Abstract

Adipose tissue is not only crucial in the storage of excessive fat and its release but also plays important role in the secretion of endo/para- and autocrine factors, thus influencing energy metabolism on the whole body level. The incapability of adipose tissue to meet its responsibilities leads to whole-body metabolic problems resulting in type 2 diabetes, storing of fat in the liver, coronary disease, and other diseases. How to prevent development of obesity and its consequences and/or completely reverse it, is a subject of great scientific interest. Activation of brown adipose tissue (**BAT**) and brite cells via induction of uncoupling protein 1 (**UCP1**) and/or stimulation of UCP1-independent energy-dissipating metabolic pathways such as futile cycles in white adipose tissue may be a promising path to fulfill this goal. This thesis is based on results from experiments with two cold-exposed inbred murine strains differing in the propensity to obesity and murine experiments with diet-induced obesity prevented by n-3 polyunsaturated fatty acids (**PUFA**).

Mice resistant to diet-induced obesity (A/J mice) showed higher induction of triacylglycerol (**TAG**)/fatty acid (**FA**) futile cycle in epididymal white adipose tissue by cold exposure in comparison to obesity-prone B6 mice.

Interestingly, the level of both Ucp1 mRNA and protein in BAT were induced similarly in both strains by cold exposure. Thus, BAT does not contribute to the lean phenotype of A/J mice as was proposed earlier. Besides BAT, skeletal muscles are also a large sink for glucose and fatty acids. Our results suggest that Ca^{2+} cycling in skeletal muscle contributes to a healthier phenotype of A/J mice.

n-3 PUFA were shown to be involved in the remodeling of epididymal white adipose tissue. Bioactive metabolites of eicosapentaenoic and docosahexaenoic acid prevented diet-induced hyperplasia by reducing the number of endothelial cells and preadipocytes and prevented disruption of immune balance.

To conclude, these experiments showed that the contribution of futile cycles, as well as control of fat cell turnover to buffer nonesterified fatty acids in plasma and to the prevention of fatty acids storing in extra-adipose tissues, leads to a healthy phenotype. Even though, the contribution of mentioned futile cycles probably would not influence whole-body energy expenditure.