Edible algae-based decellularized scaffolds as a promising platform towards novel cellular agriculture products

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Abstract (Max 2000 characters)

Cellular agriculture holds the potential to generate meat and seafood alternatives to traditional products in a sustainable way and respecting animal welfare. In order to replicate the native structure/properties of the animal tissue, there is a high demand for edible scaffolds capable of promoting cell growth and differentiation (particularly towards muscle / fat cells). To the best of our knowledge, decellularized plant-based scaffolds have not been employed to address the fabrication of cultured fish meat, nor have algae been used as a raw material to fabricate scaffolds recapitulating a more marine-like microenvironment. This study aims to fabricate and characterize novel edible algae-based decellularized scaffolds for fish cellular agriculture applications. Samples of two commercially available and edible algae (ulva lactuca and saccharina latissima) and spinach leaves (spinacia oleracea, most used plant-based scaffold) were decellularized using a sodium dodecyl sulfate (SDS)-based procedure. The success of the decellularization protocol was showed by the significant reduction of the DNA content (PicoGreen DNA assay) while retaining the typical cellulose structure, as confirmed by the positive Calcofluor White staining. The decellularized scaffolds were characterized in terms of their morphological and mechanical properties by scanning electron microscopy and nanoindentation tests, respectively. Interestingly, all decellularized scaffolds seeded with Dicentrarchus labrax (European sea bass) embryonic cell line showed ability to support cell viability and proliferation after 10 days of culture. Moreover, the scaffolds' ability to support the maturation of atlantic mackerel (Scomber scrombus) skeletal muscle cell line was assessed by immunofluorescence and RT-qPCR (gene expression) analysis. Overall, our results suggest that algae-based decellularized scaffolds may serve as edible and affordable platforms for the sustainable fabrication of fish cellular products.

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