61. Involvement of TNFα in adipocyte metabolism and the interaction with liver metabolism in dairy cows (Die Beteiligung von TNFα im Stoffwechsel des Fettgewebes und die Interaktion mit dem Lebermetabolismus bei Milchkühen). H. Anette van Dorland*, H. Sadri, Isabelle Morel and R.M. Bruckmaier – Bern/Isfahan/Posieux

Dairy cows respond differently to a negative energy balance in early lactation with various degrees of lipolysis. In this respect, high rates of lipolysis may impair liver metabolism and may thereby increase the risk for metabolic disorders. Lipolysis is under the control of endocrine factors and the sympathetic nervous system. However, the adipose tissue itself excretes a number of components, such as TNFα, that play a role in the multifaceted regulation of lipolysis. TNFα may also modulate the metabolism of other tissues including liver. The aim of the present study was to investigate the importance of TNFα and other metabolic modulators in adipose tissue over time. Secondly, the aim was to understand whether or not TNFα is involved in interactions between adipose tissue and liver metabolism.

Methods: Blood samples were obtained from 28 multiparous dairy cows every two weeks from week (wk) 9 ante partum (a.p.) up to wk 12 post partum (p.p.). Liver and adipose tissue biopsies were obtained in wk 9 a.p., on day 1, and in wk 4 p.p. Milk yield was recorded and the energy balance was calculated weekly p.p. Blood plasma was assayed for concentrations of non-esterified fatty acids (NEFA), glucose, and insulin. Additionally, plasma TNFα was measured in wk 2 and 12 p.p by radioimmunoassay. Adipose tissue samples were analyzed for mRNA expression levels by real-time RT-PCR, of genes encoding for TNFα, peroxisome proliferator activated receptor γ (PPARγ), hormone-sensitive lipase (HSL), and fatty acid synthase (FASN). Liver samples were analyzed for mRNA expression levels of genes encoding for enzymes of the fatty acid β-oxidation (CPT1A CPT2, ACADVL), and of genes encoding for nuclear receptors, PPARα, and PPARγ. These data were used for the calculation of Pearson correlations with gene expression data from the adipose tissue. Other data were evaluated by using the Mixed procedure of SAS regarding biopsy time-point and parity with cow as repeated subject.

Results: Milk production, energy balance, and plasma parameters followed a pattern usually observed in dairy cows. However, the concentration of NEFA was high at the beginning of the dry period (wk 10 a.p.; 429±46.7 mmol/L), which may suggest adaptation to the reduction of available nutrients at the start of the dry period. Additionally, ≥4-parity cows had generally higher plasma NEFA concentrations than 2 and 3-parity cows over time ($P<0.05$). Plasma TNFα concentrations were very low (0.11±0.01 ng/ml) and no significant difference was found between wk 2 and 12 p.p. Therefore the analysis for plasma TNFα was limited to wk 2 and 12 p.p. only. This may suggest that TNFα has a local effect in healthy dairy cows. TNFα mRNA abundance in adipose tissue was highest ($P<0.05$) in wk 4 p.p., followed by wk 10 a.p., compared to d 1 p.p.. Generally lower mRNA of TNFα was measured for ≥4-parity cows compared to 2 and 3-parity cows ($P<0.05$). HSL mRNA was highest in wk 10 a.p., followed by d 1 p.p., compared to wk 4 p.p., which correspond to the high plasma NEFA concentrations in wk 10 a.p., indicating a high rate of lipolysis. Abundance of mRNA encoding for PPARγ and FASN did not significantly change over time. Furthermore, concerted changes in mRNA abundance of genes involved in adipose tissue and liver metabolism were observed in wk 4 p.p. compared to d 1 p.p. and wk 10 a.p. by which TNFα was not involved (based on correlations).

Conclusion: Gene expression of TNFα in adipose tissue changed over time, which may indicate that TNFα is involved in the multifaceted regulation of lipolysis in early lactation. These changes over time may partly be explained by parity. Furthermore, it is concluded that TNFα is not a signaling factor that links adipose tissue and liver metabolism in healthy dairy cows, but other factors are responsible for the orchestrated regulation of adipose tissue and liver metabolism in week 4 p.p..

* Veterinary Physiology, Vetsuisse Faculty, University of Bern, Bern (Switzerland)