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S3-P17: Starch-Dependent Changes in Bioactive Compounds and Microbiological Stability of 3D-Printed Jostaberry Products

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3D printed food represents an emerging and rapidly developing approach in food science that enables the design and production of personalized and functionally tailored food products with precisely controlled structure, composition, and nutritional value. One of the key determinants of the quality of the final printed product is the selection of appropriate raw materials, as ingredient composition strongly influences printability, rheological behaviour, structural integrity, and the stability of the printed matrix. In addition to achieving desirable technological and sensory properties, a major challenge in 3D food printing is ensuring the stability and safety of the product during storage. Changes occurring post-processing, such as moisture redistribution, structural relaxation, and degradation of bioactive compounds, can significantly affect both the nutritional quality and microbiological safety of the final product. Therefore, stability assessment during storage is essential for the successful development of functional 3D-printed foods.

In this study, the suitability of 3D printing technology was investigated using jostaberry (*Ribes × nidigrolaria*) as a functional fruit ingredient, with a particular focus on the influence of starch type (corn or wheat) and refrigerated storage (4°C for 12 days) on the physicochemical properties, bioactive profile, and microbiological stability of printed snacks. Both starch systems enabled successful printing, however, they differently affected product quality. Wheat starch increased total soluble solids and improved anthocyanin retention, whereas corn starch contributed to higher levels of other polyphenolic subclasses, indicating substrate-dependent modulation of bioactive compound stability.

Storage time had the most pronounced effect on product stability. Colour changes became more evident during storage, with a marked increase in ΔE values after day 5, mainly associated with moisture loss and starch retrogradation processes. The degradation of polyphenols was compound-specific: condensed tannins and anthocyanins decreased by 27.6% and 37.3%, respectively, while total phenolic content remained relatively stable throughout storage.

Microbiological analysis confirmed the absence of *Salmonella*, *Enterobacteriaceae*, yeasts, and moulds after 12 days of storage, demonstrating that the printed products maintained microbiological safety under refrigerated conditions. Overall, the results indicate that jostaberry is a suitable ingredient for the development of functional 3D-printed snacks with acceptable structural, bioactive, and microbiological stability during short-term refrigerated storage.

Keywords: 3D printed food, jostaberry (*Ribes × nidigrolaria*), bioactive compounds, microbiological stability, refrigerated storage