# Lipidomic and transcriptomic analysis of the increase in eicosapentaenoic acid under cobalamin deficiency of Schizochytrium sp.

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**Abstract**

Schizochytrium sp. is a heterotrophic microorganism capable of accumulating polyunsaturated fatty acids, and has achieved industrial production of docosahexaenoic acid (DHA). It also has the potential for eicosapentaenoic acid (EPA) production. In this study, it was found that the cell growth, lipid synthesis and fatty acid composition of Schizochytrium sp. were significantly affected by the level of cobalamin in the medium, especially with regards to the content of EPA in the fatty acids. The content of EPA in the fatty acids increased 17.91 times, reaching 12.0%, but cell growth and lipid synthesis were significantly inhibited under cobalamin deficiency. The response mechanism for this phenomenon was revealed through combined lipidomic and transcriptomic analysis. Although cell growth was inhibited under cobalamin deficiency, the genes encoding key enzymes in central carbon metabolism were still up-regulated to provide precursors (Acetyl-CoA) and reducing power (NADPH) for the synthesis and accumulation of fatty acids. Moreover, the main lipid subclasses observed during cobalamin deficiency were glycerolipids (including glycerophospholipids), with EPA primarily distributed in them. The genes involved in the biosynthesis of these lipid subclasses were significantly up-regulated, such as the key enzymes in the Kennedy pathway for the synthesis of triglycerides. Thus, this study provided insights into the specific response of Schizochytrium sp. to cobalamin deficiency and identified a subset of new genes that can be engineered for modification.

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