

Preserving Fish Freshness for 3D-Printed Desserts: The Role of Sweet Basil Extract in Gilt-Head Bream Storage

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The gilt-head bream (*Sparus Aurata*), commonly known as gilthead, is a marine fish species from the *Sparidae* family. This fish is an excellent dietary source of essential fatty acids, including eicosapentaenoic acid (EPA; 20:5n-3) and docosahexaenoic acid (DHA; 22:6n-3), which are often lacking in typical adult and children diets. As consumers become more aware of the nutritional limitations of processed foods, the demand for natural and nutrient-rich ingredients continues to grow. Advances in 3D food printing have opened up new possibilities for creating personalized and nutritious meals. This technology allows for the customization of food texture and flavor, appealing to the growing interest in healthy, innovative cuisine. However, the safety of raw ingredients used in 3D printing remains a significant concern, making the development of preservation techniques crucial.

This study aimed to explore the potential of using gilt-head bream as an ingredient in 3D-printed desserts while extending the shelf life of minced fish meat through natural preservation methods. Sweet basil (*Ocimum basilicum* L.) extracts, obtained via hydrodistillation and supercritical fluid extraction (SFE), were used as natural antioxidants. The minced fish meat was divided into five groups, stored at 4 ± 1 °C, and analyzed over four days. Five treatments were tested: T1 (0.075 µL/g EO), T2 (0.150 µL/g EO), T3 (0.075 µL/g SFE), T4 (0.150 µL/g SFE), and T5 (control, without EO and SFE). Total volatile basic nitrogen (TVB-N) was used as a biomarker to assess protein and amine degradation. TVB-N values increased gradually during storage, but remained relatively low, indicating good fish quality and freshness, especially in samples treated with SFE (T3). On the first day, TVB-N levels were lowest in T3 (1.23 mgN/100 g) compared to the control (1.99 mgN/100 g). By the fourth day, T3 still had the lowest TVB-N value (5.97 mgN/100 g) relative to the control (9.42 mgN/100 g). These results suggest that the sweet basil extract, particularly SFE, effectively slowed protein degradation and helped maintain fish quality for a longer period.

In conclusion, using natural antioxidants like sweet basil extracts shows promise in preserving the freshness of fish-based ingredients for 3D-printed foods. Future research should focus on optimizing the texture and elasticity of these fish-enriched desserts to enhance their sensory appeal. Refining these aspects will be essential for bringing a viable, nutrient-rich, and innovative product to market in the coming years.

Key words: functional food; natural preservatives; *Sparus Aurata*; TVBN; 3D printing

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