Gene expression of NPC1 is down regulated in the bovine mammary gland following dietary supplementation with sunflower seeds

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Supplementing cow's diet with unsaturated fatty acids can increase the content of unsaturated fatty acids in milk. One such supplement is sunflower seeds, which contain high proportions of linoleic acid (LA). LA increases the activity of sphingomyelinase in blood, which breaks down sphingomyelin to ceramide and phosphocholine. Ceramide is metabolized in the lysosomes to sphingosine, which subsequently is phosphorylated to sphingosine-1-phosphate, a potent activator of SREBP1, the key regulator of de novo fatty acid synthesis in the mammary gland. The efflux of sphingosine from lysosomes is mediated by NPC1 protein, and decreased NPC1 activity is associated with increased lysosomal sphingosine-1-phosphate levels. The objective was to investigate the effect of sunflower seed supplementation (SFS) on the mammary gene expression of NPC1, SREBP1, and SCAP, the activator of SREBP1. Twenty four lactating cows (186±20 days in milk (DIM), 25.3±2.5 kg/d) were blocked according to parity and DIM. Cows were allocated to one of four groups fed either control diet or diets supplemented with 5, 10 or 15% sunflower seed (% of DM) for five weeks. Content of fatty acids ≤C16 was reduced from 75% to 38% by increasing SFS, indicating reduced de novo synthesis of fatty acids. mRNA abundance was determined by RT-PCR on mammary biopsies. SFS decreased mRNA levels of NPC1 ($P<0.001$), SREBP1 ($P=0.034$), and SCAP ($P=0.0075$). The reduced expression of NPC1 may be a consequence of reduced sphingosine levels in the mammary gland. A reduced sphingosine level may via an inhibition of SREBP1 and SCAP also be involved in reducing de novo fatty acid synthesis.

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mRNA abundance of the components of the adiponectin system in adipose tissue and in liver of dairy cows supplemented with or without conjugated linoleic acids throughout lactation

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Adiponectin (Ad) is an adipokine related to lipid metabolism and insulin sensitivity. Activation of the Ad receptors AdR1 and AdR2 increases insulin sensitivity and decreases inflammation. Early lactation results in negative energy balance associated with reduced insulin sensitivity. Supplementing diets with conjugated linoleic acids (CLA) decreases milk-fat and might thereby reduce the energy requirements for milk production. We aimed to investigate the mRNA expression of Ad, AdR1 and AdR2 during an entire lactation thereby considering potential lactation stage effects of CLA. Holstein Frisian cows were divided into a control group (n=10) and a CLA group (n=11, receiving 10 g each of the cis-9,trans-11- and the trans-10,cis-12-CLA isomers per day from d 1 post partum until d 182). Biopsies were collected from subcutaneous fat (ScF) and from liver at d -21 and d 1, 21, 70, 105, 182, 196, 224, 252 relative to calving. The mRNAs of Ad, AdR1 and AdR2 were quantified by real-time RT-PCR (for the CLA group only d -21, d 21, 105, 196 and 252). Data were analysed with a general linear model or nonparametric tests ($P\leq0.05$). The mRNA abundance of Ad in scF and of its receptors in liver was not different between CTR and CLA. Ad mRNA was decreased in fat samples from d 21, 196, and 252 compared to d -21. AdR1 in liver was higher on d 105 and 169 than on d -21, and lower on d 252 than on d 105. AdR2 values were higher on 21 d in comparison to all other time points; on d -21, the AdR2 content was also lower than on d 105. We herein provide a comprehensive longitudinal study about lactation-related changes in mRNA abundance of the 3 components of the Ad system. The mRNA expression seems unaltered by CLA indicating that CLA does not affect the Ad system under the conditions investigated.

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