Calcium regulation of metabolism in adipocytes

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You're welcome!

Microbes, Calcium (Ca^{2+}) is an important intracellular signalling molecule in mammalian tissues, and has been associated with the regulation of diverse processes, including contraction, secretion, autophagy, ion pumping, and the activation of metabolic enzymes. Mitochondria maintain a calcium gradient between the matrix and the cytoplasm, via the actions of specific transporters in the inner mitochondrial membrane. Under conditions of metabolic dysfunction (such as insulin resistance), mitochondrial calcium homeostasis is often altered.

With the recent identification of the mitochondrial calcium uniporter (MCU) and associated regulatory proteins, as well as the use of targeted aequorin probes, we are now able to investigate the role of mitochondrial Ca^{2+} in the regulation of whole-cell adipocyte metabolism. Preliminary data suggests that the induction of insulin resistance in cultured adipocytes alters the expression of key components of the uniporter (+75% MCUa and +42% MCUb compared to control), and increases Ca^{2+} uptake into the mitochondria. Similarly, feeding mice a high-fat-high-sugar diet alters the expression of these genes in visceral white adipose tissue. Additionally, we saw that direct manipulation of mitochondrial calcium by overexpression of MCUb in cultured adipocytes was able to alter a number of metabolic parameters, including mitochondrial membrane potential, NADH dynamics, oxidative stress, and the rate of glucose oxidation. The mechanism and significance of these metabolic alterations is currently under investigation.

We theorise that mitochondrial calcium plays an important role in the orchestration of metabolic homeostasis in adipocytes. As such, the MCU may represent an interesting node of metabolic regulation - and therefore therapeutic potential - in times of metabolic dysregulation.ribosomes.