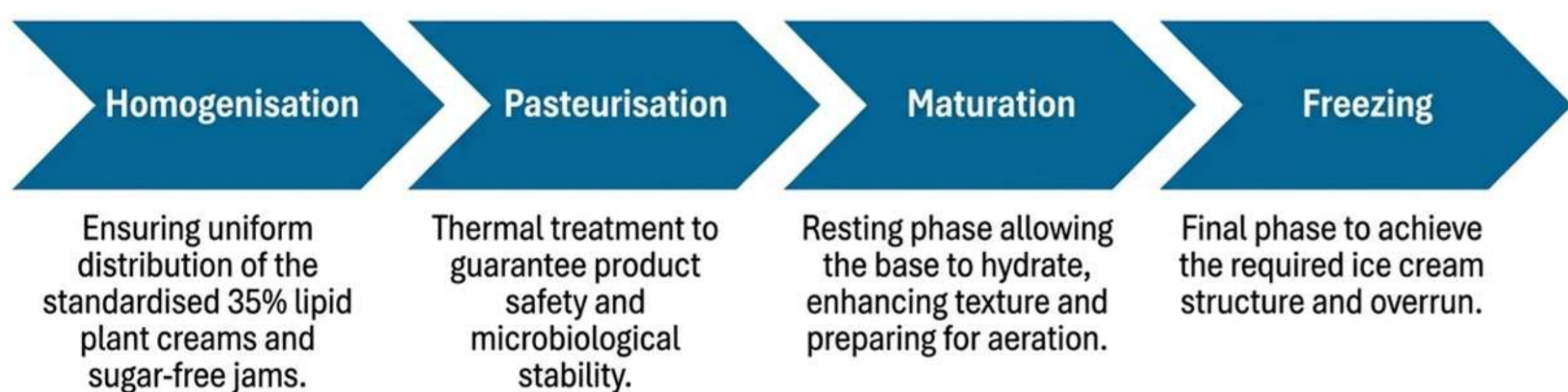
Materials and methods

The Sugar-Free Base Matrix
 Sugar-free fruit preserves provide the carbohydrate and flavour scaffolding.

The Experimental Lipid Variables

- Control Sample: Traditional Dairy Cream.
- Variant 1: Pine Nuts.
- Variant 2: Pumpkin Seeds.
- Variant 3: Sunflower Seeds.
- Variant 4: Hazelnuts.

The Technological Process Flow



In terms of materials and methods, blueberry jam and apple jam without added sugar were used, along with cream for the control sample and four types of plant-based raw materials (pine nuts, pumpkin seeds, sunflower seeds, and hazelnuts), processed into creams with an equivalent lipid content (35%) to ensure formulation comparability. Six ice cream variants were developed (one control sample and five experimental samples), obtained through standard technological processes. Subsequently, the products were analyzed from a physicochemical perspective, evaluating parameters such as dry matter content, proteins, lipids, ash, acidity, pH, soluble solids, and water activity.

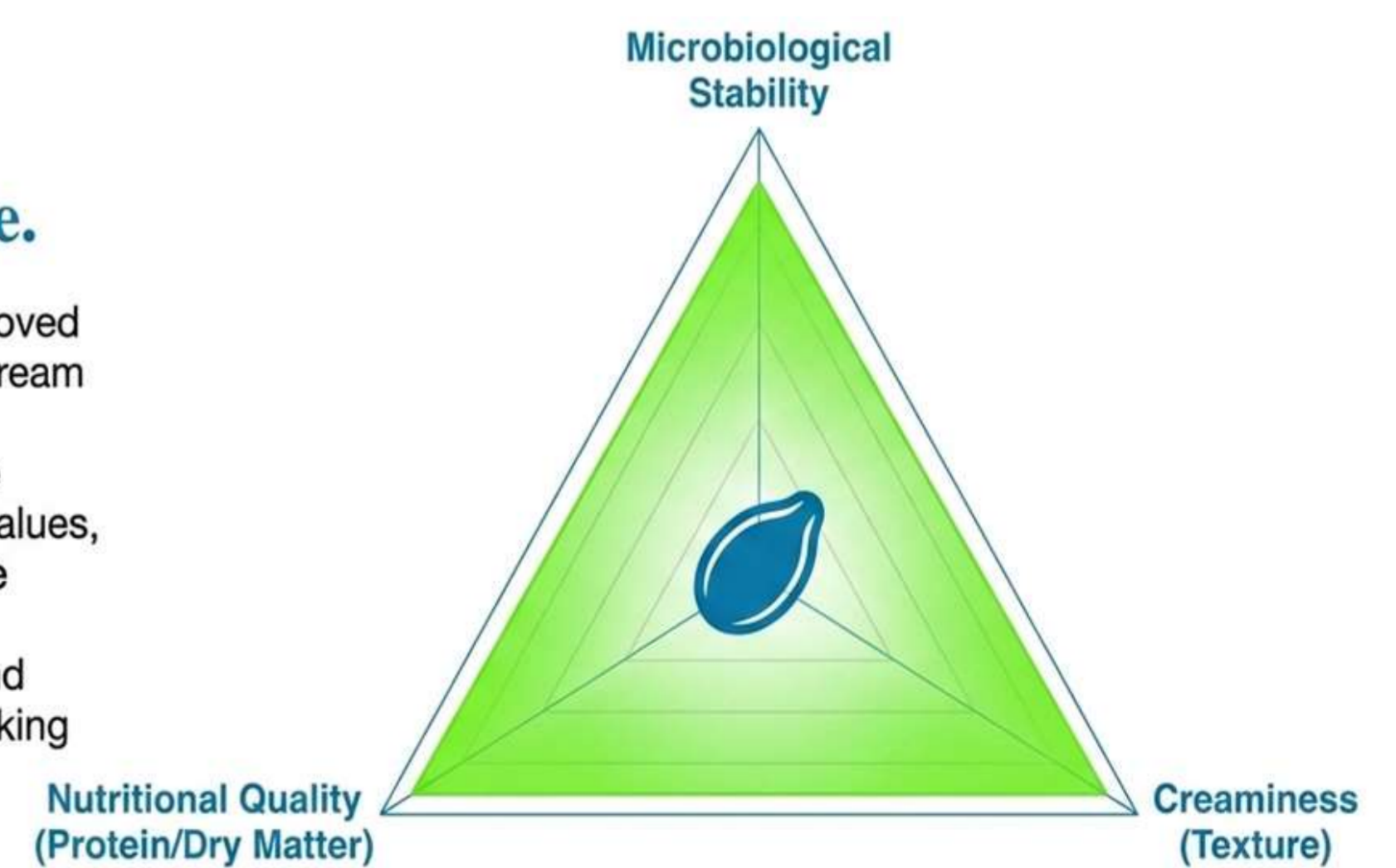
Commercial Feasibility Confirmed: All innovative plant-based variants successfully completed standard technological processing without requiring equipment modification.

Results and discussions

The results highlight significant differences between samples, determined by the type of plant-based ingredient used. In general, the variants containing seeds and nuts exhibited higher dry matter and protein contents compared to the control sample, suggesting a denser texture and superior nutritional value. In particular, the pumpkin seed sample stood out due to its high protein and dry matter values, indicating a favorable balance between stability, creaminess, and nutritional quality.

The Optimal Balance.

While all plant-based sources proved feasible, the pumpkin seed ice cream exhibited the most promising characteristics. By delivering the highest protein and dry matter values, it achieved a uniquely favourable balance between structural creaminess, product stability, and functional nutritional quality, making it the superior alternative.

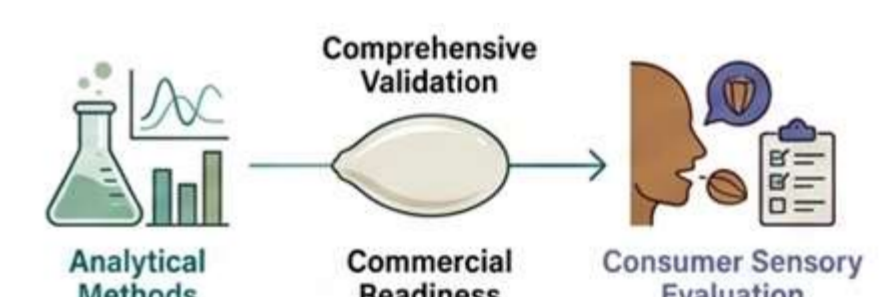


Metric	Control (Dairy)	Pine Nut	Pumpkin Seed	Sunflower Seed	Hazelnut
Acidity/pH	6.7-6.9	5.8-6.1	6.2-6.4	5.9-6.2	6.0-6.3
Water Activity	≈ 0.97	≈ 0.97	≈ 0.97	≈ 0.97	≈ 0.97



Future Research & Validation

To achieve comprehensive validation and commercial readiness, future studies must address current limitations by integrating detailed analytical methods and rigorous consumer sensory evaluation.



Conclusions

The research validates that the replacement of dairy cream with plant-based sources is not only technologically feasible but nutritionally superior. These alternatives facilitate the production of ice creams with enhanced functional properties, particularly regarding protein and mineral mineralization.