Abstract

Mol Cell Biochem. 2004 Jun;261(1-2):23-33.

Fructose transport and metabolism in adipose tissue of Zucker rats: diminished GLUT5 activity during obesity and insulin resistance.

Litherland GJ, Hajduch E, Gould GW, Hundal HS.

Division of Molecular Physiology, School of Life Sciences, Medical Sciences Institute/Wellcome Trust Biocentre Complex, The University of Dundee, Dundee, UK.

BACKGROUND: Fructose is a major dietary sugar, which is elevated in the serum of diabetic humans, and is associated with metabolic syndromes important in the pathogenesis of diabetic complications. The facilitative fructose transporter, GLUT5, is expressed in insulin-sensitive tissues (skeletal muscle and adipocytes) of humans and rodents, where it mediates the uptake of substantial quantities of dietary fructose, but little is known about its regulation.

METHODS AND RESULTS: We found that GLUT5 abundance and activity were compromised severely during obesity and insulin resistance in Zucker rat adipocytes. Adipocytes from young obese (fa/fa), highly insulin-responsive Zucker rats contained considerably more plasma membrane GLUT5 than those from their lean counterparts (1.8-fold per microgram membrane protein), and consequently exhibited higher fructose transport (fivefold) and metabolism (threefold) rates. Lactate production was the preferred route for fructose metabolism in these cells. As the rats aged and become more obese and insulin-resistant, adipocyte GLUT5 surface density (12-fold) and fructose transport (10-fold) and utilisation rates (threefold) fell markedly. The GLUT5 loss was more dramatic in adipocytes from obese animals, which developed a more marked insulin resistance than lean counterparts. The decline of GLUT5 levels in adipocytes from older, obese animals was not a generalised effect, and was not observed in kidney, nor was this expression pattern shared by the alpha1 subunit of the Na+/K+ ATPase.

CONCLUSION: Our findings suggest that plasma membrane GLUT5 levels and thus fructose utilisation rates in adipocytes are dependent upon cellular insulin sensitivity, inferring a possible role for GLUT5 in the elevated circulating fructose observed during diabetes, and associated pathological complications.

PMID: 15362482

Visit us at www.spectracell.com or call us at 800.227.LABS (5227)

SPECTRACELL LABORATORIES
ADVANCED CLINICAL TESTING