# ISOLATION AND FUNCTIONAL CHARACTERISATION UNCOVER ENZYMES FOR EICOSAPENTAENOIC ACID (EPA) BIOSYNTHESIS IN A SEA URCHIN HEMICENTROTUS PULCHERRIMUS

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**Résumé**

Sea urchins are commercially important delicacies in Asian and Mediterranean countries. Their growth, gonadal (edible part) development and nutritional quality are largely depend on diet. Hence, understanding precise dietary nutritional requirement is crucial to develop effective aquaculture methods. The present study examines the endogenous biosynthetic capability of long-chain polyunsaturated fatty acids (LC-PUFA) such as eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) in a sea urchin *Hemicentrotus pulcherrimus* through the comprehensive identification of genes encoding enzymes involved in the LC-PUFA biosynthesis and their functional characterisation. Three front-end desaturases and thirteen fatty acid elongases were identified from *H. pulcherrimus* genome and transcriptomes. Functional characterisation in yeast confirmed Δ5 and Δ8 desaturase activities in FadsA and FadsC1, respectively (Figure 1). Among the elongases, Elovl6C and Elovl1/7 showed preferential elongation activities towards C18 PUFA substrates, and C20-C22 LC-PUFA substrates, respectively (Figure 1). In summary, *H. pulcherrimus* possesses the enzymatic capacity to synthesise physiologically important LC-PUFA, namely arachidonic acid (ARA, 20:4n-6) and EPA from linoleic acid (LA, 18:2n-6) and $\alpha$-linolenic acid (ALA, 18:3n-3), respectively (Figure 1). Therefore, ARA and EPA can be classified as non-dietary essential fatty acids, whereas LA and ALA are highly likely dietary essential fatty acids for *H. pulcherrimus*. The lack of enzymatic capability to fully achieve DHA biosynthesis from EPA is consistent with previous studies suggesting that DHA might be non-essential in some sea urchin species. These findings will be valuable to develop efficient diets for *H. pulcherrimus* aquaculture.

**Mots-Clés:** sea urchin, diet, aquaculture

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