SUMMARY
Obesity and associated metabolic disorders, e. g. metabolic syndrome, represent a considerable health threat for modern society. Due to sedentary lifestyle, high caloric intake and changes in composition of diet, prevalence of obesity is increasing worldwide. One of the possible causes contributing to higher prevalence of obesity in recent population could be the change of fatty acids (FA) composition of dietary lipids, with the shift in the content of n-6 and n-3 FA toward n-6 FA. In contrast to n-6 FA, n-3 FA are known for their anti-atherogenic, anti-obesogenic and anti-inflammatory properties. In our experiments in mice, the capability of naturally occurred and chemically modified n-3 long chain polyunsaturated fatty acids (LC-PUFA) in prevention and reversal of specific parts of metabolic syndrome was demonstrated. A specific chemical derivative of docosahexaenoic acid was proven to be very effective in preventing and improving metabolic conditions of animals exposed to high-fat (HF) diet challenge. Further, the involvement of AMP-activated protein kinase (AMPK), a master regulator of lipid metabolism, in skeletal muscle thermogenesis induced by HF-feeding was investigated. Activation of AMPK in the HF-fed mice is most possibly caused by increased leptin levels and represents an important link in induction of skeletal muscle thermogenesis as possible mechanism protecting from obesity caused by HF diet administration. Besides leptin, LC-PUFA are also involved in AMPK activation, however, in an indirect way through increasing blood levels of adiponectin. Thus, these lipids contribute to preserving insulin sensitivity under the condition of HF-feeding. Insulin resistance, a state characterised by impaired response to insulin action, is at least in part caused by ectopic lipid storage and obesity-associated low-grade adipose tissue inflammation. It is well known, that the difference in the response to HF administration in dependence on the sex exists. In our experiments, we have discovered that in spite of higher adiposity, female mice show milder phenotype and later onset of metabolic disorders than their male counterparts. Better insulin sensitivity in females could be at least in part attributed to higher adipose tissue expandability resulting in decreased extra-adipose tissue lipid storage and lower fat inflammation.