Development of Vitamin-enriched Functional Curd Bars Using Cryogenic Grinding Technology and Comprehensive Quality Assessment

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Abstract

In the context of the increasing prevalence of diet-related disorders and micronutrient deficiencies, the development of food products aimed at improving the vitamin content and nutritional quality of the human diet is of particular relevance. This study explores the application of cryogenic grinding technology in the development of vitamin-enriched curd bars with functional properties. Cryogenic grinding enables the production of plant-based powders with high retention of thermolabile vitamins and amino acids, making this technology promising for use in preventive and functional nutrition. Cryogenically ground plant powders were incorporated into curd bar formulations at different concentrations as functional ingredients. Physicochemical, structural–mechanical, and sensory properties of the finished products were systematically evaluated using standard analytical techniques, including moisture content, protein and fat determination, pH measurement, texture analysis, and sensory assessment by expert panels. Additionally, the vitamin content, amino acid profile, and overall nutritional value of the curd bars were assessed. The results demonstrated that the inclusion of cryogenically processed plant raw materials led to an increase in vitamin content and improved the amino acid profile, while contributing to the formation of a stable product structure and maintaining acceptable texture and sensory characteristics. Optimal concentrations of cryopowders were identified, ensuring enhanced nutritional and functional value without deterioration of consumer acceptability. These findings confirm the feasibility of applying cryogenic grinding technology in the development of functional dairy products designed for the prevention of diet-related deficiencies and the improvement of overall nutritional quality.

Keywords

Cryogenic Grinding, Cryopowders, Vitamin Enrichment, Amino Acids, Functional Dairy Products, Curd Bars, Preventive Nutrition, Nutritional Quality