4.4 GENE EXPRESSION OF HEPATIC ENZYMES RELATED TO THE CARBOHYDRATE AND LIPID METABOLISM DURING THE TRANSITION PERIOD IN DAIRY COWS

S. Richter, I. Morel, A. Gutzwiller, H.A. Van Dorland, C. Morel, Y Zbinden, R.M. Bruckmaier,

S. Richter
Veterinary Physiology, Vetsuisse Faculty, Uni Bern
Bern,
Switzerland
susan.richter@physio.unibe.ch

I. Morel
Agroscope Liebefeld-Posieux Research Station (ALP)
Posieux
Switzerland

A. Gutzwiller
Agroscope Liebefeld-Posieux Research Station (ALP)
Posieux
Switzerland

H.A. Van Dorland
Veterinary Physiology, Vetsuisse Faculty, Uni Bern
Bern
Switzerland

C. Morel
Veterinary Physiology, Vetsuisse Faculty, Uni Bern
Bern
Switzerland

Y Zbinden
Veterinary Physiology, Vetsuisse Faculty,Uni Bern
Bern
Switzerland

R.M. Bruckmaier
Veterinary Physiology, Vetsuisse Faculty, Uni Bern
Bern
Switzerland

The capability of cows to adapt to milk production during the transition period involves tremendous metabolic changes. However, the mechanisms underlying these differences are widely unknown.

The aim of this study was to assess changes in plasma metabolites and gene expression of hepatic enzymes related to the carbohydrate and lipid metabolism in dairy cows. The study was conducted in 28 multiparous dairy cows. Liver biopsies and blood samples were obtained during the transition period, at week 10 ante partum (a.p.), within 24 hours after parturition, at 4 weeks and between 12 and 16 weeks post partum (p.p). Liver samples were analysed for mRNA expression levels of cytosolic and mitochondrial phosphoenolpyruvate carboxykinase (PEPCKc and PEPCKm, resp.), pyruvate carboxylase (PC), 3-hydroxy-3-methylglutaryl-coenzyme A synthase 1 and 2 (HMGCS1 and 2, resp.), carnitine palmitoyltransferase 1A and 2 (CPT1A and 2, resp.), acyl-CoA synthetase long-chain (ACSL), and acyl-coenzyme A dehydrogenase very long chain (ACADVL) by real-time RT-PCR. Blood plasma was assayed for concentrations of beta-hydroxybutyrate (BHBA), non-esterified fatty acids (NEFA), and glucose. Data analyses were conducted by the MIXED procedure of SAS with time-point as fixed effect and cow as repeated subject. Differences were localized by Bonferroni's t-test. Additionally, Pearson's coefficients of correlation between plasma metabolites and gene expression of the hepatic enzymes were calculated. Plasma NEFA concentration decreased from parturition onwards whereas BHBA was highest in week 4 p.p ($P < 0.001$). Plasma glucose was lowest in week 4 p.p. compared to the other time-points ($P < 0.01$). Regarding the lipid metabolism, levels of mRNA of CPT1A and CPT2 increased after calving. The mRNA expression of ACSL and ACADVL were similar at all time-points. Lowest levels of mRNA expression of HMGCS2 were measured at calving ($P < 0.001$), whereas levels of mRNA expression of HMGCS1 were lowest in week 10 a.p., increased slightly at partum and further at the other time-points p.p. ($P < 0.01$). Regarding the glucogenic enzymes, time-point affected levels PEPCKm and PEPCKc significantly ($P < 0.05$). In week 4 p.p, significant negative correlations ($P < 0.01$) were found between plasma NEFA concentration and ACADVL, PC, ACSL, HMGCS1 and CPT2.

Results from this study indicate that the metabolic adaptation during the transition period in the studied dairy cows involved changes in plasma metabolite concentrations and levels of mRNA expression of glucogenic and lipogenic liver enzymes. Furthermore, our study shows that plasma NEFA concentrations in week 4 p.p. are closely but inversely related to key enzymes in the lipid metabolism.