TRIGLYCERIDE UPTAKE OF WHITE AND BROWN ADIPOSE TISSUE INVESTIGATED BY HYPERSPECTRAL CARS

Alexandra Paul[1], Belén Chanclón[2], Eduard Peris[2], Annika Enejder[1], Ingrid Wernstedt-Asterholm[2], and Sapun H. Parekh[3]

[1]*Chemical Biology, Chalmers University of Technology, Göteborg, Sweden.*
[2]*Department of Physiology, University of Gothenburg. Göteborg, Sweden.*
[3]*Max Planck Institute for Polymer Research, Mainz, Germany.*
email: *alexandra.paul@chalmers.se.*

KEY WORDS: Multimodal nonlinear microscopy, vibrational spectroscopy, adipose tissue, obesity, high fat diet

A major worldwide healthcare challenge is the increasing incidence of obesity and the secondary diseases it can trigger. At the onset of obesity, white adipose tissue (WAT), where fat is normally stored in form of triglycerides, is no longer able to store all fat, which requires ectopic deposition of fat into non-adipose tissues. In recent years has a second type of adipose tissue, brown adipose tissue (BAT), moved into focus due to its ability to store triglycerides and convert them into thermal energy on-demand. This thermogenic process occurs in the mitochondria of brown adipocytes expressing the uncoupling protein 1. However, not only the expression of genetic markers and the mitochondrial function of the two adipose tissue types differs, but there is also evidence that BAT plays a role in the early clearance of triglycerides taken up with a fatty meal.[1]

In order to understand more about the differences of lipid uptake in WAT and BAT, we use a combination of hyperspectral coherent anti-Stokes Raman scattering (CARS) and gene expression analysis of BAT and WAT from C57 mice that were fed with either a high fiber or a high fat diet for either 1 week or 4 weeks. Spectral images were collected on sliced tissue sections from BAT and WAT depots, and gene expression profiles were determined from mRNA extracts in the same tissue sections. We observed that the nutritional content of lipids in both WAT and BAT is a stronger determinant of lipid composition in the adipocytes than the endogenous *de novo* fatty acid production. Additionally, the rate and selectivity of the uptake of fatty acids from the high fat diet seem to differ between WAT and BAT. Overall, we demonstrate the usefulness of combining genetic profiling with *in situ* chemical microscopy via CARS to assess the metabolic state of different adipose tissues in response to dietary changes.

[1] A. Bartelt, *et al.*, "Brown adipose tissue activity controls triglyceride clearance.," *Nat. Med.*, vol. 17, no. 2, pp. 200–5, 2011.