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Protein engineering: regulatory perspectives of stearoyl CoA desaturase

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Abstract

Stearoyl Co A desaturase (SCD) is a rate-limiting lipogenic enzyme that plays an integral role in catalyzing the synthesis of monounsaturated fatty acids, chiefly oleate and palmitoleate. Both contribute a major part of the biological membrane. Numerous SCD isoforms exist in mouse and humans, i.e., SCD-1 to SCD-4 and SCD-1 and SCD-5, respectively. From the biological viewpoint, hyperexpression of SCD1 cause many metabolic disorders including obesity, insulin resistance, hypertension, and hypertriglyceridemia, etc. Herein, an effort has been made to highlight the value of protein engineering in controlling the SCD-1 expression with the involvement of different inhibitors as therapeutic agents. The first part of the review describes Stearoyl CoA desaturase index and different SCD isoforms. Various regulatory aspects of SCD are reviewed in four subsections, i.e., (1) hormonal regulation, (2) regulation by dietary carbohydrates, (3) regulation by green tea, and (4) regulation via polyunsaturated fatty acids (PUFAs). Moreover, the regulation of Stearoyl CoA desaturase expression in the metabolism of fats and carbohydrates is discussed. The third part mainly focuses on natural and synthetic inhibitors. Towards the end, information is also given on potential future considerations of SCD-1 inhibitors as metabolic syndrome therapeutics, yet additional work is required.

Keywords: Protein engineering; Stearoyl CoA desaturase; Isoforms; Desaturase index; Regulation; Metabolic disorders

1. Introduction

Stearoyl-Co A desaturase (SCD) is a central lipogenic enzyme that represents a potential target for lipogenesis control [1]. SCD anchored in the endoplasmic reticulum (ER) membrane and catalyzes the synthesis of monounsaturated fatty acids (MUFAs), chiefly oleate and palmitoleate from saturated fatty acids (SFAs). Among numerous SD isoforms, two SCD isoforms exist in human i.e., SCD-1 and SCD-5, whereas, four SCD isoforms exists in mouse, i.e., SCD-1 to SCD-4. In humans, SCD-1 is abundantly expressed in lipogenic tissues, while SCD-5 is predominantly expressed in the brain and pancreas [2, 3]. Whereas, in mouse, SCD-1 is ubiquitously expressed and shows higher expression in metabolic tissues. SCD-2 is ubiquitously expressed in most tissues except adult mouse liver. SCD-3 is mainly expressed in Harderian gland, preputial gland, and in mature sebocytes of skin [4]. SCD-4 is expressed mainly in the heart [5].

Complications of venter adiposity or obesity (pear-shaped body), insulin resistance (IR), hypertriglyceridemia, hypertension, and low level of high-density lipoprotein (HDL) are the

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