

Dietary Sucrose and CD36 Receptor in Non-Alcoholic Fatty Liver Disease (NAFLD)

Mini Review

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Abstract

Ingestion of dietary sucrose or fructose or in sweetened beverages causes lipogenesis in the enterocyte to form fatty acids (FA), which are transported by chylomicrons to the liver and adipose tissue; however, the lipolysis of adipocyte during insulin resistance releases FA that are carried to hepatic tissue and are introduced in hepatocyte through CD36 receptor; these events are closely related to the formation of hepatic steatosis and development of Non-Alcoholic Fatty Liver Disease (NAFLD).

Keywords: Fatty liver; CD36; Sucrose; Lipogenesis; Steato-hepatitis

Abbreviations: NAFLD: Non-Alcoholic Fatty Liver Disease; NASH: Non Alcoholic Steatohepatitis; VLDL: Very Low Density Lipoprotein; FA: Fatty Acids; GLUT: Glucose Transporter; F-1-P: Fructose-1-Posphate; G-6-P: Glucose-6-Posphate; Tg: Triglycerides

Introduction

In the development of Non-Alcoholic Fatty Liver Disease (NAFLD), important biomolecules such as sucrose and dietary fructose give rise de novo lipogenesis causing hepatic steatosis. On the other hand, fatty acids which are released from adipose tissue during the lipolysis (in insulin resistance) are transported to the liver and introduced in the hepatocyte by the CD36 receptor (transmembrane glycoprotein), favoring the pathogenesis of fatty liver (Figure 1).

Intake of Sucrose and Hepatic Steatosis

Non-alcoholic fatty liver disease (NAFLD) defines a group of diseases ranging from simple steatosis to inflammatory steatohepatitis (NASH) with increasing levels of fibrosis and, finally, cirrhosis [1,2]. The prevalence of NAFLD has risen considerably globally and represents the most important cause of liver disease in the Western countries [3].

In many cases, NAFLD is associated with one or more features of the metabolic syndrome: insulin resistance, glucose intolerance or diabetes, central obesity, dyslipidemia and hypertension [4-6]. One of the most important causes of steatosis is the nutritional factors. Fructose consumption and/or sugar-sweetened beverages represent a potential risk for metabolic syndrome and diabetes [7-10]. The utilization of fructose in liver metabolism is not restricted by the rate-limiting step of phosphofructokinase, avoiding the regulating action of insulin [11]. Fructose intake is 2-3 fold higher in patients with NASH and recently daily fructose ingestion has been associated with increased hepatic fibrosis [7,12]. Numerous epidemiologic studies show a link between sugars sugar consumption, particularly in the form of sugar-sweetened beverages, and various adverse metabolic consequences [13-19]. A small amount of the fructose taken up by the liver may be converted in the process of lipogenesis into fatty acids (FA). These FA are converted to triglycerides in the hepatocytes and are

released into the systemic circulation complexed with the VLDL. However, it has been postulated the participation of FA in the development of fructose-induced hepatic steatosis, particularly when large doses of this sugar is administered [20].

CD36 Receptor and Fatty Liver

CD36 is a transmembrane glycoprotein present on platelets, mononuclear phagocytes, adipocytes, hepatocytes, myocytes and others [21-22]. Is also known to have functions as a facilitator of long chain fatty acid transport [23].

In animal models, ablation of CD36-mediated lipid uptake into liver or muscle prevented lipotoxicity [24] and other researches, in which CD36 was specifically induced in the liver by pharmacologic means or cDNA transduction; it may lead to steatosis, associated with metabolic disorders [25]. Overexpression of CD36 increases FA uptake and triglyceride storage in human hepatic cells and the liver of C57BL6 mice [26,27]. In patients with NAFLD, CD36 up-regulation is significantly associated with hepatic fat accumulation [28].

Conclusion

In conclusion, all these findings related with sucrose intake and hepatic lipogenesis, suggest that hepatic CD36 expression is closely related to hepatic steatosis in development of Non-alcoholic fatty liver (NAFLD) in humans and animal models.

Acknowledgement

None.

Conflicts of interest

None.

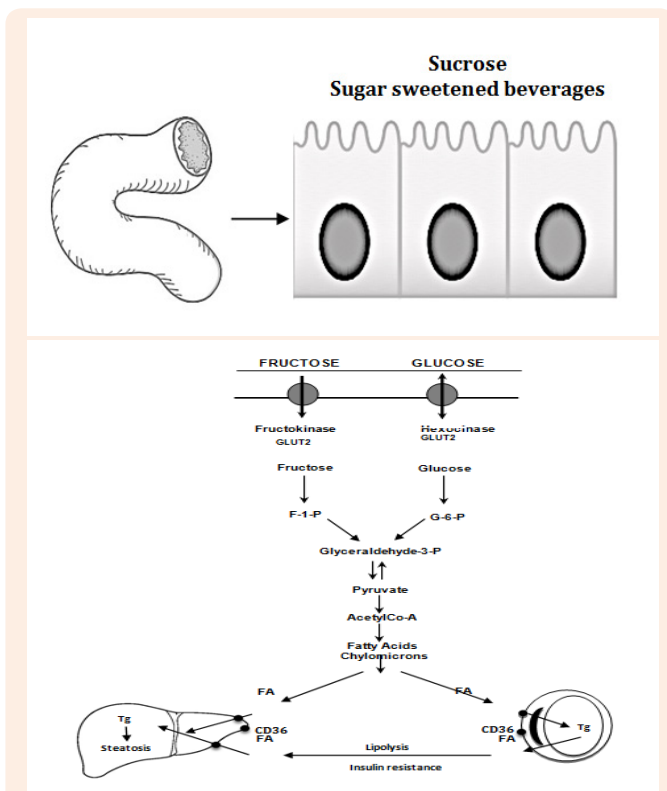


Figure 1: Interrelation between intestinal lipogenesis from sucrose for the transport of triglycerides and fatty acids to adipose and hepatic tissues, and the participation of the CD36 receptor in the development of steatosis and fatty liver.

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