

3-ketoacyl-CoA synthase 7 from *Xanthoceras sorbifolium* seeds is a crucial regulatory enzyme for nervonic acid biosynthesis

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ABSTRACT: Nervonic acid (C24:1) is a very-long-chain fatty acid that plays an imperative role in human brain development and other health benefits. In plants, 3-ketoacyl-CoA synthase (KCS) is the key rate-limiting enzyme for C24:1 biosynthesis. *Xanthoceras sorbifolium* is a valuable oil-producing economic woody species with abundant C24:1 in seed oils, but the key KCS gene responsible for C24:1 accumulation remains unknown. In this work, a correlation analysis between the transcript profiles of KCS and dynamic change of C24:1 content in developing seeds of *X. sorbifolium* were conducted to screen out three members of KCS, namely *XsKCS4*, *XsKCS7* and *XsKCS8*, potentially involved in C24:1 biosynthesis. Of which, the *XsKCS7* was highly expressed in developing seeds, while *XsKCS4* and *XsKCS8* displayed the highest expression in fruits and flowers, respectively. Overexpression of *XsKCS4*, *XsKCS7* and *XsKCS8* in yeast *Saccharomyces cerevisiae* and plant *Arabidopsis thaliana* indicated that only *XsKCS7* possessed the ability to facilitate the biosynthesis of C24:1. These findings collectively suggested that *XsKCS7* played a crucial role in specific regulation of C24:1 biosynthesis in *X. sorbifolium* seeds.

Keywords: 3-ketoacyl-CoA synthase, Regulatory enzyme, Nervonic acid, Gene functional identification, *Xanthoceras sorbifolium* seed.

文冠果XsKCS7调控种子神经酸合成

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摘要: 神经酸 (C24:1) 是一种长链脂肪酸, 在人类大脑发育和其他健康益处中起着至关重要的作用, 在植物中, 3-酮脂酰-CoA 合成酶 (KCS) 是神经酸生物合成的关键限速酶。文冠果 (*Xanthoceras sorbifolium*) 是一种有价值的木本油料经济树种, 其种子油中含有丰富的神经酸, 但调控神经酸积累的关键 KCS 基因尚不明确。本研究通过对文冠果种子发育过程 KCS 基因转录表达谱和神经酸含量动态变化作相关性分析, 筛选出可能参与神经酸生物合成的 KCS 成员 *XsKCS4*、*XsKCS7* 和 *XsKCS8*。其中, *XsKCS7* 基因在发育中的种子中表达量最高, 而 *XsKCS4* 和 *XsKCS8* 基因分别在果实和花中表达量最高; 将 *XsKCS4*、*XsKCS7* 和 *XsKCS8* 基因分别在酿酒酵母和拟南芥中过表达, 发现只有 *XsKCS7* 具有调控神经酸合成的能力。以上结果表明, *XsKCS7* 基因在文冠果种子神经酸生物合成的特异性调控中起着至关重要的作用。